



Federal Democratic Republic Ethiopia
Ministry of Agriculture and Natural Resources



**POSTHARVEST MANAGEMENT STRATEGY
IN GRAINS IN ETHIOPIA**

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POSTHARVEST MANAGEMENT STRATEGY IN GRAINS IN ETHIOPIA

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Message from State Minister of the Agricultural sector

Ethiopia is currently gaining recognition globally especially in registering rapid economic growth. For long time, Ethiopia's economy was based on agricultural products in which grain crops was and is the main source of food in Ethiopia. By the same token, Ethiopia suffers frequent food shortages, especially in some parts of the regions. The reasons for the shortage among others is inherent weaknesses in post-harvest systems, which contribute to high food prices, as a result of decreased food supply to the market, since part of the crop produced is lost soon after harvesting. Post-harvest loss is one of the major bottlenecks which hinder crop production and productivity with annual loss of 25% which feed fourteen thousand people in Ethiopia. Post-harvest losses negatively impact food security, nutrition and economic stability. Hence, concern on grain crop surplus has always been at the center of the country's policy formulation and implementation. Therefore, management of postharvest loss is an important and viable strategy to ensure food and nutritional security in efficient and sustainable agricultural systems.

In response, the Ethiopian Grain Crop Postharvest Management Strategy (EGCPMS) is developed with active participation and valuable inputs of all relevant stakeholders from key development actors (state, private and NGOs) to ensure proper and better utilization of the grain crops that is already produced and to feed the increasing population. This strategy document on *Grain Crop Postharvest Management* provides with valuable knowledge and information with particular reference to topics and issues of significance to the agricultural transformation move in Ethiopia taking action against post-harvest loss. The document identifies a number of important strategic issues that need to be taken into account in relation to *Grain Crop Post Harvest loss Management*. I am sure that in the spirit of commitment, motivation, resources and willing cooperation to solve grain crop postharvest loss problems, this strategy document will be an appropriate tool for implementers working on crop protection, agricultural extension and food security at federal, regional and *woreda* level. This strategy document can also serve as a highly valuable reference for policy makers, civil society, researchers and practitioners.

On behalf of the Agricultural Sector of the Ministry of Agriculture and Natural Resources, I am very grateful to the collaborative institutions and their staff who provided technical, financial and logistic support. Particularly I acknowledge the Food and Agricultural Organization (FAO) of the United Nations through the project "Reducing Food losses through Improved Post-Harvest management in Ethiopia -Phase I" and the government of Switzerland through the Swiss Agency for Development and Cooperation in the preparation of this strategy. Finally, I also wish to acknowledge all stakeholders who participated in the validation workshop for their valuable insights and feedbacks in the finalization of this strategy.



Tesfaye Mengsittie
State Minister

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ABBREVIATIONS AND ACRONYMS

ADLI	Agriculture Development-Led Industrialisation
AGP	Agricultural Growth Programme
AMIP	Agricultural Marketing Improvement Programme
ATVET	Agriculture Technical and Vocational Education and Training
BoARD	Bureau of Agriculture and Rural Development
BoFED	Bureau of Finance and Economic Development
CAADP	Comprehensive Africa Agriculture Development Program
DA/SMS	Development Agent/Subject Matter Specialist
EARO	Ethiopian Agricultural Research Organization
ECX	Ethiopian Commodity Exchange
EIAR	Ethiopian Institute of Agricultural Research
ETB	Ethiopian Birr
FAO	Food and Agriculture Organisation
FDRE	Federal Democratic Republic of Ethiopia
FSP	Food Security Programme
FSS	Food Security Strategy
FTC	Farmers Training Centre
FYGTP	Five-Year Growth and Transformation Plan
GDP	Growth Domestic Product
GTP	Growth and Transformation Plan
GOE	Government of Ethiopia
M&E	Monitoring and Evaluation
MDG	Millennium Development Goal
MOA	Ministry of Agriculture
MoANR	Ministry of Agriculture and Natural Resources
MoARD	Ministry of Agriculture and Rural Development
MoFED	Ministry of Finance and Economic Development
MoRD	Ministry of Rural Development
MoTI	Ministry of Trade and Industry
NARS	National Agricultural Research System
NEPAD	New Partnership for Africa Development
NGO	Non-Government Organization
NPCA	NEPAD Planning and Coordinating Agency
SO	Strategic Objective
TVET	Technical Vocational Education Training
USD	United States Dollar
VAT	Value Added Tax

EXECUTIVE SUMMARY

1) **Introduction:** The Postharvest Management Strategy in Grains in Ethiopia to define commonly agreed objectives and measures to guide, promote and support actions at all levels in the agricultural value chain to significantly reduce postharvest losses in grains. The Strategy has been developed on the recognition that focus on primary production had tended to overlook and effectively neglected the importance of postharvest losses with available data suggesting annual losses in the vicinity of 15-20 per cent of potential grain production due to poor pre-harvest practices and natural disasters and losses of up to 30 per cent postharvest due to inappropriate collection, transport, storage, pest control systems in Ethiopia. Reducing postharvest losses in grains in Ethiopia has the potential for the country to achieve not only its food security requirements, increased incomes for the agricultural sector but also achieve the overall basic objective to Ethiopia's economic development which aims to build a market economy in which (a) a broad spectrum of the Ethiopian people are beneficiaries; (b) dependence on food aid is eliminated; and (c) rapid economic growth is assured.

2) **Background:** In line with the global Sustainable Development Goal targets and continental Malabo Declaration signed by African Union Heads of State and Government, the Ethiopian Government, through its Rural Development Policy and Strategies of April 2003 and the Growth and Transformation Plan (GTP) II (2015 – 2020) made very ambitious commitments in its agricultural mechanisation technology strategy to reduce 'postharvest loss of major crops from 5 - 25% to 5% by 2020. To achieve this goal, it became imperative that a Postharvest Management Strategy in Grains in Ethiopia be developed to drive the process.

3) **Key Challenges:** Characterised as the second most populous country in Africa, whose more than 85% of the population derive their livelihoods from rural agriculture on small pieces of land hardly 0.5 hectares in extent, low productivity is the order of the day exacerbated by limited access to agricultural inputs, financial services, improved production technologies, irrigation and efficient agricultural markets. Under-developed transportation infrastructure, lack of adequate storage facilities, and lack of agro-processing industries place additional stress to the already fragile grain production and marketing systems in Ethiopia. Ethiopia's agricultural production has therefore not been able to meet total national food requirements with almost half the population subsisting in absolute poverty. In a 2010 national grain balance estimated by the United Nations Food and Agriculture Organisation and the World Food Program Crop and Food Security Assessment Mission, it was reported that total postharvest losses stood at 2.04 million tons of grain at a time when the country's import requirements stood at 1.16 million tons. A reduction in postharvest losses could mitigate against the import requirements by improving food availability in Ethiopia. Whilst data on postharvest losses is very varied and therefore not as consistent, the African Postharvest Losses Information System (APHLIS) 2012 report indicated losses in *teff* at an estimated 2.3%, sorghum was at 11.6%, wheat at 9.9% and maize at 16.8%, it is apparent that postharvest losses in Ethiopia are a major concern to food security, improved farm incomes and the general nutritional status of the country.

4) **Vision and Goal:** It is envisioned therefore that the postharvest management strategy should *contribute to improved food security and ultimately to poverty reduction through the attainment of food self-sufficiency in basic food commodities and improved incomes of the Ethiopian people*. To achieve this vision, it is the strategies goal to *improve food availability, food access, food safety and nutrition, and farmer incomes through reduced postharvest losses along the agricultural value chains of grains in Ethiopia*.

5) **Overall and Specific Objectives:** It is the overall objective of the strategy to *reduce food losses through the adaptation/adoption and implementation of appropriate postharvest management systems along the agricultural value chains in Ethiopia* and to attain this objective, focus will centre on four strategic objectives: (a) reducing, both quantitatively and qualitatively, food losses along the agricultural value chains of grains; (b) improving agricultural input and output market efficiencies for grains with the view to enhancing postharvest management practices; (c) improving access to financing and investment for improved postharvest loss management practices; and (d) supporting sustainable value addition enterprises throughout the agriculture value chain.

6) **Interventions Areas:** For each strategic objective, a set of intervention areas were identified through literature review, field studies undertaken by the author / consultant, extensive interviews with a whole range of actors in the agricultural value chain including government officials; private sector organisations involved in marketing, technology development and inputs supplies to the farming sector; training institutions at both vocational and university level; research and development institutions; and villagers, to name but a few. It is expected that a Results Framework will be developed to elaborate on strategy targets and indicators. An Investment and Implementation Plan is also expected to be developed outlining the costs and budgets towards the implementation of the Strategy.

7) **Structure of the Document:** The document is structured into five Parts

Part 1 Strategic Context: This section discusses the strategic frameworks that give rise to the Postharvest Management Strategy;

Part 2: Background to Postharvest Losses: This section outlines some of the fundamental postharvest challenges facing Ethiopia as they relate to food security and income generation. The section therefore lays the foundation, rationale and justification for the Postharvest Management Strategy in Grains in Ethiopia;

Part 3: Postharvest Management Strategic Framework: This section outlines the strategy goal, overall and specific objectives, which if attained, should allow Ethiopia to meet its food security needs, raise incomes and improve the general welfare of the Ethiopian people:

Part 4: Statements of Intent and Strategies: This section identifies strategic issues and suggests interventions to be implemented towards the attainment of the strategic objectives. The nature of these strategic statements and associated interventions varies from short-term to long-term in terms of their implementation period and consequently their impact. Through time-bound investment plans, typically designed for implementation in cycles of five years, prioritised programmes will subsequently be

identified, targets set, and implemented for the desired strategies to be achieved in the given time; and

Part 5: Implementation Mechanisms: Outlines in brief the proposed mechanisms for implementing the Postharvest Management Strategy including monitoring and evaluation. These elements will be developed as follow onto the strategies herein developed. This further work will involve developing a results framework and associated investment plans.

Part 6: Outlines in brief the results framework and investment plan for five years.

8) **Conclusions:** In order for the Strategy to succeed, which is possible, the Federal Democratic Republic of Ethiopia and all its arms of government at all levels including kebele, woreda, zonal, regional and federal should be of a common understanding to the effect of:

- a. Recognizing the high potential of agriculture in Ethiopia as the engine of economic growth that also can deliver substantially on enhanced food security and overall poverty reduction:
- b. Agreeing to focus implementation on a few actions at a time that have the most rapid impact on postharvest loss reduction whilst not ignoring those of a longer term impact;
- c. Demonstrating concretely strong political will and financial budgetary commitment to the Strategy;
- d. Establishing strong monitoring and evaluation system involving all key stakeholders with high levels of accountability;
- e. Creating and nurturing effective PPP partnerships, networking platforms, centres of excellence on postharvest management practices and such similar mechanisms for the full engagement of all key stakeholders in the implementation of the Strategy;
- f. Building confidence in the financial sector to support agriculture as a whole but particularly the implementation of this postharvest management strategy;
- g. Establishing the requisite infrastructure to support agricultural development including transport and road networks, ICT, electricity and such market related infrastructure; and
- h. Mainstreaming gender particularly women, youth, health, social, environmental and other such disciplines to collectively drive the Strategy.

PART 1: STRATEGIC CONTEXT

Introduction

9) Cognisant that the agriculture sector plays a significant role in the country's overall objectives of achieving food security, among other economic and non-economic goals, the Federal Democratic Republic of Ethiopia (FDRE) developed and promulgated in 1994 the Agricultural Development Led Industrialisation (ADLI) Strategy as the overarching policy response to Ethiopia's food security and agricultural productivity challenge. Through the ADLI, strategies were implemented in the agriculture sector towards the commercialization of smallholder agriculture through product diversification; a shift to higher-valued crops; promotion of niche high-value export crops; support for the development of large-scale commercial agriculture; effective integration of farmers with domestic and external markets; and tailoring interventions to address the specific needs of the country's varied agro-ecological zones.

10) The ADLI further articulated policy measures intended to improve agricultural productivity and promote food security. These included:

- a) The introduction of agricultural extension and research aimed at the deployment of extension workers to every rural *kebele* in Ethiopia to facilitate sustained knowledge and skills transfer to smallholder farmers and the use of effective agricultural research to improve productivity;
- b) The design and operationalization of growth corridors to integrate complementary centres of production and marketing by creating value chains within and across regional boundaries;
- c) The promotion of agricultural exports aimed at enhancing farmer income and the country's balance of payments through the more lucrative crop exports; and
- d) The introduction of food security programmes aimed at reducing vulnerability of millions of people living in continuous risk of food shortages, by, among other initiatives, reducing the variance in crop production and food availability overall through more irrigation and water control; diversification of crops; better integration of markets, transport, and information links; expanding off-farm employment and income-earning opportunities; better functioning credit markets; and other innovative measures such as experiments with crop and weather-based insurance mechanisms.

11) Arising from the ADLI are several strategies and measures including the Sustainable Development and Poverty Reduction Programme (SDPRP) (2002 – 2005); the Rural Development Policy and Strategies (RDPS) of 2003; Plan for Accelerated and Sustained Development to End Poverty (PASDEP) (2002 – 2005); Ethiopia's Agriculture Sector Policy and Investment Framework – Ten Year Road Map (2010 – 2020); Five-Year Growth and Transformation Plan (FYGTP) (2010 – 2015); and the Agriculture Sector Growth and Transformation Plan (GTP) II (2015 – 2020).

12) Key among these strategies is the Rural Development Policy and Strategies of 2003 which clearly outlined the ambitions of the country towards meeting the overall economic objectives of Ethiopia. The overall basic objective to Ethiopia's economic development is to build a market economy in which (a) a broad spectrum of the Ethiopian people are beneficiaries; (b) dependence on food aid is eliminated; and (c) rapid economic growth is assured (MoFED 2003). To achieve this, the Federal Democratic Government of Ethiopia adopted an agriculture-centred rural development programme as a major strategy expected to assist in the realization of the country's economic development objective. It was, however recognized that this must be complemented by efforts in other sectors.

13) In support of the Rural Development Policy and Strategies of 2003 and recognising through a strategic gap analysis that the focus on primary production had tended to overlook and effectively neglected the importance of postharvest losses with available data suggesting annual losses in the vicinity of 15-20 per cent of potential grain production due to poor pre-harvest practices and natural disasters and losses of up to 30 per cent postharvest due to inappropriate collection, transport, storage, pest control, etc., (MoARD 2010), the need for a strategy to reduce the level of losses to say 10 per cent (MoARD 2010) was prioritised in 2010.

14) Cognisant of the call by the African Union Heads of State and Government through the Malabo Declaration of 2014 in which they committed to ending hunger by 2025 through, among other initiatives, halving 'the current levels of Postharvest Losses, by the year 2025' (AUC 2014), and also cognisant of the Sustainable Development Goal 12 (Ensure sustainable consumption and production patterns) which calls for halving 'per capita food waste at the retail and consumer levels and reduce food losses along production and supply chains, including postharvest losses' by 2030 (UN Economic & Social Council: Statistical Commission, March 2016), the Ethiopian Government made very ambitious commitments in its agricultural mechanisation technology strategy under the Agriculture Sector Growth and Transformation Plan (GTP) II (2015 – 2020) to reduce 'postharvest loss of major crops from 5 - 25% to 5% by the end of the GTP' (MoA, 2015);

15) Similarly, the G20 in their G20 Action Plan on Food Security and Sustainable Food Systems of 2015 noted that 'one third of food produced for human consumption is lost or wasted with negative consequences for food security, nutrition, use of natural resources and the environment' (G20, 2015). Postharvest loss strategies were therefore identified as paramount to improving food security and nutrition and more sustainable food systems globally.

16) It is on this background, therefore that this Postharvest Management Strategy in Grains in Ethiopia is being developed in order to implement the provisions of the Rural Development Policy and Strategies of April 2003 and the Growth and Transformation Plan (GTP) II (2015 – 2020).

PART 2: BACKGROUND TO POSTHARVEST LOSSES

Key Definitions

17) **Food Security**, as defined by the United Nations' Committee on World Food Security, is the condition in which all people, at all times, have physical, social and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

18) **Food losses** are defined as “the decrease in edible food mass throughout the part of the supply chain that specifically leads to edible food for human consumption” (FAO 2011, p. 3). Food losses take place at production, postharvest and processing stages in the food supply chain (Parfitt et al., 2010 as quoted by FAO 2011, p. 3). Food losses occurring at the end of the food chain (retail and final consumption) are rather called “food waste”, which relates to retailers' and consumers' behaviour. (Parfitt et al., 2010 as quoted by FAO 2011, p. 3).

19) **Postharvest food loss** refers to a decrease in *quantity* and/ or *quality* of food mass. It is defined as ‘measurable qualitative and quantitative food loss along the supply chain’ (De Lucia and Assennato, 1994; Hodges, Buzby and Bennett, 2011, as quoted by Aulakh *et al*) including the production, harvesting, primary handling, aggregation, storage, transport, processing, distribution, and consumption segments (FAO 2014). Consequently, postharvest is not only multidimensional but multidisciplinary involving the agriculture sector; agro-processing industry; health and nutrition sector; distribution and manufacturing sector, among others.

20) **Quantitative food loss** refers to the decrease in edible food mass available for human consumption (FAO, 1980). In physical terms, this is grain removed from the postharvest supply chain and not consumed due to, among other causes, spillage, consumption by pests and also due to physical changes in temperature, moisture content and chemical changes. The quantity lost would have either deteriorated rendering it inedible or discarded for failure to meet regulated standards to eat as a food or to use as an animal feed.

21) **Qualitative food loss** is when grain loses its quality attributes resulting in the deterioration in quality leading to a loss of economic, social and nutritional value. The qualitative loss can occur due to incidence of insect pests, mites, rodents and birds, or from handling, physical changes or chemical changes in fat, carbohydrates and protein, and by contamination of mycotoxins, pesticide residues, insect fragments, or excreta of rodents and birds and their dead bodies. When this qualitative deterioration makes food unfit for human consumption and is rejected, this contributes to food loss (Aulakh *et al*). In most cases, the quality deterioration goes along with a significant loss of nutritional value, which might affect the health and nutrition status of the whole community (FAO 2014).

22) **Supply chain** is characterised as a system of organizations, people, activities, information, and resources involved in moving a product or service from supplier to customer.

23) **Value chain** is characterised as a set of activities that a firm or organisation operating in a specific industry or supply chain performs in order to transform and deliver a valuable product to the market.

24) **Value added** is a process involving the transformation (addition of time, place and/or form utility) of a raw material by changing its form to produce a high quality end product in order to meet the needs, tastes or preferences of consumers

25) **Postharvest System** encompasses the delivery of a crop from the time and place of harvest to the time and place of consumption, with minimum loss, maximum efficiency and maximum return for all involved (Grolleaud 2002).

26) **Postharvest technology**¹ is inter-disciplinary "Science and Technique" applied to agricultural produce after harvest for its protection, conservation, processing, packaging, distribution, marketing, and utilization to meet the food and nutritional requirements of the people in relation to their needs. It has to develop in consonance with the needs of each society to stimulate agricultural production; prevent postharvest losses, improve nutrition and add value to the products. In this process, it must be able to generate employment, reduce poverty and stimulate growth of other related economic sectors. The process of developing of postharvest technology and its purposeful use needs an inter-disciplinary and multi-dimensional approach, which must include, scientific creativity, technological innovations, commercial entrepreneurship and institutions capable of inter-disciplinary research and development all of which must respond in an integrated manner to the developmental needs.

Postharvest System

27) According to the FAO, a postharvest system can be considered to encompass 'the delivery of a crop from the time and place of harvest to the time and place of consumption with minimum loss, maximum efficiency and maximum return for all involved' (Hidden Harvest, 1976 as quoted by Grolleaud, 2002). Box 1 outlines the main elements of the postharvest system.

28) To address postharvest losses effectively requires the evaluation of such losses at every stage of the agro-supply chain. In Ethiopia, the grains supply chain can be distinguished into two marketing chains, the first dealing with grains consumed on the domestic market and the second comprising commodities for export. The marketing chain involving domestically consumed commodities is not well defined in the terms of the roles and responsibilities of the various actors, grades and standards, packaging, transportation, payment systems, and market information, among other system attributes. The system involves many traders or middlemen between farmer and final consumer generally to the disadvantage of the farmer in terms of income benefits. Figure 1 is an illustration of the marketing chain for domestically consumed commodities in Ethiopia.

¹ http://amickau.nic.in/index.php?option=com_content&task=view&id=53&Itemid=87

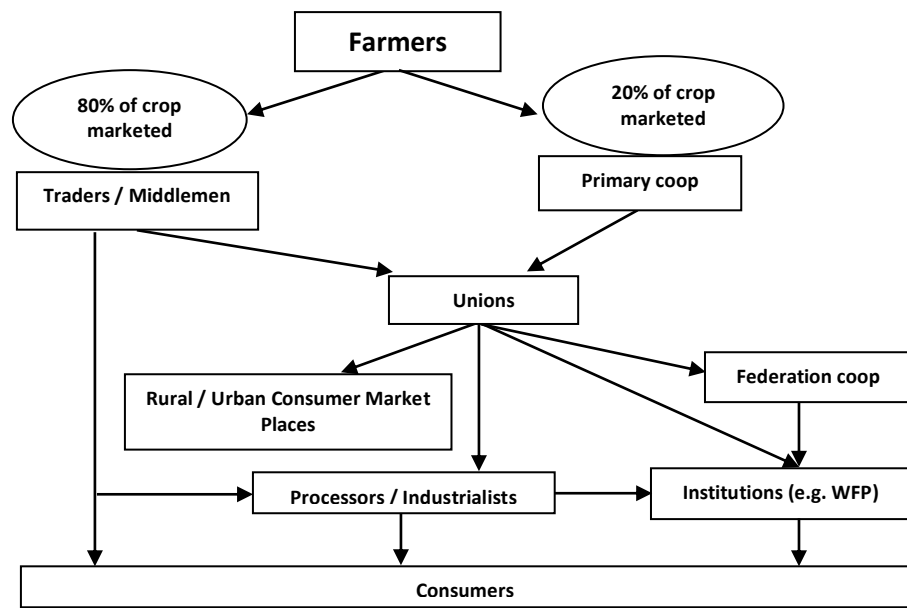


Figure 1: Illustration of marketing / Supply chain of commodities domestically consumed in Ethiopia (Source: Martin Muchero based on Field Findings of May 2016)

Box 1: Main elements of postharvest system

Main Elements of Postharvest System

Harvesting. The time of harvesting is determined by the degree of maturity. With cereals and pulses, a distinction should be made between maturity of stalks (straw), ears or seedpods and seeds, for all that affects successive operations, particularly storage and preservation.

Pre-harvest drying, mainly for cereals and pulses. Extended pre-harvest field drying ensures good preservation but also heightens the risk of loss due to attack (birds, rodents, insects) and moulds encouraged by weather conditions, not to mention theft. On the other hand, harvesting before maturity entails the risk of loss through moulds and the decay of some of the seeds.

Transport. Much care is needed in transporting a really mature harvest, in order to prevent detached grain from falling on the road before reaching the storage or threshing place. Collection and initial transport of the harvest thus depend on the place and conditions where it is to be stored, especially with a view to threshing.

Postharvest drying. The length of time needed for full drying of ears and grains depends considerably on weather and atmospheric conditions. In structures for lengthy drying such as cribs, or even unroofed threshing floors or terraces, the harvest is exposed to wandering livestock and the depredations of birds, rodents or small ruminants. Apart from the actual wastage, the droppings left by these marauders often result in higher losses than what they actually eat. On the other hand, if grain is not dry enough, it is vulnerable to mould and can rot during storage.

Moreover, if grain is too dry it becomes brittle and can crack after threshing, during hulling or milling. This applies especially to rice if milling takes place a long time (two to three months) after the grain has matured, when it can cause heavy losses. During winnowing, broken grain can be removed with the husks and is also more susceptible to certain insects (e.g. flour beetles and weevils). Lastly, if grain is too dry, this means a loss of weight and hence a loss of money at the time of sale.

Threshing. If a harvest is threshed before it is dry enough, this operation will most probably be incomplete. Furthermore, if grain is threshed when it is too damp and then immediately heaped up or stored (in a granary or bags), it will be much more susceptible to attack from micro-organisms, thus limiting its preservation.

Storage. Facilities, hygiene and monitoring must all be adequate for effective, long-term storage. In closed structures (granaries, warehouses, hermetic bins), control of cleanliness, temperature and humidity is particularly important. Damage caused by pests (insects, rodents) and moulds can lead to deterioration of facilities (e.g. mites in wooden posts) and result in losses in quality and food value as well as quantity.

Processing. Excessive hulling or threshing can also result in grain losses, particularly in the case of rice (hulling) which can suffer cracks and lesions. The grain is then not only worth less, but also becomes vulnerable to insects such as the rice moth (*Corcyra cephalonica*).

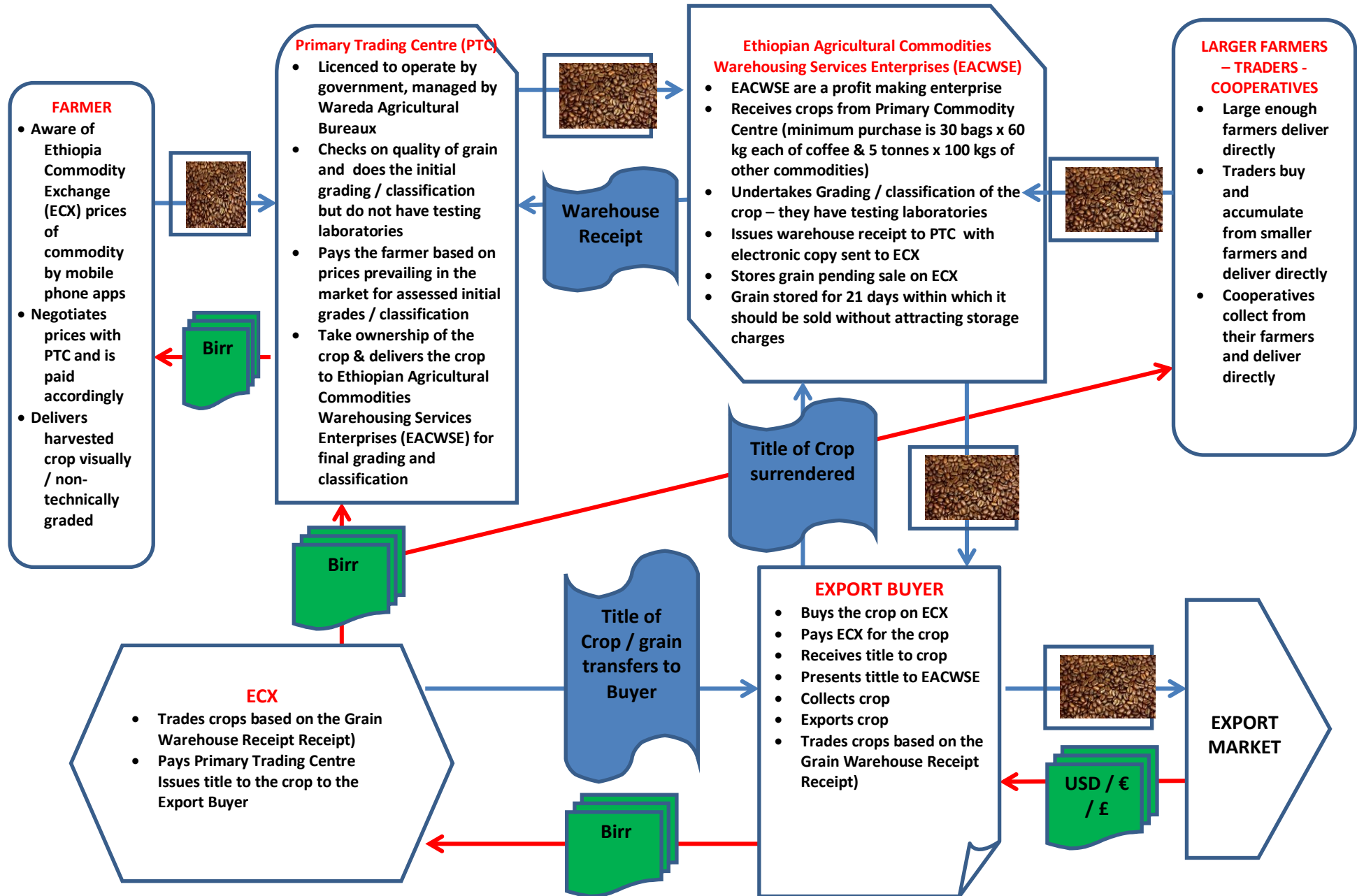
Marketing. Marketing is the final and decisive element in the postharvest system, although it can occur at various points in the agro-food chain, particularly at some stage in processing. Moreover, it cannot be separated from transport, which is an essential link in the system.

Source: Grolleaud, 2002

29) On the other hand, the marketing chain involving export crops is well defined and structured (See Figure 2) in terms of roles and responsibilities of the various actors, grades and standards, packaging, transportation, payment systems, and market information, among other system attributes.

30) It is through these chain linkages that postharvest losses are experienced in varying degrees of loss.

Figure 2: Marketing Chain for Export Crops in Ethiopia



Source: Author (Martin Muchero) based on interviews during Field Study, May 2016

Key Strategy Observations

31) Deriving from the field surveys conducted during the development of this strategy, (see Annex 3 for the full list of interviews conducted by the consultant) a range of key issues surrounding postharvest losses in grains through the agro-supply or marketing chains operational in Ethiopia emerged. These included: awareness and communication on issues of postharvest losses (PHL); lack of policy direction on PHL; lack of skills and human development including training on PHL; lack of coordination of actors involved in PHL initiatives; lack of relevant Research and Development into PHL; markets; technology and mechanisation; macro-economic conditions; institutional and organisational structures; extension services; market infrastructure including agro-processing; financing and investment; agri-business; agro-processing; and regulatory frameworks. These issues are summarised in Table 1.

Table 1: Summary of key postharvest management issues observed during the field study

Thematic Area	Sample of Key Observations
Awareness and Communication	<ol style="list-style-type: none"> 1. Postharvest Loss (PHL) is an awareness issue affecting the way of doing business; 2. Awareness of the impact or consequences of PHL is very limited; and 3. PHL is usually misunderstood, concepts are not well understood.
Policy	<ol style="list-style-type: none"> 1. PHL has been neglected in Ethiopia with little or no emphasis on PHL until GTPII; 2. Lack of appreciation of economic value of PHL and its impact on food security; 3. Lack of coordination on PHL issues with other disciplines such as health; 4. Lack of or weak enforcement of regulatory frameworks affecting PHL.
Skills and Human Development including Training	<ol style="list-style-type: none"> 1. Training curricula needs strengthening in PHL; 2. Lack of Opportunities for trained PHL experts; 3. Lack of training of extension service agents and farmers on PHL; 4. Lack of capacity building in PHL in institutions dealing with PHL; 5. Technologies and promotions mainly focus on production as priority and hardly PHL
Research and Development	<ol style="list-style-type: none"> 1. Research is currently fragmented and not well coordinated 2. Lack of evidence based study data on actual loss assessments of PHL.
Markets and Market Infrastructure	<ol style="list-style-type: none"> 1. Lack of formal, coordinated marketing structures for domestically consumed commodities; 2. Challenges with grades and standards, pricing structures (no quality payment incentives for domestically consumed commodities); packaging; warehouse management; etc. 3. Lack of trade / marketing regulations (domestically consumed commodities) 4. Limited / poor infrastructure in terms of harvesting/ marketing storage facilities including commodity handling (poor fumigation and general commodity storage systems); road and transport infrastructure, services (e.g. power) infrastructure, testing laboratories etc.
Technology and Mechanisation	<ol style="list-style-type: none"> 1. Generally poor PHL management with lack of appropriate and access to PHL reducing technologies (post production); 1. High cost of technologies, lack and high cost of service repairs, lack of regulatory / standardisation of machinery (operational performance); 2. No women-friendly and time saving production / processing technologies
Macro-economic conditions	<ol style="list-style-type: none"> 1. High taxation on imported agricultural equipment and supplies 2. No regulation on labour wages
Institutional and Organisational Structures	<ol style="list-style-type: none"> 1. Lack of coordination among country (including inter-disciplinary) actors involved in PHL; 2. Lack of support for PHL best practices and knowledge platforms, universities, research institutions, training centres, etc.;

Thematic Area	Sample of Key Observations
	3. Lack of PHL skills, capacity and personnel in the Ministry
Financing and Investment	1. Lack of financial support throughout the agricultural supply chain 2. Limited budgetary resource allocation for PHL activities 3. Lack of private sector incentives to get involved in PHL issues
Agri-Business / Agro-Processing	1. Lack of involvement of private sector in inputs production and distribution; 2. Lack of support for industry in areas such as bag, sheller, thrasher manufacturing; 3. Lack of support for micro rural agro-processing of crops to reduce PHL 4. Poorly developed agro-processing industry such that most grains are consumed immediately with little value addition and therefore enhanced shelf life of some of the products. 80% to 90% of products produced are consumed immediately after primary processing.

Rationale for Postharvest Management Strategy

General Overview of the Agriculture Sector

32) The second most populous country in Africa after Nigeria, Ethiopia had a population on 1st January 2016, according to the United Nations Department of Economic and Social Affairs – Population Division, estimated at close to 100 million people. In 2013, the population stood at 94.1 million according to the World Bank. More than 85% of the population reside in rural areas and are engaged in and depend on agricultural production for their livelihoods. The major source of food for Ethiopia is from cereals (mainly *teff*, maize, wheat, and sorghum), pulses and oil crops.

33) Agriculture contributes 50% of total GDP, 85% of employment, 70% of raw material requirements for large and medium industries in the agro-processing sector and 90% of exports (Global Growing Casebook, 2012). There is no doubt that agriculture is the mainstay of Ethiopia's economy contributing immensely to exports, employment and subsistence. As such, the agriculture sector influences the performance of other sectors of the economy, making it the Federal Democratic Government of Ethiopia's top priority.

34) It is estimated that a third of the rural households farm on less than 0.5 hectares (MoFED, 2003; MoARD, 2010) although the land size in some areas will range up to 3 hectares per household for wheat and *teff* farmers. Typically, Ethiopian agriculture comprises mainly subsistence small-scale farming systems that are estimated to account for 95% of total area under agricultural use and are responsible for approximately 90% of the total agricultural output, 94% of food crops production and 98% of coffee production (Global Growing Casebook, 2012).

35) The small-scale agriculture is however characterised by low productivity attributed to limited access by smallholder farmers to agricultural inputs, financial services, improved production technologies, irrigation and agricultural markets; and, more importantly, to poor land management practices that have led to severe land degradation (MoARD, 2010). When there are surpluses, smallholder farmers are constrained by lack of access to markets (MoARD, 2010) as the country has an under-developed transportation infrastructure (U.S. Department of State, 2013), lacks adequate storage facilities, and lacks agro-processing industries to preserve surpluses, among other challenges.

Postharvest Losses - a Major Challenge

36) According to the Ministry of Agriculture and Rural Development, Ethiopia's agricultural production has not been able to meet total national food requirements with almost half the population subsisting in absolute poverty (MoARD, 2010). The agricultural sector has failed to provide moderate and sustained incomes for many who are engaged in the sector such that poverty and food insecurity are concentrated in rural areas (MoARD, 2010). This has been the result of an extended period without appropriate development policies and strategies for a sector which has seen a population increase of more than 38 million during the 40-year period 1962/63 to 2002/03 in rural areas compared to 8.2 million in urban areas during the same period (Gebre-Selassie, 2003). Previous policies did not address the major structural constraints of the economy particularly the agriculture sector (MoARD, 2010). One such structural constraint that has been ignored for years yet can significantly make a difference is postharvest losses.

37) As evidenced in the review of the agricultural related policies, programmes and strategies promulgated since ADLI in 1994, (see Annex 1), the Government of Ethiopia's attention and priority has been focused on increased production and productivity, at the almost complete exclusion of postharvest loss reduction. There has been no explicit strategy outlined thus far in relation to postharvest loss reduction on grains in Ethiopia apart from the recent Agricultural Sector Growth and Transformation Programme (GTP) II (2015 – 2020) which recognised overall postharvest loss reduction by setting a very ambitious target to reduce it from the current estimated 5 – 25% to 5% by 2025 (MoA, 2015).

38) In an earlier report by the African Postharvest Losses Information System (APHLIS), postharvest losses in 2012 for *teff* were estimated at 12.3%, for sorghum at 11.6%, for wheat at 9.9% and for maize at 16.8%. It was reported in the 2010 national grain balance estimated by the United Nations Food and Agriculture Organisation and the World Food Program Crop and Food Security Assessment Mission that total postharvest losses stood at 2.04 million tons of grain at a time when the country's import requirement stood at 1.16 million tons (US Dept. of State, 2013). A reduction in postharvest losses could mitigate against the import requirements by improving food availability in Ethiopia.

Guiding Principles

39) Guiding the formulation of this postharvest management strategy are the following principles, among others:

- a. By its nature, postharvest loss management involves both quantitative and qualitative issues making it both multidimensional and multi-sectoral requiring therefore a holistic approach to its formulation and implementation with close collaboration of various sectors including agriculture, health, trade, manufacturing and storage and transport;
- b. As a multidimensional and multi-sectoral issue, formulation and implementation of postharvest management practices requires participatory and extensive

consultative processes among users, practitioners, trainers, researchers, and facilitators at various levels in various capacities;

- c. To the above effect, field work was conducted in May 2016 and a range of actors and key informants were met allowing for the production of the zero draft that was circulated to a wider audience for comments;
- d. Taking into account all the initial comments raised on the Zero draft, a First Draft was produced and circulated for consideration by key stakeholders at a validation workshop held in October 2016. Taking into account comments and suggestions made from the validation workshop, this final document has now been prepared for consideration by the various arms of the Federal Democratic Government of the Ethiopia towards its approval and adoption.

40) While postharvest loss reduction is a specialised set of systems and processes which makes it crop or sector specific, this strategy is developed specifically targeting grains but its general principles can, subject to sector and region contextual adjustments, apply to other crops, sectors and regions.

PART 3:

POSTHARVEST MANAGEMENT STRATEGIC FRAMEWORK

Purpose of the Strategy

41) The purpose of the Postharvest Management Strategy (PHMS) in Grains in Ethiopia is *to define commonly agreed objectives and measures to guide, promote and support actions at all levels in the agricultural value chain to significantly reduce postharvest losses in grains.*

Vision

42) The vision of the Postharvest Management Strategy in grains is *to contribute to improved food security and ultimately to poverty reduction through the attainment of food self-sufficiency in basic food commodities and improved incomes of the Ethiopian people.*

Goal

43) The goal of the Postharvest Management Strategy in grains is *to improve food availability, food access, food safety and nutrition, and farmer incomes through reduced postharvest losses along the agricultural value chains of grains in Ethiopia.*

Objectives

44) The overall objective of the Postharvest Management Strategy in grains is *to reduce food losses through the adaptation/adoption and implementation of appropriate postharvest management systems along the agricultural value chains in Ethiopia.* More specifically, the strategy aims to:

- a. Reduce, both quantitatively and qualitatively, food losses along the agricultural value chains of grains;
- b. Improve agricultural input and output market efficiencies for grains with the view to enhancing postharvest management practices;
- c. Improve access to financing and investment for improved postharvest loss management practices; and
- d. Support sustainable value addition enterprises throughout the agro-industry.

45) Cross-cutting issues of significance to postharvest management systems including gender, youth, HIV/AIDs, environmental factors and agricultural information management shall be mainstreamed in all activities undertaken towards the attainment of the above specific objectives.

Overall Conceptual Framework

46) This strategy derives from a number of previously promulgated policy frameworks but largely from the Rural Development Policy and Strategies of 2003 and the Growth and Transformation Plan II (2015 – 2020). These and other relevant policy frameworks are summarised in Annex 1. The overall conceptual framework of the Postharvest Management Strategy is as shown in Figure 3.

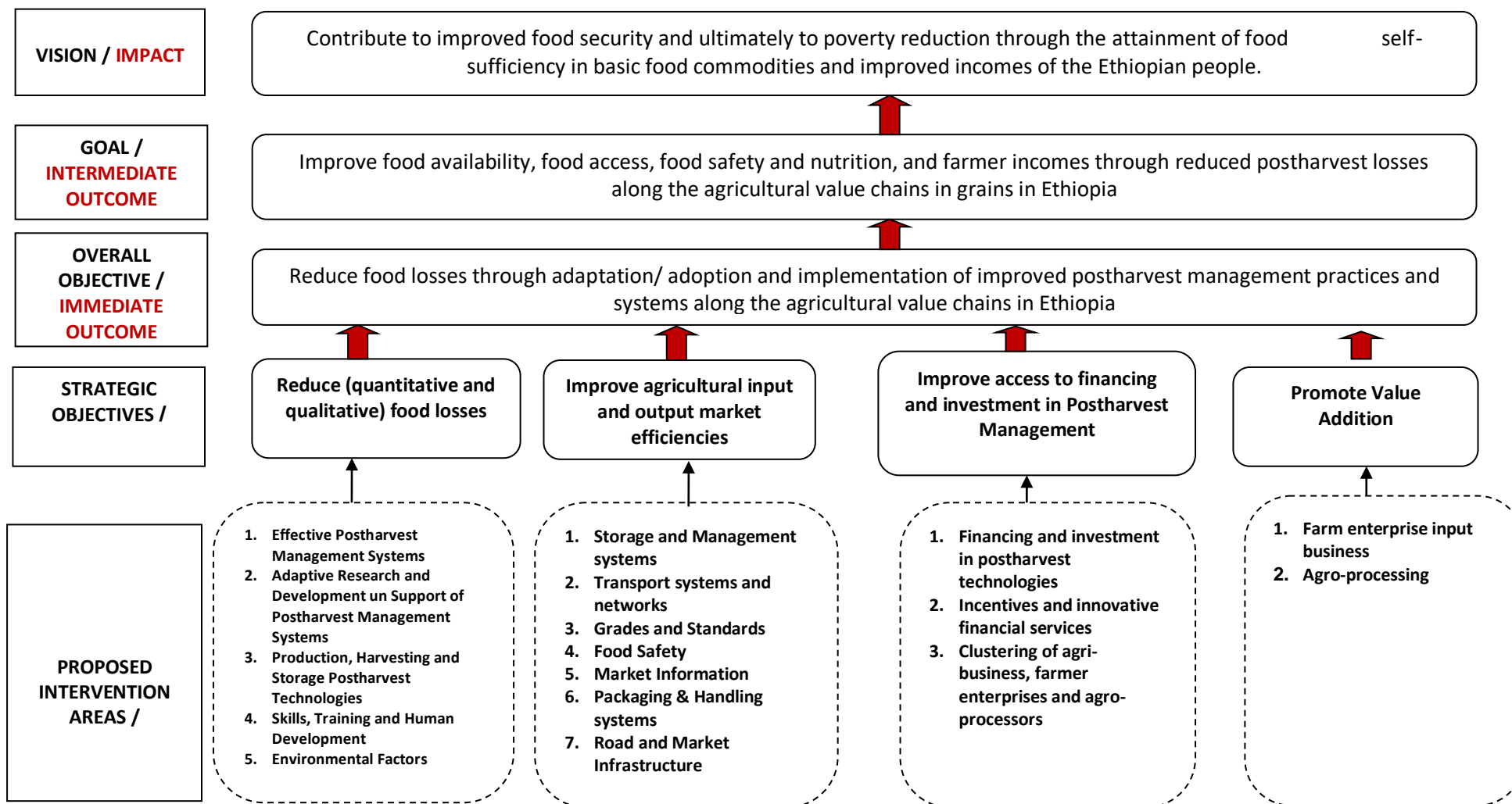


Figure 3: Conceptual framework (Results Chain) of postharvest management strategy in grains in Ethiopia

PART 4: POSTHARVEST MANAGEMENT STRATEGIC INTERVENTIONS

Structure of Strategic Statements and Interventions

47) In line with the conceptual framework of the Postharvest Management Strategy, this Part outlines focus areas or strategic issues identified as critical challenges towards the attainment of strategic objectives. For each strategic issue, a number of intervention areas will guide the identification of activities to be undertaken towards the resolution of the strategic challenges.

48) Using the Results Based Management (RBM) terminology, the results of *activities* implemented under each intervention area are reflected in the *outputs*, aligned to each specific objective, that cause and therefore contribute to change towards the desired *immediate and intermediate outcomes* with the result that the intended overall *impact* is attained.

49) The intention in this structuring is such that strategic issues identified are of a medium to longer term horizon in terms of the timeframe within which they can be fully achieved. The activities under each intervention area are intended to be of short to medium term horizon in terms of the timeframe of implementation towards addressing strategic issues or challenges. It is in the intervention areas that the Postharvest Management Strategy remains live to emerging issues making this part of the strategy a living and ever-changing instrument (in line with the time-bound implementation investment plans) for the long term attainment of the strategy objectives.

50) Each sub-part in Part 4 reflects the individual strategic objectives as outlined in the Part 3. For each strategic objective, the document is structured to:

- a. Provide a brief **overview** of the challenges facing Ethiopia in grains;
- b. Outline, deriving from the challenges identified, the main **objective** to be achieved for each strategic objective; and
- c. Outline the **potential intervention areas** through which specific action taken should have an impact in addressing the identified challenges.

STRATEGIC OBJECTIVE 1: REDUCE (QUANTITATIVE AND QUALITATIVE) FOOD LOSSES

Overview

51) Postharvest losses, both quantitative and qualitative losses, are one of the key challenges facing Ethiopia's agricultural value chains. In 2010, the United Nations Food and Agriculture Organisation and the World Food Program Crop and Food Security Assessment Mission estimated total postharvest losses in Ethiopia at 2.04 million tonnes of grain at a time when the country's import requirement stood at 1.16 million tonnes. Effectively, the import requirement would have been much less for any level of reduction in postharvest losses achieved.

52) In the African Postharvest Losses Information System (APHLIS) report on postharvest losses in 2012, it was estimated that for *teff*, the loss was 12.3%, for sorghum, the loss was 11.6%, for wheat, the loss was 9.9% and for maize, the loss was 16.8%. Clearly, postharvest food losses are significant requiring specific attention.

Objective

53) As such, it is the main aim for interventions identified under this strategic objective *to effectively improve food availability that is also safe for human consumption.*

Proposed Intervention Areas

54) To achieve the above objective, the following critical elements are examined in some detail in the following sub-sections:

- a. The effectiveness of postharvest management systems;
- b. The uses of adaptive research and development to postharvest management systems;
- c. The provision of production, harvesting and storage postharvest technologies;
- d. The development of appropriate skills, training and human development; and
- e. The care for environmental factors.

Effective Postharvest Management Systems

55) There is a general lack of awareness of the impact and implications of postharvest losses (PHL) on food security in Ethiopia at most levels from the policy level all the way down to the farmer level. This may be a consequence of lack of policy visibility in this area. Aligned to this is lack of understanding of the concept of PHL as a multidimensional and multidisciplinary supply chain concept therefore the need to tackle PHL as a system and not an incident.

56) Whilst reference to food losses in general were noted in the Rural Development Policy and Strategy of 2003, the Agricultural Sector Growth and Transformation Plan – II of 2015 took more specific interest in postharvest losses by setting an ambitious target of reducing postharvest losses from a range of 5% – 25% to 5%. At the continental level also,

postharvest losses took prominence with the pronouncement.

57) In the Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods of 2014 in which the Heads of the African Union undertook to half the current levels of postharvest losses by 2025 towards achieving the commitment to end hunger by 2025. At the global level, the Sustainable Development Goal 12 (Ensure sustainable consumption and production patterns) calls for halving 'per capita food waste at the retail and consumer levels and reduce food losses along production and supply chains, including postharvest losses' by 2030.

58) In Ethiopia, work has begun in earnest to deal with postharvest losses particularly at the policy level, education and training level as well as at the research and development level. A number of organisations including government departments and government agencies; research centres; non-governmental organisations; the private sector and many others are in one way or another involved in efforts to reduce postharvest losses. However, each institution is operating under its own mandate with little reference to what others are doing. This has resulted in wasted synergistic opportunities, inefficient resource utilisation, and disjointed attempts at reducing postharvest losses in Ethiopia. This calls for strong institutional mechanisms to coordinate the efforts in postharvest loss management throughout the agricultural value chain.

59) It is proposed to intervene therefore in the following strategic areas of action:

- a. Establish and strengthen appropriate postharvest management institutional and operational structures including monitoring and evaluation systems in both the public and private sectors ensuring clear roles, responsibilities, and levels of accountability;
- b. Establish effective advocacy and promotion of good practices in postharvest management systems throughout the agricultural value chains;
- c. Establish effective inter-disciplinary (agriculture, health, nutrition, Science & Technology, social sciences, etc.) postharvest management coordination systems; and
- d. Provide for sufficient financial and technical resources for postharvest activities at all levels of the agricultural value chain.

Adaptive Research and Development in Support of Postharvest Management Systems

60) The final quality of grains before consumption is determined by different pre-harvest and harvest factors including the kind of variety, environment, the growing condition, harvest and postharvest handling operations. Early harvesting results in grain being harvested at high moisture content which cause spoilage due to moulds and pests during handling or storage. On the other hand, delayed harvesting causes the grain to over dry resulting in shattering before and during harvesting and loss of saleable weight because of excessive loss of moisture. In addition, failure to harvest at the right stage of maturity may diminish the quality of grains harvested through infestation with insect pest and mould which often times are carried into the storage.

61) The selection and use of appropriate seed varieties that mature early or late depending on when harvesting should be done help in reducing losses. Depending on their

availability, growing varieties that are resistant to shattering will reduce losses at harvesting to a great extent. Making use of seed varieties that are resistant to storage pests can reduce losses during storage. Poorly drained fields particularly in humid agro-ecological zones during farming operations cause water logging resulting in plants falling down affecting the harvesting process as grain on fallen plants are difficult to harvest especially with machine harvesters. Properly managing fields so that there is no water logging ensures that machine harvesting is more efficient.

62) It is in these pre-and harvesting processes that research and development as well as extension services can render effective support to the farming activities towards reducing food losses, in both quantity and quality, during and post production. Improvements in agricultural research and technologies are essential for both improved and enhanced agricultural production and productivity as well as reduced postharvest loss management. Whilst agricultural research and development in Ethiopia dates back more than six decades, very little if any attention has been given to postharvest management. It is essential that research and development be focused on issues, among others, such as identifying the causes and types of postharvest losses, where and how these losses occur and why they occur along the agricultural supply chains; what must be done about reducing postharvest losses and providing appropriate and relevant measures to address this challenge.

63) It is therefore proposed to intervene in the following strategic areas of action in relation to adaptive research and development in support of postharvest management systems:

- a. Facilitate research and development institutions as well as universities to prioritise postharvest management research and training in postharvest management systems;
- b. Promote public and private sector partnerships in postharvest management systems research and development; and
- c. Facilitate evidence based studies to measure the actual postharvest losses in both physical as well as economic value terms throughout the agricultural value chain for decision making.

Production, Harvesting and Storage Postharvest Technologies

64) Closely linked to research and development but deserving separate and special mention are issues involving production, harvesting and storage postharvest technologies. One of the key challenges facing the agriculture sector in Ethiopia in relation to reduction of postharvest loss is the widespread use of traditional harvesting, drying, threshing, cleaning and storage technologies by smallholder farmers. The use of improved production, harvesting and storage technology is generally expected to stimulate agricultural production, prevent postharvest losses, and add value to agricultural products.

65) The importance of the use of technology is acknowledged in the Rural Development Policy and Strategy of 2003 which states that while a healthy, industrious and sufficiently educated and trained agricultural labor force is its foundation, it is not possible to accelerate growth to any meaningful extent unless the agricultural labour force has access to technology that will enable it to substantially increase its productivity. However, improved productivity

without the accompanying reduced postharvest losses through the use of appropriate technologies will not achieve the food self-sufficiency and overall food security objectives.

66) According to the internet online Network of Agricultural Market Intelligence Centres², and as defined earlier, postharvest technologies constitute an inter-disciplinary science and techniques applied to agricultural commodities after harvest for the purpose of preservation, conservation, quality control/enhancement, processing, packaging, storage, distribution, marketing, and utilization to meet the food and nutritional requirements of consumers in relation to their needs. The process of developing postharvest technologies therefore requires an interdisciplinary and multidimensional approach, which includes scientific creativity, technological innovation, and commercial entrepreneurship and stakeholder inputs.

67) In Ethiopia, the cost of postharvest technologies is high such that the technologies become unaffordable to the ordinary farmer or entrepreneur. The cost of procuring patented technologies even for local adaptation is prohibitive. Worsening the situation is the lack of credit support in the area of postharvest technologies although the Government of Ethiopia, through its mechanisation programmes, is attempting to bridge this gap. This situation is exacerbated by lack of access to financing. Financing and investment into agriculture ventures is the least of priorities for the commercial financial sector in Ethiopia.

68) Where such technologies have been made available, particular problems have arisen, for instance in the area of mechanised harvesting and threshing with sometimes higher postharvest losses being experienced. These losses are not necessarily a result of the technology itself but the ill-use of the technology sometime in the form of lack of adherence to manufacturer's specification in machine calibrations or service requirements. This could be a result of partly skills and human development issues, a subject matter for the next section, or lack of financing to ensure adequate spares are available or lack of regulatory frameworks and institutions to enforce adherence to specifications and standards of machinery and technology use.

69) It is therefore proposed to intervene in the following strategic areas of action in relation to production, harvesting and storage postharvest technologies:

- a. Promote coordinated research and development on appropriate and affordable technologies to support harvesting, threshing, drying, packing, transporting and storage of grains with minimal postharvest losses;
- b. Create incentives and easy access to financing for the adoption of postharvest loss minimising technologies as well as financing for its servicing and maintenance;
- c. Promote improved human skills development in machine operators and machine maintenance to improve on the efficiency of machinery technology that can reduce postharvest losses; and
- d. Establish regulatory frameworks and institutions to enforce adherence to machinery and technology use specifications.

Skills, Training and Human Development

² http://amickau.nic.in/index.php?option=com_content&task=view&id=53&Itemid=87

70) Acknowledging the mammoth task of training and educating the agricultural and mainly rural population that currently has minimal educational opportunities, the Rural Development Strategy of 2003 prioritised the improvement of agricultural practices taking into

account traditional and indigenous agricultural practices and knowledge, through the expansion of agricultural extension services. Vocational training centres remain the major training ground for development agents. Through these centres, extension services provision in Ethiopia is robust with four development agents at each *kebele* to deal with crops, livestock, natural resource management, and health issues respectively. The main challenge, however, remains the level of training of these development agents in postharvest issues. Their current training curriculum concentrates on production and productivity with very little on postharvest and postharvest demonstrations. As a consequence, little attention is being given to postharvest losses.

71) Whilst more than ten Universities in Ethiopia are now offering training related to postharvest issues, it is still in its infancy. Coupled with the fact that chances of employment as a specialist in postharvest losses are so limited even in government, the interest in postharvest management learning and training is not significant.

72) The lack of formal education for the majority of the population limits the capacity of farmers to appreciate and use modern technologies, hence the aim under the Rural Development Strategy of 2003 to transfer skills and technological know-how through practical demonstrations and experience in the short to medium term to farmers and the population in general whilst efforts are being pursued elsewhere to raise the educational level of the farming and mainly rural population.

73) Gender and youth in agriculture are crucial elements that require specific attention particularly in agriculture. In the first instance, women are generally in the majority in agricultural activities and they have a key role to play in the production, processing and preparation of food and the overall nutritional status of the family yet their status is underplayed. The youth are key to the future of agriculture and, therefore it is essential that efforts be made to ensure the involvement of the youth in agriculture. As they become more educated, the youth become the source of change through which future actions in postharvest management can be championed. Agriculture however needs to be transformed sufficiently to provide incentives for the youth to remain in and make careers out of agriculture, which currently is not the case.

74) It is therefore proposed to intervene in the following strategic areas of action in relation to skills, training and human development in support of postharvest management systems:

- a. Deepen the training curriculum to cover postharvest management practices and systems including practical in-the-field robust demonstrations at existing vocational and university postharvest training levels;
- b. Establish a centre of excellence / incubation centre in postharvest management systems training;
- c. Promote knowledge sharing including indigenous knowledge and understanding of postharvest losses, its causes and possible solutions;
- d. Create career incentives and opportunities for postharvest management trained personnel; and

e. Mainstream gender particularly women and youth, in skills and human development activities in postharvest management systems.

Environmental Factors

75) Like all agricultural activities, postharvest operations also have an impact on the environment. The construction of household storage structures like cribs and drying platforms using a lot of wood results in deforestation and general land degradation. Land degradation is the common environmental problem in Ethiopia. It is one of the major causes of low and declining agricultural productivity and continuing food insecurity and rural poverty (Gashaw et al 2014). This has resulted partly due to the rapid population increase particularly in the rural areas. Unbalanced crop and livestock production and inappropriate land-use systems have also contributed to land degradation in Ethiopia.

76) To mitigate this, farmers and traders should be encouraged to use modern postharvest technologies like tarpaulins, hermetic bags and metal silos for drying and storage. This however calls for easy access to financing and issues of affordability of such technologies are of concern. As discussed elsewhere, there is need for government to make concerted efforts in making the enabling environment conducive to the provision of and easier access to financing.

77) The use of pesticides to control storage pests if not properly done can affect the environment through contaminating water sources and soil, affecting biodiversity, contaminating food, and exposing humans to fumigants. It was observed during field studies that phosphine tablets which should be applied in specially confined places by specially trained personnel are applied directly on open bags and containers at places like markets and in open trucks. Such dangerous use of pesticides means that the distribution and use of highly dangerous pesticides should be regulated and appropriate training be offered for the safe use of these products. Furthermore, appropriate enforcement of contaminated foods should be implemented.

78) To address the misuse of pesticides and protect the environment, the sell and use of dangerous pesticides must be regulated. Also, parallel to this, the development of pests should be prevented by undertaking preventive pest measures to avoid the need to use chemicals. Preventive measures form part of the approach known as Integrated Pest Management. Integrated pest management is a holistic approach to controlling pests with minimum risks to human health, non-target organisms, and the environment.

79) Ethiopia's Climate Resilient Green Economy Strategy (CRGE) addresses both climate change adaptation and mitigation objectives with the view to reducing the country's foot print on greenhouse gas emissions. The plan to mitigate GHG emissions is built on four pillars, namely (a) improving crop and livestock production practices for greater food security and higher farmer incomes while reducing emissions; (b) protecting and re-establishing forests for their economic and ecosystem services, while sequestering significant amounts of carbon dioxide and increasing the carbon stocks in landscapes; (c) expanding electric power generation from renewable energy; and (d) leapfrogging to modern and energy efficient technologies in transport, industry and building sectors. This therefore calls for conscious decisions and practices in the development and implementation of climate sensitive postharvest management practices and technologies.

80) To this effect, the Ethiopian Intended Nationally Determined Contribution (INDC)³ calls for the improvement of traditional methods that scientifically prevent deterioration of food and feed in storage facilities to enable local communities to store food and feed in productive years and secure food supply in case of extreme weather events.

81) It is therefore proposed to intervene in the following strategic areas of action in relation to environmental factors as they are affected by and as they affect postharvest processes:

- a. Facilitate effective land use practices and implement environmentally friendly agricultural practices that maximize vegetation cover to prevent erosion, replace nutrients removed, and to put in place structures (terraces, bunds, vegetation strips) to reduce the speed and volumes of water flow over the soil;
- b. Protect and re-establish forests for their economic and ecosystem services but more so to regenerate forest cover destroyed through postharvest practices; and
- c. Regulate, monitor and enforce the proper sale, use and disposal of pesticides and other such agro-chemicals using integrated pest management practices.

³ <http://www4.unfccc.int/submissions/INDC/Published%20Documents/Ethiopia/1/INDC-Ethiopia-100615.pdf>

STRATEGIC OBJECTIVE 2: IMPROVED AGRICULTURAL INPUT AND OUTPUT MARKET EFFICIENCIES

Overview

82) According to the Rural Development Strategy of 2003, one of the essential elements towards market-led agricultural development is the building of an efficient agricultural marketing system capable of delivering produce at the right time, in the right place, at the right price and in an acceptable quality. Except for export commodities such as coffee, haricot beans and sesame seed, the marketing systems for most grains are not as well and formally structured.

83) The serious challenges faced in this area which exacerbate postharvest losses include poor and most times inadequate and inappropriate storage facilities and management; inadequate or inefficient transport systems and networks; lack of enforcement of existing grades and standards; lack of value differentiation for quality of product except for those commodities that are exported; outdated packaging and handling systems; and lack of market information including lack of support from extension services in matters of markets and trade as all efforts are usually centred around increased production and productivity with little regard for post-production issues. Effectively, the grain value chains are poorly and inefficiently structured due to deficiencies in the various distribution and marketing systems and the lack of appropriate market infrastructure.

Main Objective

84) The main objective of interventions proposed in the overall strategic area of improving agricultural market efficiencies is *to develop an effective and efficient agricultural marketing system capable of delivering produce at the right time, in the right place, at the right price and in an acceptable quality whilst promoting and ensuring effective postharvest loss management systems.*

Proposed Intervention Areas

85) The principal intervention areas, each elaborated in the next sub-sections, identified to achieve this strategic objective include:

- a. Storage and management systems;
- b. Transport systems and networks;
- c. Grades and standards;
- d. Food Safety;
- e. Market Information
- f. Packaging and handling systems; and
- g. Road and Market infrastructure.

Storage and Management Systems

86) Strategically located and well managed storage facilities play a central role in postharvest loss reduction and marketing of crops. The main function of storage is to preserve the quality and quantity of commodities, and to facilitate the marketing and the collateralisation of commodities. In addition, the systematic information on the movement of grain in and out of storage over the course of the year is useful in planning for production and or supplementary imports or exports in the following season because the movement of inventory from storage gives pointers to the demand and supply of a commodity.

87) For a postharvest management system to be efficient and with minimum losses, adequate and appropriate storage facilities should be available at all the key stages of the supply chain. For Ethiopia, having suitable storage at household, *kebele*, *woreda*, zonal and regional levels will ensure efficient postharvest management and minimise losses. Storage at household level is for the purpose of storing commodities for food security and marketing. Storage at the *woreda* level is usually in aggregation of small volumes into larger, presentable standard units acceptable in the formal market. Individual traders, cooperatives or small businesses usually own aggregation centres. In addition, warehouse operators who run centralised storage facilities can operate aggregation centres to support their warehouses.

88) Storage facilities at zonal or regional level fall in the category of centralised or terminal storage and these are designed for large-scale commercial operations. The main purpose of this type of storage is to supply agro-processing industries and institutions, support trading on the commodity exchange, and handle export crops in accordance with international standards.

89) It is therefore proposed to intervene in the following strategic areas of action in relation to *improved commodity storage and management systems*:

- a. Facilitate the development of suitable and affordable storage facilities along the supply chains at the various household, *kebele*, *woreda*, zonal and regional levels;
- b. Facilitate and promote the manufacture and wide distribution of efficient and affordable storage technologies including silos and improved traditional storage systems;
- c. Promote food safety standards in the handling of grains both in terms of warehouse physical space as well as grain cleanliness and quality;
- d. Promote proper and safe storage pest management systems including the use and disposal of fumigants;
- e. Promote the maintenance of high warehouse standards through warehouse certification requirements; and
- f. Promote PPP in storage infrastructure services and provision.

Transport Systems and Networks

90) Efficient food supply chains that operate with minimal losses, hinge on the effectiveness of the transport system in moving commodities and other elements along the

supply chain. In turn, an effective transport system is premised on the right road network and use of appropriate retail and bulk packaging, cargo vehicles and vessels. This is well acknowledged in the Rural Development Strategy of 2003 when it stated:

'In Ethiopia, transportation is associated with motor vehicles or pack animals or human load. Although there are several other alternatives these have not been developed to the desired degree. Even if the mode of transport could be improved significantly by using carts or wagons drawn by horses or donkeys, the practice is not common in rural Ethiopia, except in few places. Similarly, the use of bicycles or motor bicycles is not common outside urban areas. One cannot expand transport services unless one is able to use all these alternatives. *Kebele* and *woreda* officials should, therefore, encourage the participation of private entrepreneurs and cooperatives in the expansion of carts and wagons and other alternative modes of transport' (MoFED 2003).

91) Postharvest management requires appropriate transport at two levels, at the community and distributor levels. At community level, farmers and other actors need to move their produce within the farm, from the farm to the homestead and between homesteads and to local markets and processing locations. Cargo loads vary from quantities as low as 5 kg up to one to five tonnes per load. Such diverse loads need a mode of transport which is adaptable and easy to operate in rural settings. For small loads, wheel burrows are very convenient. For loads in the one to five tonne range, an animal drawn 'scotch cart' is suitable for rural settings. Locally trained artisans using old vehicle body parts can fabricate Scotch Carts.

92) Large cargo sized and longer distance distribution transport systems require vehicular mode of transport supported by well-maintained feeder and main roads. The stock of vehicular trucks must be suitable for carrying commodities to be delivered to warehouses. The commodities must be transported under adequate protection from weather elements using such materials as tarpaulins. The feeder roads from the farming communities to the storage facilities and across rivers must be well maintained and connected to the main roads.

93) It is therefore proposed to intervene in the following strategic areas of action in relation to *improved transportation systems and networks*:

- a. Facilitate the local manufacture or assembling of labour saving small sized transport technologies suitable for smallholder households for farm use and transport to the local market;
- b. Upgrade feeder roads and main trunk road network infrastructure;
- c. Support the acquisition of appropriate vehicular modes for transporting commodities from woreda to zonal to regional markets; and
- d. Promote and enforce standardised packaging and transportation standards.

Grades and Standards

94) The importance of grades and standards was highlighted in the Rural Development Policy and Strategy of 2003 which stated that:

'Delivery of quality goods through an efficient marketing system requires a product standardization and grading system. One can make sure that any given product or good satisfies acceptable quality standards only when a known quality grade is given to it. Producers can produce goods which satisfy acceptable quality standards only when these standards are known and specified. Similarly, consumers can ensure that they are buying goods of the right quality only when the quality standards are properly specified. It is therefore important to develop quality standards from the point of view of both producers and consumers. At the same time, it is essential to create an acceptable grading system and provide measuring devices befitting the system' (MoFED 2003).

95) Grades and Standards (G&S) is a system of commodity classification based on quantifiable attributes and rules of measurement established and put in place by a competent authority. The Ethiopian Standard Agency (ESA) is the national standards body of Ethiopia established in 2010 following the restructuring of the Quality and Standards Authority of Ethiopia. Grades and standards in agriculture provide a clear set of descriptive commodity parameters that indicate quality levels, as well as provide a common language and terminology for defining product value. Grades and standards allow for value differentiation of what is traded on the market. In addition, grades and standards serve to differentiate and segment markets in positive ways that define market niches. On the negative side, grades and standards can create barriers to entry for market participants who are still developing, however this can be mitigated by putting in place what might be termed developmental grades and standards that get reviewed as the market develops.

96) The broad attributes of a sound grades and standards system promote market efficiency and transparency in many ways. Grades and standards systems allow suppliers and buyers of a commodity to agree on a price based on product description without the physical presence of the commodity. The system also promotes value for quality where higher prices are paid for higher quality of commodity and its convenience of handling. They also facilitate price/quality comparisons across regions or nations and enable diverse market mechanisms such as futures trading, commodity exchanges, inventory credit or warehouse receipts schemes, and letters of credit to function more efficiently and make market information more meaningful. Grades and standards systems facilitate the resolution of disputes regarding quality and/or composition of shipped products.

97) These and other attributes have a significant positive impact on reducing postharvest losses as they promote proper and better crop grades selection, storage, packaging, transportation and handling throughout the value chain with minimal double or triple handling which physical inspections require. An efficient marketing system allows for minimal movement of commodities until the final destination of consumption is secured with fair trade and wealth distribution along the value chain.

Setting and ensuring the presence of grades and standards is one thing. Enforcing them is another challenge requiring concerted effort by the regulatory authorities such as the Food, Medicine and Health Care Administration and Control Authority of Ethiopia (FMHACA) to put in place mechanisms that encourage the proper use of grades and standards with access to laboratories for confirmation at each stage along the supply chain. This would involve a significant amount of advocacy for adopting grades and standards, price structuring that allows value for higher grades, incentive based schemes that reward for maintenance of high

standards of grades and standards and corrective measures for working outside laid down grades and standards and procedures.

98) It is therefore proposed to intervene in the following strategic areas of action in relation to *improved application of commodity grades and standards*:

- a. Develop appropriate crop quality grades and standards using international grain grades and standards as a reference point;
- b. Establish quality testing laboratories to support postharvest management systems;
- c. Establish market price differentiations for quality to promote postharvest management activities; and
- d. Build capacity to enforce the application of established grades and standards.

Food Safety

99) Food safety issues are of serious concern to postharvest as they concern the food quality. Issues of aflatoxin in the grains, microbes and other such toxins in the food grains make the food unsafe for human and sometimes even for animal consumption. The current marketing system in place in Ethiopia that uses the quintile size bag calls for the admixing of grains from many different suppliers. Farmers sell varying small quantities of commodities from as little as 5 kgs to traders who mix these commodities in order to make up a quintile as the standard size bag measure. This practice compromises the hygiene and quality of grain supplied onto the market. The need to preserve food safety calls for a multidisciplinary approach involving the social science disciplines to postharvest management of agricultural commodities.

100) It is therefore proposed to intervene in the following strategic areas of action in relation to *improved food safety*:

- a. Strengthen mandate and capacities of food safety inspectorates; and
- b. Enforce food safety standards in the transportation, warehouse, storage and market place operations.

Market Information

101) The provision of accurate and timely agricultural market information is central to an efficient marketing system. Even though a Postharvest Loss Platform has been established to assist with coordination of activities in PHL, this has not fully taken off the ground and therefore needs support to be more effective as information exchange is vital for all actors including policy makers, businesses, research, farmers and traders.

102) It is therefore proposed to intervene in the following strategic areas of action in relation to *improved market information provision*:

- a. Promote the effective functioning of the postharvest loss platform;
- b. Establish an agricultural information management system (AIMS); and

c. Implementing the right to information act as it refers to agricultural market information.

Packaging and Handling Systems

103) Although packaging is usually considered as part and parcel of the grades and standards, it deserves articulation of its own due to the uniqueness of packaging and handling systems in Ethiopia. In grain handling, the type of bags, and how the bags are used, are key elements of commodity marketing and more so for a postharvest management system. Inappropriate bags and improper use can cause postharvest losses and supply chain inefficiency. In order to ensure that the correct bag is selected and used properly, it will require standardisation of the grain bag and how it is filled.

104) In postharvest management, bag standardisation is important for various reasons including having a standard unit for trading in grain, accuracy in sampling, easy accounting of grain, and effective transport and storage management that allows for ease of handling of bagged produce. In addition, the International Labour Organisation requires the use of a standard bag such that an individual worker should not carry weights above 55 kg. In its 51st session in June 1967, ILO recommended that the maximum weight that can be carried and transported manually by an adult worker should be 55 kg and for female workers it should be substantially lower than that for male workers.

105) For raw food grains, the common unit of trade is 50 kilograms (kg). All cross-border trade and exports and even food aid programs use the 50 kg bag unit. The benefits of using the 50 kg bag unit are that it allows for random sampling in quality analysis, it facilitates efficient handling, transportation and storage management particularly in terms of fumigation. In addition, the size of the bag enables proper stack construction, which ensures optimum use of storage space.

106) Currently, Ethiopia uses the quintile (100 kg) as the standard of measure. To fill this size of bag requires the mixing of grains from many suppliers, a process that introduces quality, type and standardisation problems for the concerned grain. Smaller sized bags would allow each farmer to uniformly fill a number without compromising on their quality efforts. Using the 50kg bag unit as a trading standard also enables farmers to develop mechanisms to pack and estimate without scales the weight of their produce before taking it to the market. Having accurate estimates of weight before marketing reduces exploitation of farmers.

107) It is therefore proposed to intervene in the following strategic areas of action in relation to *improved packaging and handling of commodities*:

- a. Promote standardisation of packaging to the 50 kg standard used world-wide;
- b. Establish bag specifications including the material used in the manufacture of the bag; bag measurements; construction patterns of the bag taking into account the need for fumigation and exposure to the weather elements; sewing or closing of the bags; labelling of the bags; and other such specifications;
- c. Promote good warehouse husbandry systems facilitated by a smaller and standardised 50 kg bag allowing for efficient handling; reduced spillage and waste; and effective control of storage pests and rodents; and

- d. Promote the appropriate application and use of different bag designs and structures to prevent the use of wrong packaging which may lead to increased postharvest losses.

Road and Market Infrastructure

108) With respect to road and market infrastructure, the Rural Development Strategy of 2003 observed and stated that:

‘The availability of social and economic infrastructures is essential both for agricultural and rural development. It is not possible to attain rapid and sustainable agricultural or overall rural development where there is a lack of services in the fields of: education, training, health, rural road and transport. Rural development and infrastructural facilities and services are almost inseparable. The expansion of rural infrastructural facilities is a major government responsibility in view of its crucial role in expanding these facilities and services in general. In fact, the government's main tasks are to expand rural infrastructure, motivate and coordinate farmers and generally create favorable conditions for development’ (MoFED, 2003).

109) The provision of adequate and appropriate road and market infrastructure is critical for agriculture in general and particularly so for reduction of postharvest losses and has a direct impact on rural incomes. Generally, transaction costs particularly transport costs are high mainly due to poor road and market infrastructure. Poor road networks are generally compensated by higher transport charges which the farmer bears the biggest if not the full brunt of. It is critical therefore that market infrastructure servicing agriculture be better factored into the general infrastructural development plans of the country.

110) The Rural Development Policy and Strategy of 2003 acknowledges that although the issue of expanding telecommunications and electricity services will be gradual and costly, it is a development task that must be addressed with resolve lest farmers remain disadvantaged due to lack of accurate and timely information. Advancements in ICT should be taken advantage of in supporting marketing infrastructure in the rural areas. The provision of adequate coverage in ICT in the rural areas will greatly enhance and support farmers in their day-to-day transactions and trade of agricultural commodities. Even mobile banking would be possible engendering to some degree the culture of savings across the rural areas which has a significant bearing on economic development.

111) Similarly, the Rural Development Policy and Strategy of 2003 acknowledges that although new technologies (e.g. solar energy, wind-driven electricity generation, etc.) which can expedite the expansion of electricity services in rural areas are being developed, it is relatively more difficult to expand these services. The supply of energy in rural areas would greatly support and facilitate small scale agro-processing and value addition closer to the production and consumption sources, hence reduce postharvest losses considerably by cutting down on losses incurred during transportation to and from far away processing centres.

112) It is therefore proposed to intervene in the following strategic areas of action in relation to *improved road and market infrastructure*:

- a. Promote the provision of adequate rural feeder road infrastructure networked to the main road system in order for easier and more appropriate transport systems to service the rural areas thereby reduce losses usually incurred during transportation of commodities;
- b. Promote the provision of ICT in rural areas to enhance farmer connectivity to the rest of the country with the view to improving their standards of education, receiving genuine and up-to-date market information, practicing mobile banking and other such activities facilitated by ICT;
- c. Promote small scale rural based agro-processing and value addition to allow for the preservation of crops closer to source of production and therefore reduce postharvest losses in transportation of commodities far afield and storage losses including quality losses associated with unprocessed commodities;
- d. Promote the provision of service provision facilities such as testing centres closer to the smallholder farmers; and
- e. Strengthen linkages among credit and saving institutions with locally established fabricators of postharvest technologies and smallholder farmers who through the provision of market infrastructure are encouraged to establish their enterprises in rural areas.

STRATEGIC OBJECTIVE 3: IMPROVED ACCESS TO FINANCING AND INVESTMENT INTO POSTHARVEST MANAGEMENT

Overview

113) While the term ‘investment’ is usually associated with public and private sector engagement and ventures into various sectoral activities, it also can be interpreted to include the continuous decision-taking processes by farmers and agri-businesses on the use of their income and savings. Undertaking investments involves decision on how much will be spent on production, technological acquisitions, and various other farm related activities once all other non-farm related requirements have been taken care of. For the smallholder and mainly rural farmers in Ethiopia, disposable income allocated to these activities is limited to their on-farm earnings which are little for the demands at hand. Farmer investment in technological improvements including postharvest loss reduction activities is therefore limited due to lack of access to financing. The government and large enterprises are looked upon to provide significant support to allow for smallholder farmer growth and commercialisation.

114) To stimulate private sector engagement and investment in the agriculture sector and particularly into postharvest management systems requires an enabling economic policy environment that makes these activities profitable. Increased investment by government and its various arms in public goods is a major incentive to making agriculture attractive enough for investment. Some of these public investments have been discussed earlier in terms of feeder roads, main road networks, ICT, and electricity, among others. Enhanced incentive based schemes including tax rebate schemes by government will also influence positively the economic environment for increased public sector investment and financing into postharvest management. The establishment and maintenance of efficient marketing systems is another example of a market incentive that will allow for increased investment in agriculture and reduction in postharvest losses.

Objective

115) The main objective of interventions proposed in the strategic area of improved access to financing and investment in postharvest management is *to create an enabling environment for private sector investment into agriculture and easier access to affordable financing by farming enterprises towards improved postharvest management practices throughout the agricultural supply and value chain activities.*

Proposed Intervention Areas

- 116) To achieve the above objective, the strategy will focus on the following issues:
- a. Financing and investment in postharvest technologies;
 - b. Providing incentives and innovative financial services; and
 - c. Clustering of farmers and farmer associations as business models.

Financing and Investment in Postharvest Management

117) One of the basic problems facing smallholder farmers in relation to access to financing for agricultural activities in general and more specifically postharvest management requirements such as postharvest technologies is the difficulty in predicting with reasonable accuracy the farmers' incomes as the basis for considering financing factors such as repayment capabilities. This difficulty is a result of many factors including price volatility; oftentimes unfavourable terms of trade in both the input and output markets for the farmers; the high risks associated with climate change resulting in frequent crop failures due to droughts or pest invasions; the poor infrastructure resulting in high transaction costs; and others. All these factors work negatively against favourable borrowing rates for the farmers.

118) It is therefore proposed to intervene in the following strategic areas of action in relation to *improved access to financing in agriculture in support of effective postharvest management systems*:

- a. Support local postharvest technology manufactures and or artisans with specialised tax rebates on imported raw materials; and
- b. Facilitate conditions for cooperatives and unions to purchase and provide postharvest management services to farmers.

Incentives and Innovative Financing Services

119) Yet another basic problem facing smallholder farmers in relation to access to financing is the lack of collateral to secure financing loans. Traditionally land title deeds have been used as collateral. Without title deeds, the smallholder farmers are without the means to secure their loans. Furthermore, the unavailability in Ethiopia of insurance and or lending guarantee schemes for smallholder farmers as an alternative form of collateral makes them high risk borrowers in the eyes of financial institutions.

120) The lack of efficient and structured marketing systems that could allow for the use of grain warehousing receipt systems does not assist with the need to access financing by smallholder farmers. Furthermore, the lack of availability of banking or financial facilities in most rural areas does not assist with information flow between potential lenders and borrowers creating mistrust. The recent rapid spread of mobile phones is expected to ease this problem.

121) It is therefore proposed to intervene in the following strategic areas of action in relation to *enhanced incentives and innovative financing services*:

- a. Promote the development of financing products such as lending guarantee schemes or insurance guarantee schemes, and innovative fund systems to support easier access to financing by smallholder farmers for their technological and machinery requirements towards efficient postharvest loss management practices;
- b. Provide innovative financial services that enable value-chain actors to access postharvest technologies and services;
- c. Provide smart subsidies to facilitate the micro-finance sub-sector and cooperatives to provide cheaper loans to smallholder farmers particularly in areas involving technologies and machinery for postharvest loss management; and

d. Promote cooperatives and unions to build their capacity to provide credit for postharvest technological acquisitions by farmers.

Clustering of Agri-Business, Farmer Enterprises and Agro-Processors

122) The concept of clustering may be new, but its basic fundamentals have long been used in many economic and social business settings. The concept, in agricultural terms, speaks to the coming together of supply chain actors including farmers into a business model that allows for economies of scale. Such cluster business models make access to financing, one of the most critical crippling factors of production, easier as the risk assumed to be associated with agriculture is reduced by the assurances provided in a cluster. In order to ensure postharvest loss reduction, clustering of the various agriculture entities should be promoted.

123) It goes without saying that additional critical organisations such as farmer organisations or cooperatives will certainly add value to such clustering by providing training, market information functions, financing facilities, storage and transporting facilities and many other such relevant activities.

124) It is therefore proposed to intervene in the following strategic areas of action in relation to *clustering of agricultural value chain actors as a means of improving economies of scale with beneficial consequences in postharvest loss reduction*:

- a. Promote the partnering of agricultural value chain actors to form clusters for mutual benefit in creating economies of scale and leveraging financing and investment in agriculture in general and postharvest loss management in particular; and
- b. Strengthen farmer organisations / cooperatives in their supporting role in farmer-training, market information, credit and saving services, negotiation skills, and other promotional functions with emphasis on postharvest loss reduction.

STRATEGIC OBJECTIVE 4: PROMOTE VALUE ADDITION

Overview

125) The third key factor of the Rural Development Strategy of 2003 to building an effective agricultural marketing system is the promotion and strengthening of cooperatives. The first two key building blocks, already discussed, are grades and standards and the provision of market information. The Strategy envisages that in addition to providing collection and storage facilities for agricultural products, cooperatives and or unions should also set up small agro-processing industries where processed agricultural products with greater value-added may be produced and in the process, reduce postharvest losses overall. Similarly, the private sector is encouraged to do the same in an orderly agricultural marketing system and through such actions, it is also expected postharvest losses would be reduced. Currently, cooperatives and or unions can buy agricultural machinery, equipment and implements to lease to farmers who individually cannot access these technologies.

126) This environment brings to light three key components of the agricultural value chain that oftentimes are not clearly distinguished yet they each have their own challenges requiring specific measures to address them. Furthermore, each component plays a specific and significant role in the overall postharvest management system. The components involve the supply of inputs mainly to the farming enterprises and these inputs include seeds, fertiliser, farming implements, agrochemicals and pesticides, packaging material such as bags, weighing equipment, and postharvest technologies, among other such inputs. This is a whole but very intricate industry whose main customer is the farmer. The profitability of farming activities is greatly influenced by what takes place in the input sector and the reduction of postharvest losses at the farm can be greatly influenced by actions by this segment of the industry.

127) The agro-processing industry, on the other hand, uses the produce of farming enterprises as raw material for value added products for the consumer market. Naturally, the farmer is in the middle of input suppliers and agro-processors, oftentimes squeezed from both ends. It is essential therefore that the postharvest management strategy should pay particular attention to the needs of these three distinct but closely interwoven enterprises, agri-business, farming enterprises and agro-processing to ensure maximum benefit to the farmers.

Objectives

128) The main objective of interventions in this strategic area involving value addition throughout the agricultural value chains is *to promote efficient, effective, fair and holistic value addition systems involving the agriculture sector for the improved benefit of the smallholder farmer and the consumers at large through reduced postharvest losses.*

Proposed Intervention Areas

- 129) To achieve the above objective, the policy will focus on the following issues:
- a. Farm enterprise input business; and
 - b. Agro-Processing.

Farm Enterprise Input Business

130) Farm enterprise input business activities in Ethiopia, like in most other countries, involve the production of inputs of various kinds for the farming enterprises. This industry includes:

- a. Manufacturers of equipment and machinery including those with an impact on postharvest losses such as harvesters, threshers, milling machines and many more;
- b. Manufacturers and distributors of pesticides and insecticides, the kind used for farm production and storage pest control systems;
- c. Manufacturers of packaging materials, storage equipment such as metal silos;
- d. Producers of improved seed and genetic material for improved production and productivity; and
- e. Ancillary service providers in the form of transport equipment and many other such facilities as are required in the farming enterprises.

131) Based on field study work undertaken, their single most important challenge is the cost of raw materials to fabricate and produce the various technologically advanced and adaptive equipment and supplies required in the farming enterprises. Admittedly, they not only produce for the farming enterprises but for a wider range of consumers making it difficult for the authorities to control the use of any equipment made or produced as a result of any tax or interest rate or financial concessions that may be given to the industry by government. This therefore calls for smart and targeted subsidies. On the other hand, input supply businesses find it a challenge to offer credit, concessions, or financing to the farming enterprises for fear of non-repayments.

132) It is therefore proposed to intervene in the following strategic areas of action in relation to *improved input suppliers business environment for enhanced production and supply of farm inputs in support of effective postharvest management systems*:

- a. Promote coordinated, integrated and targeted smart subsidies for the agricultural input supplier manufacturers to effectively reduce costs for the farming enterprises; and
- b. Promote the development of an effective service industry.

Agro-Processing

133) Agro-processing involves transforming agricultural produce into commodities acceptable for trade, warehousing, processing, transportation and quality preservation with minimum postharvest losses. Value addition for food grains along the agricultural value chain requires chain actors to ensure the commodities meet the required grades and standards protocols. Ensuring that food commodities presented for trade and storage meet these required grades and standards is a critical value addition exercise which forms the backbone of postharvest management.

134) It is therefore proposed to intervene in the following strategic areas of action in relation to *improved agro-processing for sustainable and consistent supply of quality raw materials with minimal postharvest losses along the value chain*:

- a. Promote the partnering of agro-processing and the farming enterprises to develop strong supply links involving technological, financial and human skills advancements support to the farming enterprises;
- b. Promote value addition cooperatives and unions; and

c. Create awareness and promote the desire for quality differentiation through value addition for the benefit of the value chain actors particularly farmers.

PART 5:

POLICY IMPLEMENTATION MECHANISMS

Prerequisites for Successful Implementation

135) The Federal Democratic Republic of Ethiopia (FDRE) and all its arms of government at all levels including kebele, woreda, zonal, regional and federal acknowledge the following as some of the key success factors in the implementation of the Postharvest Management Strategy:

- i. Recognition of the high potential of agriculture in Ethiopia as the engine of economic growth that also can deliver substantially on enhanced food security and overall poverty reduction:
- j. Focusing on a few actions with the most rapid impact on postharvest loss reduction and within those specific objectives, pay attention to a few selected strategic interventions and commodities at a time;
- k. Strong political will and financial budgetary commitment to the Strategy;
- l. The establishment of a strong monitoring and evaluation system involving all key stakeholders;
- m. The creation of effective partnership platforms, institutions (e.g. the Ethiopian Society of Postharvest Management), centres of excellence on postharvest management practices and such similar mechanisms for the full engagement of all key stakeholders in the implementation of the Strategy;
- n. The building of confidence in the financial sector to support agriculture;
- o. The establishment of the requisite infrastructure to support agricultural development including transport and road networks, ICT, electricity and such market related infrastructure; and
- p. The mainstreaming of Gender, youth, HIV/AIDS, environmental including climate change and variability factors and other cross cutting issues into the Strategy interventions at all levels.

Phased Planning and Implementation

136) It is intended that this strategy will be operationalised in five-year cycles allowing for progressivity based on experiences gained during the implementation of the one five-year period into the next. The implementation of identified interventions will be prioritised in such a manner that allows for quick impact and results in the short and medium term. This however does not imply that those actions that need to commence now but for longer term impact will be ignored, these will also be programmed to start at appropriate times.

137) To effectively operationalise this Strategy therefore requires the development of Results Framework followed by the development of the Investment and Implementation Plan and the Monitoring and Evaluation Systems. These are separate activities and therefore not fully developed in this strategy. The next sub-sections however give a brief overview for each.

Results Framework

138) A **Results Framework (RF)** is a key planning, monitoring and evaluation tool. It reflects the “results chain”⁴ of the Strategy and provides the criteria (indicators and targets) to monitor and assess progress being made towards the expected outputs, outcomes and impacts. The Results Framework is a key tool for the alignment and coordination of investments in the implementation of the Strategy. Deriving from the overall strategic framework and proposed intervention areas identified in this document, a Postharvest Management Strategy Results Framework will be developed towards the implementation of the strategy. Shown in Annex 2 is an example of template to the completed developing the Strategy Results Framework.

Investment and Implementation Plan

139) Deriving from the Results Framework, a **Postharvest Management Strategy Investment and Implementation Plan** will be developed. This investment and implementation plan will articulate costed prioritised programmes and sub-programs, identified from the Results Framework, to be implemented every five years. Furthermore, the investment plan will articulate the implementation mechanisms including the institutional, organisational and governance structures to be employed in implementing the Strategy.

140) Furthermore, the Investment and Implementation Plan will provide the costs and budgets, types of funding, levels and amounts of funding and sources of funding to implement the interventions of this strategy. The costing and budgeting is an extensive exercise of its own.

Monitoring and Evaluation

141) It is proposed that the process of Monitoring and Evaluating the Policy be based on Results Based Management (RBM) principles namely, focusing on the achievement of results that contribute effectively towards achieving goals or outcomes; improving institutional and stakeholders’ knowledge on the Policy and its impacts; improving decision making; and promoting an accountability culture towards results.

⁴ **Results** are those changes that can be attributed to a development measure or intervention. The mere fact that a change occurs is not enough to merit its designation as a result of the development measure or intervention, even if the change was planned and intended. The observed change can only be taken up as a result of the intervention if a causal or at least plausible link can be established. We refer to changes that can be causally or plausibly attributed as the results of a development measure. These may be intended or unintended, expected or unexpected, positive or negative.

142) To the above effect stakeholder participation in the Policy monitoring and evaluation systems will also be critical. This engagement will promote transparency in the implementation of the Policy, create a platform for adding value to the Policy and continue to broaden ownership.

143) Furthermore, monitoring and evaluation of the Policy shall be based on manageable processes, measurable and verifiable indicators and conform to basic rules of simplicity, timeliness and cost effectiveness and shall be in alignment with the CAADP Results Framework and Malabo Declaration.

Risks and Assumptions

144) The risks and assumptions in relation to this strategy will be outlined in detail both in the Results Framework and the associated Investment and Implementation Plan.

PART 6A:

RESULTS FRAMEWORK AND INVESTMENT PLAN (2018 – 2022)

RESULTS FRAMEWORK

Principles of Results Framework

A Results Framework (RF) is a key planning, monitoring and evaluation tool. It reflects the “results chain”⁵ of the Strategy and provides the criteria (indicators and targets) to monitor and assess progress being made towards the expected outputs, outcomes and impacts. The Results Framework is a key tool for the alignment and coordination of investments in the implementation of the Strategy

The results chain of this strategy will be developed using the *Results Based Management (RBM)*⁶ system. The results based management system focuses on achievement of results that contribute effectively towards achieving the vision and mission of the strategy; improving institutional knowledge with regard to factors which affect operations; improving decision making; and promoting an accountability culture towards results.

Results Chain Impact

The Results Chain Impact reflects the strategic vision and goal of the PHM strategy, this being the impact desired to which a fully implemented PHM Strategy should contribute to. According to the Ministry of Agriculture and Rural Development, Ethiopia’s agricultural sector has failed to provide moderate and sustained incomes for many who are engaged in the sector such that poverty and food insecurity are concentrated in rural areas (MoARD, 2010). Attention and priority has generally been focused on increased production and productivity, at the almost complete exclusion of postharvest loss reduction yet postharvest losses can be as high as 25% (MoA, 2015). A reduction in postharvest losses could seriously enhance the food security situation of Ethiopia. As such, the vision and desired impact of establishing the Postharvest Management Strategy in Grains in Ethiopia is *to contribute to improved food security and ultimately to poverty reduction through the*

attainment of food self-sufficiency in basic food commodities and improved incomes of the Ethiopian people.

Results Chain Outcomes

To achieve the desired impact, the PHM Strategy needs to target strategic outcomes that will contribute to the impact. These can be divided into intermediate and immediate outcomes. The intermediate outcome of the PHM Strategy is its goal which aims to *improve food availability, food access, food safety and nutrition, and farmer incomes through reduced postharvest losses along the agricultural value chains of grains in Ethiopia.*

Supporting the attainment of this goal is the immediate outcome that aims more specifically to *reduce food losses through the adaptation / adoption and implementation of appropriate postharvest management systems along the agricultural value chains in Ethiopia.* This immediate outcome comprises the overall objective of the PHM Strategy.

Results Chain Outputs

In order to achieve the overall objective of the PHM Strategy, four strategic or specific objectives or outputs were identified as follows:

- e. Food losses (quantitatively and qualitatively) reduced along the agricultural value chains of grains;
- f. Agricultural input and output market efficiencies for grains improved with the view to enhancing postharvest management practices;
- g. Access to financing and investment improved for enhanced postharvest loss management practices; and
- h. Value addition enterprises sustainable supported throughout the agro-industry.

Figure 2 summarises the Postharvest Management Strategy in Grains in Ethiopia Results Framework. Annex I, Tables A to D outline the outputs identified for each of these specific objectives. For each output, these tables outline the main activities expected during the investment period (2018 – 2022) and the intervention areas for each expected main activity.

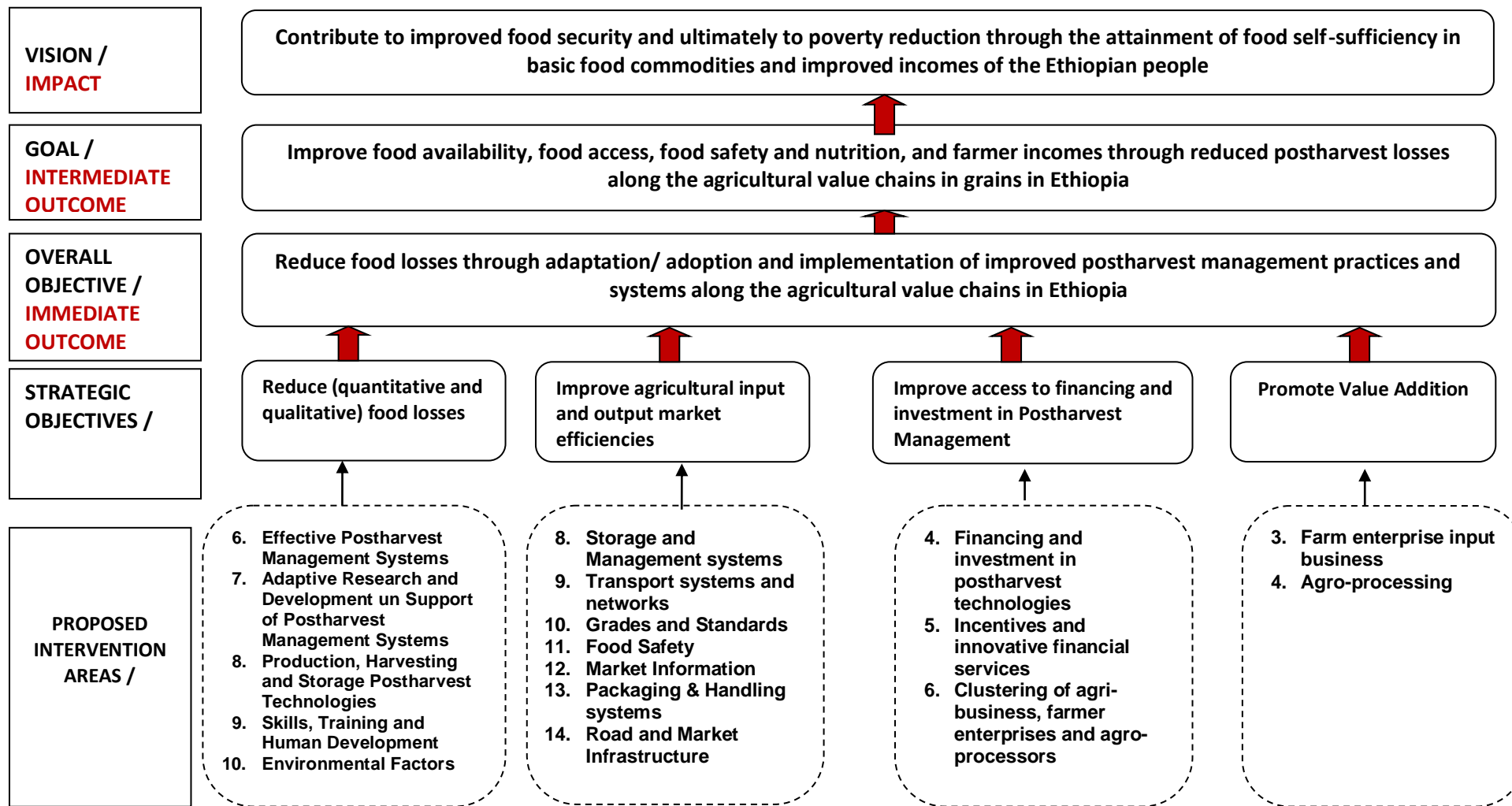


Figure 2: Results chain of postharvest management strategy in grains in Ethiopia

PHM PRIORITISED PROGRAMMES

PROGRAMME PRIORITIES

Overview

Deriving from the Results Framework a set of programmes have been priorities for implementation during the five-year period 2018 – 2022. Each programme is broken down into one or more sub-programmes and for each sub-programme, a set of intervention areas into which investment should be made during the implementation period, are suggested (see Annex I, Tables A to D). These are as follows:

Programme 1: Food Losses Reduced

Postharvest losses, both quantitative and qualitative losses, are one of the key challenges facing Ethiopia's agricultural value chains. In the African Postharvest Losses Information System (APHLIS) report on postharvest losses in 2012, it was estimated that for teff, the loss was 12.3%, for sorghum, the loss was 11.6%, for wheat, the loss was 9.9% and for maize, the loss was 16.8%. Clearly, postharvest food losses are significant requiring specific attention.

The objective of this output is to *effectively improve food availability that is also safe for human consumption.*

Five main activities and related intervention areas identified as contributing to the attainment of this objective are:

Sub-Program 1.1: Effective Postharvest Management Systems Developed

This requires:

- Establishment and strengthening of appropriate postharvest management institutional and operational structures including monitoring and evaluation systems in both the public and private sectors ensuring clear roles, responsibilities, and levels of accountability;
- Establishment of effective advocacy and promotion of good practices in postharvest management systems throughout the agricultural value chains;
- Establishment of effective inter-disciplinary (agriculture, health, nutrition, Science & Technology, social sciences, etc) postharvest management coordination systems; and
- Provision of sufficient financial and technical resources for postharvest activities at all levels of the agricultural value chain.

Investment is therefore required in the following intervention areas/ activities:

- a. **Establish and strengthen inter-disciplinary national, regional and woreda level PHM Platforms;**
- b. **Establish and strengthen PHM Units in the MOA at all levels;**
- c. **Develop a PHM Communications and Awareness plan for the advocacy of PHM; and**
- d. **Establish annual exhibitions of PHM technologies.**

Sub-Program 1.2: Adaptive Research and Development in Support of Postharvest Management Systems promoted

This requires:

- Facilitation of research and development institutions as well as universities to prioritise postharvest management research and training in postharvest management systems;
- Promotion of public and private sector partnerships in postharvest management systems research and development; and
- Facilitation of evidence based studies to measure the actual postharvest losses in both physical as well as economic value terms throughout the agricultural value chain for decision making.

Investment is therefore required in the following intervention areas/ activities:

- a. Establish and regulate the provision of PHM attachment / apprenticeship;**
- b. Establish grant support system through Universities and / or research institutions to sponsor field and laboratory PH estimation and analysis;**
- c. Launch Annual Post Harvest Loss Statistical Yearbook;**
- d. Develop cohesive methodologies for PH assessment;**
- e. Promote adoption and adaption of affordable PHM technologies from abroad;**
- f. Promote adoption and adaption of PH methods and techniques to reduce food losses; and**
- g. Promote nutritional recipes preparations to preserve foods.**

Sub-Program 1.3: Production, Harvesting and Storage Postharvest Technologies developed and disseminated

This requires:

- Promotion of coordinated research and development on appropriate and affordable technologies to support harvesting, threshing, drying, packing, transporting and storage of grains with minimal postharvest losses;
- Creation of incentives and easy access to financing for the adoption of postharvest loss minimising technologies as well as financing for its servicing and maintenance;
- Promotion of improved human skills development in machine operators and machine maintenance to improve on the efficiency of machinery technology that can reduce postharvest losses;
- Establishment of regulatory frameworks and institutions to enforce adherence to machinery and technology use specifications; and
- Promotion of the development of an effective service industry to render machinery repair and services.

Investment is therefore required in the following intervention areas/ activities:

- a. **Identify PHM technologies and associated investment plan to implement the Mechanisation Strategy;**
- b. **Promote local manufacture / sub-assembly of PHM technologies and dissemination of prioritised technologies;**
- c. **Establish PHM Technology Demonstration Centres;**
- d. **Establish, in collaboration with private sector and in alignment with RTCs, PHM Machine Repairs, Maintenance, Training and Service Hubs at the woreda level;**
- e. **Equip the PHM Machine Repairs, Maintenance, Training and Service Hubs with relevant PHM machinery and equipment;**
- f. **Establish a national standard control and enforcement system on the design, manufacture and performance of PHM technology; and**
- g. **Conduct feasibility study to establish a national testing and certification centre for all machinery including PHM technologies.**

Sub-Program 1.4: Skills, Training and Human Development in postharvest management improved

This requires:

- Deepening of the training curriculum to cover postharvest management practices and systems including practical in-the-field robust demonstrations at existing vocational and university postharvest training levels;
- Establishment of a centre of excellence / incubation centre in postharvest management systems training;
- Promotion of knowledge sharing including indigenous knowledge and understanding of postharvest losses, its causes and possible solutions;
- Creation of career incentives and opportunities for postharvest management trained personnel; and
- Mainstreaming gender particularly women and youth, in skills and human development activities in postharvest management systems.

Investment is therefore required in the following intervention areas/ activities:

- a. **Establish grant support at Universities / Research Institutions for the establishment of Postharvest Engineering Programmes;**
- b. **Establish grant support for business training centres to train farmers / end users in business management skills;**
- c. **PHM training / apprenticeship programmes established in collaboration with the private sector and recognised as an industry qualification;**
- d. **Strengthen Central Statistical Agency personnel with PHM experts;**
- e. **Strengthen Centres of Excellence, training centres and extension services centres in PHM including on indigenous knowledge in PHM**
- f. **Strengthen the Ethiopia Bureau of Standards on standard setting and testing to include PHM;**

- g. Develop PHM curriculum for agricultural technical vocational education training (ATVET) program to strengthen the development and knowledge of Development Agents on PHM;**
- h. Incorporate PHM packages and manuals in the Development Agents toolkits;**
- i. Establish grassroots capacity building training programme on PHM targeting particularly women and youth;**
- j. Develop women and youth entrepreneurs in the provision of repair and maintenance of PHM technologies; and**
- k. Promote behavioural change to good agricultural practices including improved PHM techniques.**

Sub-Program 1.5: Sustainable Environmental Management Promoted

This requires:

- Facilitation of effective land use practices and implement environmentally friendly agricultural practices that maximize vegetation cover to prevent erosion, replace nutrients removed, and to put in place structures (terraces, bunds, vegetation strips) so as to reduce the speed and volumes of water flow over the soil;
- Protection and re-establishment of forests for their economic and ecosystem services but more so to regenerate forest cover destroyed through postharvest practices; and
- Monitoring and enforcement of the proper sale, use and disposal of pesticides and other such agro-chemicals using integrated pest management practices.

Investment is therefore required in the following intervention areas/ activities:

- a. Develop Guidelines on the proper sale, use, handling and disposal of agro-chemicals including storage chemicals;**
- b. Strengthen and fully equip inspectorate authority to enforce guidelines on proper sale, use, handling and disposal of agro-chemicals including storage chemicals;**
- c. Establish training programmes on the use, handling and disposal of agro chemicals including storage chemicals;**
- d. Support establishment of certified chemical handling enterprises that can provide and certify such services; and**
- e. Create awareness on the side effects of mis-use of chemicals especially those related to PHM.**

Programme 2: Agricultural Input and Output Market Efficiencies Improved

According to the Rural Development Strategy of 2003, one of the essential elements towards market-led agricultural development is the building of an efficient agricultural marketing system capable of delivering produce at the right time, in the right place, at the right price and in an acceptable quality. The serious challenges facing input and outputs markets and therefore exacerbate postharvest losses include: poor and most times inadequate and inappropriate storage facilities and management; inadequate or inefficient transport systems and networks; lack of enforcement of existing grades and standards; lack of

value differentiation for quality of product except for those commodities that are exported;

outdated packaging and handling systems; and lack of market information including lack of support from extension services in matters of markets and trade as all efforts are usually centred around increased production and productivity with little regard for post-production issues.

The objective of this output is therefore *to develop an effective and efficient agricultural marketing system capable of delivering produce at the right time, in the right place, at the right price and in an acceptable quality whilst promoting and ensuring effective postharvest loss management systems.*

Eight main activities and related intervention areas identified as contributing to the attainment of this objective are:

Sub-program 2.1: Sustainable and Affordable Postharvest Systems Promoted

This requires:

- Facilitation of the development of suitable and affordable storage facilities along the supply chains at the various household, *kebele*, *woreda*, zonal and regional levels;
- Facilitation and promotion of the manufacture and wide distribution of efficient and affordable storage technologies including silos and improved traditional storage systems; and
- Promotion of PPP in storage infrastructure services and provision.

Investment is therefore required in the following intervention areas/ activities:

- Promote the use of improved PH handling technologies;**
- Promote the warehouse receipt system ensuring that trust in the system is built throughout;**
- Support domestic production of improved PH technologies;**
- Establish investment incentives, tax breaks and other forms of support for local manufacturers of PHM technologies; and**
- Promote agro-dealers for the distribution of PHM technologies.**

Sub-programme 2.2: Effective Storage Management Systems Implemented

This requires:

- Promotion of food safety standards in the handling of grains both in terms of warehouse physical space as well as grain cleanliness and quality;
- Promotion of proper and safe storage pest management systems including the use and disposal of fumigants; and
- Promotion of the maintenance of high warehouse standards through warehouse certification requirements.

Investment is therefore required in the following intervention areas/ activities:

- a. Develop warehouse accreditation and certification systems;**
- b. Establish warehouse accreditation and certifying agency;**
- c. Support the development of high standard warehouse facilities particularly at the primary market level;**
- d. Develop grain handling, warehouse management and operational guidelines taking into account food safety standards;**
- e. Strengthen integrated pest management systems for storage pests;**
- f. Train warehouse keepers on grain handling and management systems; and**
- g. Modernize the registration, handling, management and control system of storage chemicals.**

Sub-programme 2.3: Transport Systems and Marketing Networks Improved

This requires:

- Facilitation of the local manufacture or assembling of labour saving small sized transport technologies suitable for smallholder households for farm use and transport to the local market;
- Upgrading of feeder roads and main trunk road network infrastructure;
- Supporting the acquisition of appropriate vehicular modes for transporting commodities from woreda to zonal to regional markets;
- Promotion of the provision of ICT in rural areas to enhance farmer connectivity to the rest of the country with the view to improving their standards of education, receiving genuine and up-to-date market information, practicing mobile banking and other such activities facilitated by ICT;
- Promotion of the provision of service provision facilities such as testing centres closer to the smallholder farmers; and
- Strengthening of linkages among credit and saving institutions with locally established fabricators of postharvest technologies and smallholder farmers who through the provision of market infrastructure are encouraged to establish their enterprises in rural areas.

Investment is therefore required in the following intervention areas/ activities:

- a. Support the local manufactures of small sized agricultural and farm level transport machinery and equipment;**
- b. Promote alternative improved farm transport systems;**
- c. Support the upgrading and maintenance of feeder roads; and**
- d. Encourage the design of appropriate ICT applications for ease of information transfer even by mobile phones.**

Sub-programme 2.4: Grades and Standards Established and Implemented

This requires:

- Development of appropriate crop quality grades and standards using international grain grades and standards as a reference point;
- Establishment of quality testing laboratories to support postharvest management systems;
- Establishment of market price differentiations for quality to promote postharvest management activities; and
- Building capacity to enforce the application of established grades and standards.

Investment is therefore required in the following intervention areas/ activities:

- a. Update the Grain Grades and Standards**
- b. Strengthen Grades, Standards and Quality certification system**
- c. Establish grain grades, standards and quality testing and training centres**
- d. Support the establishment of certified grades, standards and quality superintendent institutions**
- e. Train laboratory technicians on grain grades and standards and quality testing**

Sub-programme 2.5: Food Safety Standards Established and Implemented

This requires:

- Strengthening mandate and capacities of food safety inspectorates
- Enforcement of food safety standards in the transportation, warehouse, storage and market place operations

Investment is therefore required in the following intervention areas/ activities:

- a. Revive the Food and Safety Inspectorate to implement, monitor and enforce food safety standards;**
- b. Fully equip the food safety inspectorate to enable full functionality;**
- c. Review and update the food safety standards, and warehouse and transportation food safety related standards; and**
- d. Train food safety inspectors on food safety.**

Sub-programme 2.6: Agricultural Market Information System Developed

This requires:

- Promotion of the effective functioning of the postharvest loss platform;
- Establishment of an agricultural information management system (AIMS); and
- Implementation of the right to information act as it refers to agricultural market information.

Investment is therefore required in the following intervention areas/ activities:

- a. Establish an Agricultural Market Information System**
- b. Develop commodity trading exchanges**

Sub-programme 2.7: Packaging and Handling Systems Established and Implemented

This requires:

- Promotion of standardisation of packaging to the 50 kg standard used world-wide;
- Establishment of bag specifications including the material used in the manufacture of the bag; bag measurements; construction patterns of the bag taking into account the need for fumigation and exposure to the weather elements; sewing or closing of the bags; labelling of the bags; and other such specifications;
- Promotion of good warehouse husbandry systems facilitated by a smaller and standardised 50 kg bag allowing for efficient handling; reduced spillage and waste; and effective control of storage pests and rodents; and
- Promotion the appropriate application and use of different bag designs and structures to prevent the use of wrong packaging which may lead to increased postharvest losses.

Investment is therefore required in the following intervention areas/ activities:

- a. Establish packaging standards to international standards including the type, use and quality of the packaging;**
- b. Promote the use of hermetic type bags; and**
- c. Support the local manufacture of polypropylene and hermetic bags.**

Programme 3: Improved Access to Financing and Investment into Postharvest Management

Undertaking investments involves decision on how much will be spent on production, technological acquisitions, and various other farm related activities once all other non-farm related requirements have been taken care of. For the smallholder and mainly rural farmers in Ethiopia, disposable income allocated to these activities is limited to their on-farm earnings which are little for the demands at hand. Farmer investment in technological improvements including postharvest loss reduction activities is therefore limited due to lack of access to financing. To stimulate private sector engagement and investment in the agriculture sector and particularly into postharvest management systems requires an enabling economic policy environment that makes these activities profitable.

The main objective therefore of this output is *to create an enabling environment for private sector investment into agriculture and easier access to affordable financing by farming enterprises towards improved postharvest management practices throughout the agricultural supply and value chain activities*

Sub-programme 3.1: Access to Financing and Investment in Postharvest Management Improved

This requires:

- Supporting of local postharvest technology manufactures and or artisans with specialised tax rebates on imported raw materials; and
- Facilitating conditions for cooperatives and unions to purchase and provide postharvest management services to farmers.

Investment is therefore required in the following intervention areas/ activities:

- a. Review tax rebates on sub-assembled or locally manufactured machinery/ technologies;**
- b. Strengthen business training and service support programmes for entrepreneurs;**
- c. Support PHM technology rental service providers; and**
- d. Develop Lending Guarantee Products in collaboration with the Financing and Insurance sector for cooperatives or unions – as form of collateral for loan access towards PH Management servicing.**

Sub-programme 3.2: Incentives and Innovative Financing Services Promoted

This requires:

- Promotion of cooperatives and unions to build their capacity to provide credit for postharvest technological acquisitions by farmers;
- Provision of innovative financial services that enable value-chain actors to access postharvest technologies and services;
- Provision smart subsidies to facilitate the micro-finance sub-sector and cooperatives to provide cheaper loans to smallholder farmers particularly in areas involving technologies and machinery for postharvest loss management; and
- Promotion of cooperatives and unions to build their capacity to provide credit for postharvest technological acquisitions by farmers.

Investment is therefore required in the following intervention areas/ activities:

- a. Strengthen capacity development activities (human as well as material) for credit service;**
- b. Promote warehouse receipting system;**
- c. Strengthen group loan guarantee system;**
- d. Promote Micro-Financing through enabling financial instruments at local levels;**
- e. Support low interest financing for PHM technologies; and**
- f. Promote forward delivery contracting and out-grower systems.**

Sub-programme 3.3: Clustering of Agri-Business, Farmer Enterprises and Agro-Processors Promoted

This requires:

- Promotion of the partnering of agricultural value chain actors to form clusters for mutual benefit in creating economies of scale and leveraging financing and investment in agriculture in general and postharvest loss management in particular; and
- Strengthening of farmer organisations / cooperatives in their supporting role in farmer-training, market information, credit and saving services, negotiation skills, and other promotional functions with emphasis on postharvest loss reduction.

Investment is therefore required in the following intervention areas/ activities:

- a. Support preparation of bankable business / project proposals involving clusters;**
- b. Promote the business cluster concept in the agriculture value chain including PH; and**
- c. Support Business Training of Farmer Organisations to better service their members.**

Programme 4: Promote Value Addition

The Rural Development Strategy of 2003 envisages that in addition to providing collection and storage facilities for agricultural products, cooperatives and or unions should also set up small agro-processing industries where processed agricultural products with greater value-added may be produced and in the process, reduce postharvest losses overall. Similarly the private sector is encouraged to do the same in an orderly agricultural marketing system and through such actions, it is also expected postharvest losses would be reduced.

The main objective of this output is therefore *to promote efficient, effective, fair and holistic value addition systems involving the agriculture sector for the improved benefit of the smallholder farmer and the consumers at large through reduced postharvest losses.*

Sub-programme 4.1: Farm Enterprise Input Business Promoted

This requires:

- Promotion of coordinated, integrated and targeted smart subsidies for the agricultural input supplier manufacturers to effectively reduce costs for the farming enterprises.

Investment is therefore required in the following intervention areas/ activities:

- a. Support financing for rural value addition;**
- b. Support micro-financing institutions in rural areas; and**
- c. Introduce Postharvest technology for processing in Agro-Parks.**

Sub-programme 4.2: Agro-Processing Promoted

This requires:

- Promotion of the partnering of agro-processing and the farming enterprises to develop strong supply links involving technological, financial and human skills advancements support to the farming enterprises;
- Promotion of value addition cooperatives and unions;
- Creation of awareness and promote the desire for quality differentiation through value addition for the benefit of the value chain actors particularly farmers; and
- Promotion of small scale rural based agro-processing and value addition to allow for the preservation of crops closer to source of production and therefore reduce postharvest losses in transportation of commodities far afield and storage losses including quality losses associated with unprocessed commodities.

Investment is therefore required in the following intervention areas/ activities:

- a. Support women-based and youth- based business entrepreneurial programmes for value addition and agro-processing activities;**
- b. Create agro-processing platform;**
- c. Support agro-processing business training service providers;**
- d. Develop local commodity exchanges based on set grades and standards; and**
- e. Promote village level value addition technologies including food processing.**

Summary of Prioritised Programmes and Intervention Areas

Annex I Tables A to D summarise these priority programmes, their objectives and relevant suggested intervention areas. These will form the basis of costing the PHM Investment Plan which is the subject matter of the next chapter.

PHM INVESTMENT PLAN (2018 – 2022)

BUDGET AND COSTS

Overview

This investment plan articulates costed prioritised programmes and sub-programmes identified earlier and outlined in the Results Framework. It is essential to note that there are various categories into which the investment plan budget and costs can be established. First is the facilitation or coordination category which estimates the cost of facilitating the implementation of specific interventions outlined in the Results Framework. Examples of such facilitation costs are the undertaking of studies; the development of bankable project proposals; the undertaking of surveys; etc.

The second category of costs of an investment plan involves the actual hard core capital investment. Examples of these could be the purchase of equipment and setting up of a bag manufacturing plant; the cost of manufacturing a specific technology or equipment; the cost of establishing a processing plant; etc. These hard core investment costs generally run into billions of Birr. They are very project specific and are not easily estimable. These hard core investment costs are not part of this investment plan.

8.2 PHM Investment Plan Budget and Costs

Table 1 is an overview of the proposed investment plan for the period 2018 – 2022 amounting to a total of Birr 212 billion (US\$10.6 million). The largest proportion of this investment (47%) is earmarked for the first specific objective, Reducing Food Losses. This is followed by Access to Financing and Investment into Postharvest Management at 20%, then Improved Agricultural Input and Output Market Efficiencies at 16% and lastly the Promotion of Value Addition at 13%.

Table 1: Overview of investment plan budget and costs by specific objective

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Sub-Totals	% of TI
	37,825,000	57,240,000	50,760,000	38,280,000	27,820,000	211,925,000	BIRR
TOTAL POSTHARVEST MANAGEMENT INVESTMENT PLAN (2018 - 2022)	1,891,250	2,862,000	2,538,000	1,914,000	1,391,000	10,596,250	US\$
SO 1: Reduce (quantitative and qualitative) Food Losses	974,250	1,232,000	1,264,000	917,000	617,000	5,004,250	47
SO 2: Improved Agricultural Input and Output Market Efficiencies	427,000	708,000	457,000	310,000	252,000	1,665,000	16
SO 3: Improve Access to Financing and Investment into Postharvest Management	325,000	497,000	482,000	437,000	337,000	2,078,000	20
SO 4: Promote Value Addition	165,000	425,000	335,000	250,000	185,000	1,360,000	13

Table 2 overleaf provides a more detailed breakdown of the investment plan budget and costs by specific objective. Provided separately are the schedules that give a breakdown of the activities to be undertaken for each intermediate outcome. It is these activities that have been costed as summarised in Table 2.

Table 2: Estimated coordination / facilitation costs – Investment plan

			Birr Exch /US\$	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Sub-Totals	% of TI
			20	37,825,000	57,240,000	50,760,000	38,280,000	27,820,000	211,925,000	BIRR
TOTAL POSTHARVEST MANAGEMENT INVESTMENT PLAN (2018 - 2022)				1,891,250	2,862,000	2,538,000	1,914,000	1,391,000	10,596,250	US\$
SO 1: Reduce (quantitative and qualitative) Food Losses				974,250	1,232,000	1,264,000	917,000	617,000	5,004,250	47
Intermediate Outcome	1.1	Effective Postharvest Management Systems Established		340,250	205,000	134,000	122,000	24,000	825,250	16
	1.2	Adaptive Research and Development in Support of PHM Systems Promoted		81,000	216,000	434,000	69,000	9,000	809,000	16
	1.3	Production, Harvesting and Storage PH Technologies developed and disseminated		141,000	152,000	56,000	220,000	64,000	633,000	13
	1.4	Skills, Training and Human Development in PH Management Improved		362,000	364,000	461,000	382,000	341,000	1,910,000	38
	1.5	Sustainable Environmental Management promoted		50,000	295,000	179,000	124,000	179,000	827,000	17
SO 2: Improved Agricultural Input and Output Market Efficiencies				427,000	708,000	457,000	310,000	252,000	1,665,000	16
Intermediate Outcome	2.1	Sustainable and affordable PH systems promoted		235,000	35,000	25,000	25,000	25,000	345,000	21
	2.2	Effective storage management systems implemented		65,000	197,000	77,000	12,000	12,000	363,000	22
	2.3	Transport systems and networks improved		10,000	45,000	20,000	10,000	20,000	105,000	6
	2.4	Grades and Standards established and implemented		55,000	137,000	12,000	227,000	47,000	478,000	29
	2.5	Food Safety Standards established and implemented		-	117,000	199,000	24,000	34,000	374,000	22
	2.6	Agricultural Market Information system developed		-	107,000	72,000	12,000	62,000	253,000	15
	2.7	Packaging and Handling systems established and implemented		62,000	70,000	52,000	-	52,000	236,000	14
SO 3: Improve Access to Financing and Investment into Postharvest Management				325,000	497,000	482,000	437,000	337,000	2,078,000	20
Intermediate Outcome	3.1	Access to Financing and Investment in PHM Improved		90,000	57,000	112,000	12,000	22,000	293,000	14
	3.2	Incentives and Innovative Financing Services promoted		55,000	150,000	105,000	60,000	20,000	390,000	19
	3.3	Clustering of agri-business, farmer enterprises and agro-processors promoted		180,000	290,000	265,000	365,000	295,000	1,395,000	67
SO 4: Promote Value Addition				165,000	425,000	335,000	250,000	185,000	1,360,000	13
Intermediate Outcome	4.1	Access to Financing and Investment in PHM Improved		-	180,000	100,000	80,000	20,000	380,000	28
	4.2	Incentives and Innovative Financing Services promoted		165,000	245,000	235,000	170,000	165,000	980,000	72

PHM IMPLEMENTATION PLAN

IMPLEMENTATION PLAN

An effective Postharvest Management Implementation Plan should comprise of at least the following broad functions:

- a. A management structure whose role is to coordinate efforts of all stakeholders towards implementing the strategy for reducing postharvest losses. The management structure should harness the available technical and financial resources that will be needed to implement the strategy;
- b. A resource mobilisation function as without adequate and affordable resources, the attainment of the strategy results and impact would not be achieved; and
- c. Monitoring and evaluation to ensure implementation remains on course to achieving the set out targets.

In this Chapter, the management structure and resources mobilisation will be discussed in more detail. Chapter 6 will be dedicated to the Monitoring and Evaluation function. This chapter will also summarise the risks and assumptions to PHM strategy implementation.

PHM Implementation Plan Management Structure

One of the key recommendations by stakeholders during the process of developing this strategy was that there is need for the establishment of coordinated functions in efforts towards understanding, managing and reducing postharvest losses in grains in Ethiopia. Central therefore to the PHM Implementation Plan is the creation of a holistic structure that will manage and implement the strategy by involving and ensuring effective participation throughout the value chain. The following functions stood out as most essential towards the effective implementation of the strategy for maximum results:

- a. Policy and Regulatory Functions;
- b. Agricultural R&D and Extension Service Provision;
- c. Trade and Marketing Service Provision
- d. Technology Service Provision;
- e. Value Addition and Agro-processing; and
- f. Financial and Support Services.

The coordinated actions among these functional groups is needed to ensure effective PHM strategy implementation. The roles and responsibilities of these functional groups, diagrammatically represented in Figure 3, will be briefly discussed in the next sub-sections. Required to operationalise this management structure will be an adequately resourced PHM Directorate in the Ministry of Agriculture and Natural Resources.

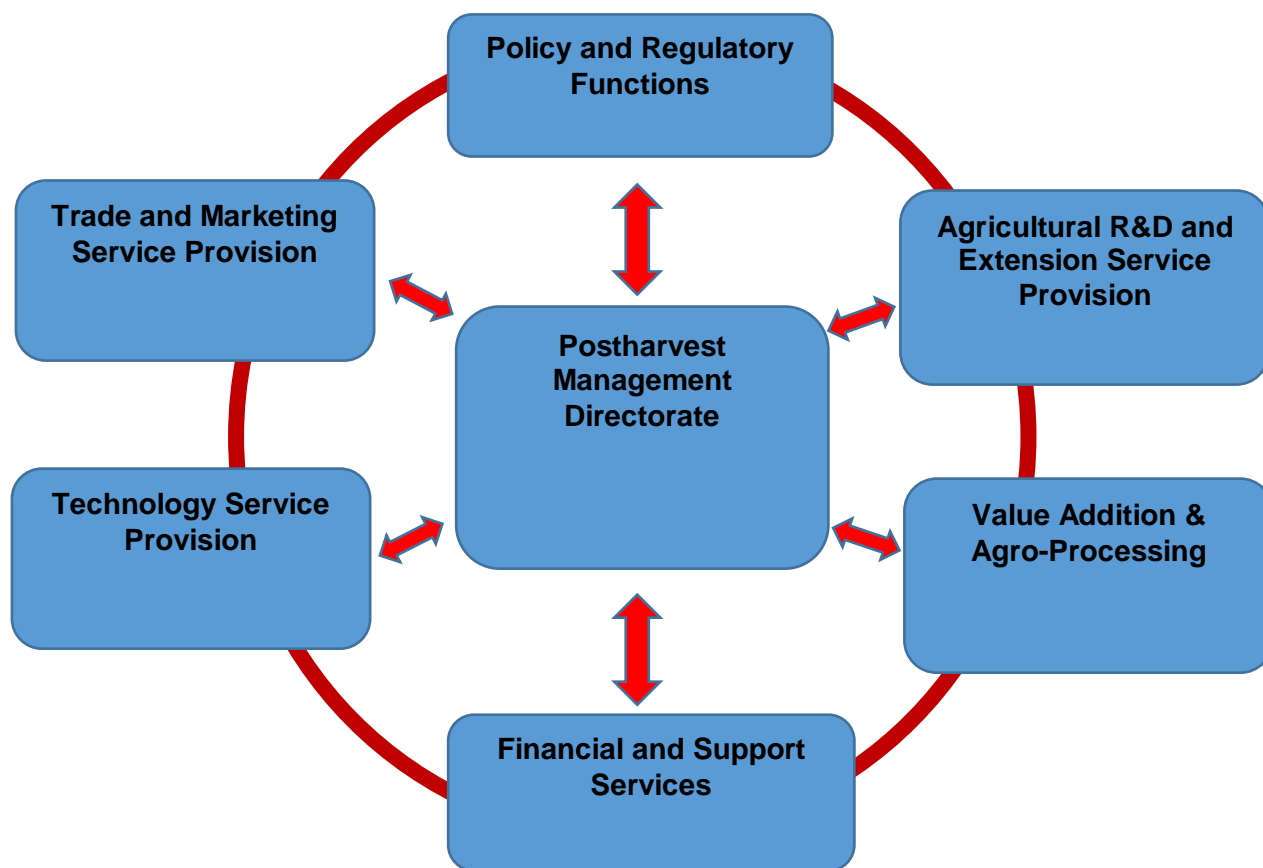


Figure 3: Schematic Representation of the PHM Implementation Management Structure

Policy and Regulatory Functions

The Policy and Regulatory Functions involve policy formulation and direction; regulatory, certification and inspectorate functions; and resource (technical and financial) mobilisation for the effective implementation of the strategy. The core institutions involved in these processes and activities include the government ministries with the Ministry of Agriculture and Natural Resources as the leading governmental institution responsible for implementing the PHM Strategy. In support are regulatory frameworks such as the various inspectorates to undertake and ensure adherence to grades and standards, technology manufacturing specifications, food safety standards, chemical use and disposal systems and such similar functions. Lastly, technical and financial services providers including public, private domestic and international investors and development partners play an essential facilitative role.

It is proposed therefore that the coordination of the policy and regulatory functions reside with the Ministry of Agriculture and Natural Resources through the creation of a specific Postharvest Management Directorate and structure represented at all levels (federal, zonal and woreda levels). The Directorate's overall function will be to oversee and coordinate with all key stakeholders in all key functional groups towards a coherent and coordinated implementation

of the postharvest management strategy.

Agricultural R&D and Extension Service Provision

The Agricultural and Extension Service Provision functions involve agricultural research and development; farmer training, education and knowledge services; and extension services. The role of the agricultural research institutions and other similar supporting institutions will be critical towards the effective implementation of this strategy. It is not enough to put lots of effort on increased production but also to deal with loss reduction throughout the agricultural value chain and research plays a critical role in this function.

The role of Universities is both in (a) field research on the actual losses in grains in Ethiopia, the causes of these losses, and potential solutions to reducing these losses; and (b) training and teaching on PH technologies, traditional and best practices in grains production, storage and value addition processes.

The role of agricultural training centres including the ATVETs will be critical towards PH training and knowledge development for the effective implementation of this strategy. All the results from research institutions, universities and training colleges need to be translated into action at the producer, trade and marketing levels requiring comprehensive extension services. The training in PH management and deployment of Development Agents and similar such agents is most crucial. Training and the strengthening of farmer organisations, cooperatives and unions is also very essential in these processes.

It is proposed therefore that in the PHM implementation plan, the services of the following sectors be represented as the Agricultural R&D and Extension Services Provision group:

- Agricultural research and development institutions;
- Universities and other tertiary institutions;
- Agricultural Technical and Vocational Education and Training institutions; and
- Farmer organisations, cooperatives and unions.

Trade and Marketing Service Provision

The Trade and Marketing Service Provision function involves storage systems; trade and marketing of agricultural produce systems; packaging, transportation and warehousing systems; commodity exchange systems; and agricultural information systems. The role of primary market centre operations, commodity exchanges and retail market centres are central to implementing this PHM Strategy. With a systematic and organised trade and marketing system that is easily accessible to producers and with innovative storage and marketing arrangements including warehousing receipt systems through professional storage and marketing service providers, the targets of reducing postharvest losses could be attainable. It is therefore crucial for the PHM implementation plan to consider and take into account the trade and marketing service issues as a group in the overall PH management structure.

However, there are no central or apex institutional representatives of these many market players making it difficult to single out key institutional structures that will be involved in the implementation of the PHM strategy. The PHM Platform that has existed but may not have functioned fully could provide a way forward assuming that the PHM Platform is widely representative of these key stakeholders in the agricultural value chain. Primary market

centres and farmer cooperatives and unions are also critical players in this role as are the commodity exchanges.

It is proposed therefore that the PHM Platform be strengthened, be made more fully functional and therefore take on the role of an apex body representing the many facets of production, storage, marketing and value addition in the implementation plan of the PHM strategy. Where there are large institutions such as the Ethiopian Commodity Exchange, the Federal Cooperative Union, and such similar institutions, these could also actively assume key responsibilities in the implementation of the PHM strategy.

Technology Service Provision

The Technology Services Provision sub-sector plays a major role in the success or failure of the implementation of the PHM Strategy. This sector, however faces many challenges including high costs of manufacture of PHM machinery due mainly to high costs of imports; lack of skilled resources for the provision of efficient and effective services in the repairs and maintenance of machinery; and lack of support in the domestication of imported technologies to local conditions, to name but a few. Yet it is through technological advances in production, harvesting, storage, processing that PH losses can effectively be contained.

As with Trade and Marketing Service Provision, this sub-sector does not have an apex institutional structure whose services could be used in the PHM implementation plan as a single coordinated source for the industry. However, there are institutions including the Ethiopia Agricultural Transformation Agency, NGOs and international support agents such as Sasakawa – Global 2000, the department of Mechanisation in the Ministry of Agriculture and Natural Resources, HiTEC Trading and others whose role in this function is crucial.

It is therefore proposed that the PHM strategy roll-out and management structure incorporate representation from the technology service providers.

Value Addition and Agro-Processing

The Value Addition and Agro-Processing functions not only at the industrial level but more so at the primary levels are critical in the transformation of agricultural produce. The value addition starts with improved grading and packaging standards at the farm level. This can have a considerable positive impact on the incomes of the farmers when higher quality produce is rewarded with higher prices. Certainly good grading and standards has a positive impact on profits generated by the agro-processing industry who then also do not need to spend a lot in cleaning and grading processes. Whilst currently value adding and agro-processing industry are not taking a very active role in promoting PHM, the sustainable success of the PHM Strategy can be assured by the heavy involvement of this industry in its implementation.

As with the two previous sub-sections, there are no central or apex institutional representatives of these players in value addition and agro-processing making it difficult to single out key institutional structures that will be involved in the implementation of the PHM strategy. Once again, the PHM Platform could provide a way forward by ensuring the involvement of the value addition and agro-processing industry.

Financial and Support Services

Financial and Support Services play one of the major roles without which implementation cannot be undertaken. At every stage of the value chain, there is need to access financing. Therefore, the role of financial institutions in understanding the entire agriculture value chain needs is crucial. Providing this service are a range of service providers including micro-financers, commercial banks, credit and savings cooperatives and individual sources. To a large extent, NGOs and development partners have also been a source of financing for PHM activities although often in relation to specific projects.

As this grouping is not homogeneous, it is difficult to have a single institutional representation. It is however one of the most essential elements in the PHM implementation plan management structure and therefore the PHM Platform could be central to harnessing the support and contributions of this sector towards the implementation of the PHM strategy.

Resource Mobilisation

A strategy that is not adequately resourced is unlikely to achieve its targets. It is therefore vital that resource mobilisation be given priority. This calls for budgetary allocations from the government as well as closer and more coordinated resource mobilisation from development and cooperating partners. One of the central tasks therefore of the suggested PHM Directorate in the Ministry of Agriculture and Natural Resources is to mobilise resources for the implementation of the PHM strategy. The Investment Plan chapter outlined the needed funding for coordinating and undertaking activities that will unlock further investment into agriculture. These funds need to be raised and managed properly for the implementation of the PHM strategy.

Risks and Assumptions

Table 3 is a risk matrix for the Postharvest Management Strategy implementation.

Table 3: Risk matrix for the postharvest management strategy implementation

Risk	Impact	Probability	Mitigation
Lack of political support of the PHM Strategy	PHM remains a non-priority	Medium	<ul style="list-style-type: none"> AGP2 and the development of the PHM Strategy essentially provide a way forward; The continued determination of the Federal Government and Ministry of Agriculture and Natural Resources to highlight PHM as a solution to food insecurity and income generation in Ethiopia The effective implementation of the PHM Strategy
Failure to structure an effective PHM management structure	Fragmented (incoherent and uncoordinated) action towards PHM strategy implementation will prevail leading to failure to attain PHM Strategy goals, objectives and targets	Medium	<ul style="list-style-type: none"> Ministry of Agriculture and Natural Resources is setting up a PHM structure; PHM Platform exists but needs to be strengthened taking into account support from the six functional groups identified as crucial to the sustained and successful implementation of the PHM Strategy Coordinate more efficiently actions and efforts by all stakeholders in the agricultural value chain on PHM issues
Failure to adequately resource the PHM Strategy management and implementation investment plan	High costs of fragmented actions PH Strategy implementation will fail and therefore continued high levels of postharvest losses will remain	Very High	<ul style="list-style-type: none"> Engage with Federal Government for budgetary allocation of resources for PHM Leverage private sector funding by involving the value addition / agro-processing industry more in promoting PHM by adopting grades and standards and paying for quality differentiation
Failure to promote appropriate and affordable PHM technologies	Continued high levels of postharvest technologies leading to continued lack of adoption of improved PHM technologies – hence continued high losses in grains	Very High	<ul style="list-style-type: none"> Consider innovative tax rebate system based on proof of burden placed on technology / equipment manufacturers to show that products were sold for the intended use upon which reimbursements / rebates can be accessed / offered Provide deliberate and targeted financial incentives for the purchase and use of improved PHM technologies
Lack of organised marketing systems including agricultural information management systems	Lack of transparency in the grain trading and marketing system leading to farmers not benefiting from agricultural enterprise actions, chaotic trading to the benefit of middlemen, and ill knowledge of the exact status of food availability in the country	Very High	<ul style="list-style-type: none"> Improve on the primary marketing centres Undertake serious promotions on grading and standards towards price differentiation for quality Reconsider packaging from quintile to 50kg packaged sizes Involve the cooperatives more into providing extended service to their membership in terms of encouraging warehouse receipting systems, Establish more functional agricultural information management systems
Lack of training and support on PHM best practices	General lack of awareness on PHM and its impact on food security and farmer's income base therefore continued food insecurity in the long run and poor farmer income base	Very High	<ul style="list-style-type: none"> Engage in extensive promotional and demonstration exercises to enlighten the population on postharvest losses Ensure ATVETs train more emphatically PH management and equip Development Agents with demonstration packages Support Universities in training in PHM and in field assessments of actual losses on the ground

MONITORING AND EVALUATION PLAN

MONITORING AND EVALUATION SYSTEM

Scope of the Monitoring and Evaluation System

Efforts to ensure that the objectives of the PHM Strategy are achieved need a robust Monitoring and Evaluation system by which processes put in place, commitments and investments made by different stakeholders are regularly monitored against the targets, and if necessary adjustments to the interventions are made in order for the implementation to stay on track. The M&E system provides an interactive, consistent and reliable mechanism with which to guide and support decision making at various levels. It provides a means of involving key players in planning and generating relevant information in a continuous, regular and timely manner at each level of implementation.

The three functional elements of this M&E System therefore are:

- a. *Tracking the implementation of the Investment and Implementation Plans:* This element shall track progress towards achievement of stated outputs/results based on the activity milestones and output indicator targets. Typically, implementation monitoring assesses the degree to which the implementation process is in compliance with work-plans and budgets in order to ensure timely delivery of output. All the data and information shall therefore be generated by the implementing agencies/units (see the five functional groups described in Chapter 5) following well-defined reporting formats.
- b. *Tracking the outcomes and impacts of interventions:* Monitoring the implementation of the Strategy needs to show (i) the current status of postharvest losses; ii) the trend that may need to be reversed; and, iii) the current course of action that may improve the performance of postharvest management in the country. Data will need to be captured on different indicators for Outcomes to show if there are changes in postharvest losses.
- c. *Facilitating organization lessons learning:* The M&E System needs to synthesize the information from monitoring and evaluation initiatives in order to draw out key lessons for the PHM strategy. Periodically, a team of external experts will be contracted to conduct in-depth evaluations and reviews. The lessons learning will enable stakeholders to respond more proactively to the changing needs of its stakeholders and therefore remain a relevant and viable entity in a constantly changing environment. More importantly, the indicators and lessons shall not only form a basis for evaluating progress towards postharvest management targets, but also help to adjust and fine tune policies in order to meet the planned targets by linking programmes, goals, objectives and strategies of various interventions within the grain sector of the Ethiopian economy.

Definition of Terms

The monitoring and evaluation system and its processes are anchored on a few key concepts that are outlined and defined below.

Table 4: Definition of key M&E terms

Term	Definition
Monitoring	Monitoring is a process of tracking implementation to ensure that the strategy's interventions are being implemented according to plan. This allows corrective action to be taken in good time. It involves systematic collection and analysis of information as implementation of the interventions progresses.
Evaluation	Evaluation is the tracking of whether outputs prescribed in the investment and implementation plans have produced changes in postharvest management in the country. The criteria for the evaluation of the Strategy will be: relevance, efficiency, effectiveness, impact equity, sustainability and external utility.
Efficiency	Efficiency tells if the interventions are appropriate in terms of the output. This could be input in terms of money, time, staff, equipment and so on.
Effectiveness	Effectiveness is a measure of the extent to which interventions achieve the objectives of the strategy
Impact	Impact tells whether or not the strategy made a difference to the postharvest problem situation that was being addressed.

Results Framework Matrix and Indicators

Deriving from the Results Framework as outlined in Chapter 2, a Results Framework Matrix and Indicators schedule was developed giving rise to the Monitoring and Evaluation System of the PHM Strategy. Annex II provides detailed schedules of indicators, baselines and targets identified for the PHM Strategy Monitoring and Evaluation System. Annex II Table A shows the indicators at the impact level; Annex II Table B shows indicators at the Intermediate Outcome level; and Annex II Tables C to F show the indicators at the Immediate Outcome level for each of the identified expected outputs.

The rest of this chapter provides a descriptive overview of the principles behind this Monitoring and Evaluation System.

Objectives of the PHM Strategy Monitoring and Evaluation System

The Monitoring and Evaluation (M&E) System for the PHM Strategy in Grains in Ethiopia focuses on the attainment of results identified in Chapter 3. Concomitant with these results, the objectives of this PHM Strategy M&E System are to:

- ensure that programmes and related interventions as outlined in Chapter 3 are implemented according to plan by the different stakeholders outlined in Chapter 5;

- ensure that the correct milestones and outputs as provided in the results framework matrix (Annex II) are being achieved;
- act as an early warning system in cases where targets are unlikely to be achieved;
- provide regular information to all stakeholders on progress of the PHM Strategy and provide an informed basis for any reviews;
- ascertain the relevance and effectiveness of programmes and related interventions in meeting the objectives of the PHM Strategy;
- ensure the continuous sharpening and focusing of interventions and assist in the mobilization of appropriate resources for implementation; and
- verify the importance of interventions in strengthening the capacity of the stakeholders in meeting the objectives of the PHM Strategy.

Evaluation

Results Based Evaluation builds on the monitoring process, by identifying the level of achievement of results at immediate, intermediate and impact levels and approaches that worked well and those that did not work as well. Evaluation also gives answers for success or failure and presents an opportunity of learning from both scenarios. The following are proposed types of evaluation for the PHM Strategy (Table 5):

Table 5: Types of evaluations for the strategy

Type of Evaluation	Description	Scope	Responsibility
Baseline	This is a study (still to be conducted for the PHM Strategy) that ascertains the status quo as the basis of subsequent evaluations.	Applicable to all outcome indicators of the PHM Strategy	MoANR / Universities / R&D Institutions
Annual Evaluation	Comprehensive annual evaluation report, giving a detailed assessment of performance. The report should highlight common issues occurring across all sectors/implementing sites, highlighting issues of sustainability of interventions and processes	Applicable to the investment and implementation plans of the Strategy	MoANR
Mid-term Evaluation	The mid-term evaluation, conducted internally or externally, will analyse and describe achievement against the plans outlined in the results framework. It will discuss issues of design, initial lessons learnt (positive or negative) and needs for possible adjustments.	Applicable to outcomes and outputs of the strategy	MoANR or Independent Evaluator
Final Evaluation	The evaluation conducted at the end of the implementation period focuses on the achievement of purpose and contribution towards the goal. Measuring achievements against the benchmark (baseline survey), the report assesses whether particular outcomes had been achieved and the level of contribution towards the planned impact. Issues of effectiveness, impact and sustainability are a major consideration.	Applicable to the investment and implementation plans and the indicators for outcomes	Independent Evaluator

Reporting

It is recommended that this M&E system be supported by a number of review meetings that include, quarterly and annual reviews and farmer visits as outlined below:

- a) Quarterly progress reviews are done by the implementing stakeholders as outlined in Chapter 5. These reports provide quantitative and qualitative analysis of information during the reporting period and reflect trends in the quarter. The purpose of this review is to analyse progress against achievement of outputs and consequent implications for achievement of purpose. This report should provide an in depth analysis of the challenges, gaps, lessons learnt and how all this is integrated in the planning and implementation process.
- b) Farmer and Institutional visits by technical teams of implementing agencies assess overall progress on the achievement of outputs, giving particular details on the challenges and gaps in the implementation process. The level of achievement of outputs is the main focus. However, the team(s) also assesses the extent to which the outputs are close towards the realization of the target.
- c) Annual Reviews: Annual reviews are done to assess if the annual work plans were implemented according to plan and if the interventions are having some impact on postharvest losses in the country. These are done by all stakeholders as identified in Chapter 5.

Governance Structure for Monitoring and Evaluation

The M&E system will be the responsibility of the PHM Directorate to be created under the Ministry of Agriculture and Natural Resources.

ANNEX I: POSTHARVEST MANAGEMENT (PHM) PRIORITISED PROGRAMMES AND INTERVENTION AREAS

Table A

Ultimate Outcome / Impact		Contribute to improved food security and ultimately to poverty reduction through the attainment of food self-sufficiency in basic food commodities and improved incomes of the Ethiopian people	
Intermediate Outcomes		Improve food availability, food access, food safety and nutrition, and farmer incomes through reduced postharvest losses along the agricultural value chains in grains in Ethiopia	
Immediate Outcomes		Reduce food losses through adaptation/ adoption and implementation of improved postharvest management practices and systems along the agricultural value chains in Ethiopia	
Outputs (SO1)	Main Activities	Objectives	Intervention Areas
1. Reduce (quantitative and qualitative) food losses	1.1. Effective Postharvest Management Systems developed	<ul style="list-style-type: none"> a. Establish and strengthen appropriate postharvest management institutional and operational structures including monitoring and evaluation systems in both the public and private sectors ensuring clear roles, responsibilities, and levels of accountability b. Establish effective advocacy and promotion of good practices in postharvest management systems throughout the agricultural value chains c. Establish effective inter-disciplinary (agriculture, health, nutrition, Science & Technology, social sciences, etc) postharvest management coordination systems d. Provide for sufficient financial and technical resources for postharvest activities at all levels of the agricultural value chain 	<ul style="list-style-type: none"> 1.1.1. Establish and strengthen inter-disciplinary national, regional and woreda level PHM Platforms 1.1.2. Establish and strengthen PHM Units in the MOA at all levels 1.1.3. Develop a PHM Communications and Awareness plan for the advocacy of PHM 1.1.4. Establish annual exhibitions of PHM technologies
	1.2. Adaptive Research and Development in Support of Postharvest Management Systems promoted	<ul style="list-style-type: none"> a. Facilitate research and development institutions as well as universities to prioritise postharvest management research and training in postharvest management systems b. Promote public and private sector partnerships in postharvest management systems research and development c. Facilitate evidence based studies to measure the actual postharvest losses in both physical as well as economic value terms throughout the agricultural value chain for decision making 	<ul style="list-style-type: none"> 1.2.1. Establish and regulate the provision of PHM attachment / apprenticeship 1.2.2. Establish grant support system through Universities and / or research institutions to sponsor field and laboratory PH estimation and analysis 1.2.3. Launch Annual Postharvest Loss Statistical Yearbook 1.2.4. Develop cohesive methodologies for PH assessment 1.2.5. Promote adoption and adaption of affordable PHM technologies from abroad 1.2.6. Promote adoption and adaption of PH methods and techniques to reduce food losses 1.2.7. Promote nutritional recipes preparations to preserve foods

Ultimate Outcome / Impact		Contribute to improved food security and ultimately to poverty reduction through the attainment of food self-sufficiency in basic food commodities and improved incomes of the Ethiopian people	
Intermediate Outcomes		Improve food availability, food access, food safety and nutrition, and farmer incomes through reduced postharvest losses along the agricultural value chains in grains in Ethiopia	
Immediate Outcomes		Reduce food losses through adaptation/ adoption and implementation of improved postharvest management practices and systems along the agricultural value chains in Ethiopia	
Outputs (SO1)	Main Activities	Objectives	Intervention Areas
	1.3. Production, Harvesting and Storage Postharvest Technologies developed and disseminated	<ul style="list-style-type: none"> a. Promote coordinated research and development on appropriate and affordable technologies to support harvesting, threshing, drying, packing, transporting and storage of grains with minimal postharvest losses b. Create incentives and easy access to financing for the adoption of postharvest loss minimising technologies as well as financing for its servicing and maintenance c. Promote improved human skills development in machine operators and machine maintenance to improve on the efficiency of machinery technology that can reduce postharvest losses d. Establish regulatory frameworks and institutions to enforce adherence to machinery and technology use specifications e. Promote the development of an effective service industry to render machinery repair and services 	<ul style="list-style-type: none"> 1.3.1. Identify PHM technologies and associated investment pan to implement the Mechanisation Strategy 1.3.2. Promote local manufacture / sub-assembly of PHM technologies and dissemination of prioritised technologies 1.3.3. Establish PHM Technology Demonstration Centres 1.3.4. Establish, in collaboration with private sector and in alignment with RTCs, PHM Machine Repairs, Maintenance, Training and Service Hubs at the woreda level 1.3.5. Equip the PHM Machine Repairs, Maintenance, Training and Service Hubs with relevant PHM machinery and equipment 1.3.6. Establish a national standard control and enforcement system on the design, manufacture and performance of PHM technology. 1.3.7. Conduct feasibility study to establish a national testing and certification centre for all machinery including PHM technologies
	1.4. Skills, Training and Human Development in postharvest management improved	<ul style="list-style-type: none"> a. Deepen the training curriculum to cover postharvest management practices and systems including practical in-the-field robust demonstrations at existing vocational and university postharvest training levels b. Establish a centre of excellence / incubation centre in postharvest management systems training c. Promote knowledge sharing including indigenous knowledge and understanding of postharvest losses, its causes and possible solutions d. Create career incentives and opportunities for postharvest management trained personnel e. Mainstream gender particularly women and youth, in skills and human development activities in postharvest management systems 	<ul style="list-style-type: none"> 1.4.1. Establish grant support at Universities / Research Institutions for the establishment of Postharvest Engineering Programmes 1.4.2. Establish grant support for business training centres to train farmers / end users in business management skills 1.4.3. PHM training / apprenticeship programmes established in collaboration with the private sector and recognised as an industry qualification 1.4.4. Strengthen Central Statistical Agency personnel with PHM experts 1.4.5. Strengthen Centres of Excellence, training centres, and Extension Service Centres in PHM including on indigenous knowledge in PHM 1.4.6. Strengthen the Ethiopia Bureau of Standards on standard setting and testing to include PHM 1.4.7. Develop PHM curriculum for agricultural technical vocational education training (ATVET) program to strengthen the development and knowledge of Development Agents on PHM 1.4.8. Incorporate PHM packages and manuals in the Development Agents toolkits 1.4.9. Establish grassroots capacity building training programme on PHM targeting particularly women and youth 1.4.10. Develop women and youth entrepreneurs in the provision of services including repair and maintenance of PHM technologies. 1.4.11. Promote behavioural change to good agricultural practices including improved PHM techniques

Ultimate Outcome / Impact		Contribute to improved food security and ultimately to poverty reduction through the attainment of food self-sufficiency in basic food commodities and improved incomes of the Ethiopian people	
Intermediate Outcomes		Improve food availability, food access, food safety and nutrition, and farmer incomes through reduced postharvest losses along the agricultural value chains in grains in Ethiopia	
Immediate Outcomes		Reduce food losses through adaptation/ adoption and implementation of improved postharvest management practices and systems along the agricultural value chains in Ethiopia	
Outputs (SO1)	Main Activities	Objectives	Intervention Areas
	1.5. Sustainable Environmental management promoted	<ul style="list-style-type: none"> a. Facilitate effective land use practices and implement environmentally friendly agricultural practices that maximize vegetation cover to prevent erosion, replace nutrients removed, and to put in place structures (terraces, bunds, vegetation strips) so as to reduce the speed and volumes of water flow over the soil b. Protect and re-establish forests for their economic and ecosystem services but more so to regenerate forest cover destroyed through postharvest practices c. Monitor and enforce the proper sale, use and disposal of pesticides and other such agro-chemicals using integrated pest management practices 	<ul style="list-style-type: none"> 1.5.1. Develop Guidelines on the proper sale, use, handling and disposal of agro-chemicals including storage chemicals 1.5.2. Strengthen and fully equip inspectorate authority to enforce guidelines on proper sale, use, handling and disposal of agro-chemicals including storage chemicals; 1.5.3. Establish training programmes on the use, handling and disposal of agro chemicals including storage chemicals 1.5.4. Support establishment of certified chemical handling enterprises that can provide and certify such services 1.5.5. Create awareness on the side effects of mis-use of chemicals especially those related to PHM

Table B

Ultimate Outcome / Impact		Contribute to improved food security and ultimately to poverty reduction through the attainment of food self-sufficiency in basic food commodities and improved incomes of the Ethiopian people			
Intermediate Outcome		Improve food availability, food access, food safety and nutrition, and farmer incomes through reduced postharvest losses along the agricultural value chains in grains in Ethiopia			
Immediate Outcome		Reduce food losses through adaptation/ adoption and implementation of improved postharvest management practices and systems along the agricultural value chains in Ethiopia			
Outputs (SO2)	Main Activities	Objectives	Intervention Areas		
2. Improved agricultural input and output market efficiencies	2.1. Suitable and affordable PH Systems promoted	<ul style="list-style-type: none"> a. Facilitate the development of suitable and affordable storage facilities along the supply chains at the various household, <i>kebele</i>, <i>woreda</i>, zonal and regional levels b. Facilitate and promote the manufacture and wide distribution of efficient and affordable storage technologies including silos and improved traditional storage systems c. Promote PPP in storage infrastructure services and provision 	2.1.1.	Promote the use of improved PH handling technologies	
			2.1.2.	Promote the warehouse receipt system ensuring that trust in the system is built throughout	
				2.1.3.	Support domestic production of improved PH technologies
			2.1.4.	Establish investment incentives, tax breaks and other forms of support for local manufacturers of PHM technologies	
			2.1.5.	Promote agro-dealers for the distribution of PHM technologies	
	2.2. Effective Storage management systems implemented	<ul style="list-style-type: none"> a. Promote food safety standards in the handling of grains both in terms of warehouse physical space as well as grain cleanliness and quality b. Promote proper and safe storage pest management systems including the use and disposal of fumigants c. Promote the maintenance of high warehouse standards through warehouse certification requirements 	2.2.1.	Develop warehouse accreditation and certification systems	
			2.2.2.	Establish warehouse accreditation and certifying agency	
			2.2.3.	Support the development of high standard warehouse facilities particularly at the primary market level	
			2.2.4.	Develop grain handling, warehouse management and operational guidelines taking into account food safety standards	
			2.2.5.	Strengthen integrated pest management systems for storage pests	
			2.2.6.	Train warehouse keepers on grain handling and management systems	
			2.2.7.	Modernize the registration, handling, management and control system of storage chemicals	
	2.3. Transport Systems and Marketing Networks improved	<ul style="list-style-type: none"> a. Facilitate the local manufacture or assembling of labour saving small sized transport technologies suitable for smallholder households for farm use and transport to the local market b. Upgrade feeder roads and main trunk road network infrastructure c. Support the acquisition of appropriate vehicular modes for transporting commodities from woreda to zonal to regional markets d. Promote the provision of ICT in rural areas to enhance farmer connectivity to the rest of the country with the view to improving their standards of education, receiving genuine and up-to-date market information, practicing mobile banking and other such activities facilitated by ICT e. Promote the provision of service provision facilities such as testing centres closer to the smallholder farmers f. Strengthen linkages among credit and saving institutions with locally established fabricators of postharvest technologies and smallholder farmers who through the provision of market infrastructure are 	2.3.1.	Support the local manufactures of small sized agricultural and farm level transport machinery and equipment	
			2.3.2.	Promote alternative improved farm transport systems	
			2.3.3.	Support the upgrading and maintenance of feeder roads	
			2.3.4.	Encourage the design of appropriate ICT applications for ease of information transfer even by mobile phones	

Ultimate Outcome / Impact		Contribute to improved food security and ultimately to poverty reduction through the attainment of food self-sufficiency in basic food commodities and improved incomes of the Ethiopian people	
Intermediate Outcome		Improve food availability, food access, food safety and nutrition, and farmer incomes through reduced postharvest losses along the agricultural value chains in grains in Ethiopia	
Immediate Outcome		Reduce food losses through adaptation/ adoption and implementation of improved postharvest management practices and systems along the agricultural value chains in Ethiopia	
Outputs (SO2)	Main Activities	Objectives	Intervention Areas
		encouraged to establish their enterprises in rural areas.	
	2.4. Grades and Standards established and implemented	<ul style="list-style-type: none"> a. Develop appropriate crop quality grades and standards using international grain grades and standards as a reference point b. Establish quality testing laboratories to support postharvest management systems c. Establish market price differentiations for quality to promote postharvest management activities d. Build capacity to enforce the application of established grades and standards 	<ul style="list-style-type: none"> 2.4.1. Update the Grain Grades and Standards 2.4.2. Strengthen Grades, Standards and Quality certification system 2.4.3. Establish grain grades, standards and quality testing and training centres 2.4.4. Support the establishment of certified grades, standards and quality superintendent institutions 2.4.5. Train laboratory technicians on grain grades and standards and quality testing
	2.5. Food Safety standards established and implemented	<ul style="list-style-type: none"> a. Strengthen mandate and capacities of food safety inspectorates b. Enforce food safety standards in the transportation, warehouse, storage and market place operations 	<ul style="list-style-type: none"> 2.5.1. Revive the Food and Safety Inspectorate to implement, monitor and enforce food safety standards 2.5.2. Fully equip the food safety inspectorate to enable full functionality 2.5.3. Review and update the food safety standards, and warehouse and transportation food safety related standards 2.5.4. Train food safety inspectors on food safety
	2.6. Agricultural Market Information system developed	<ul style="list-style-type: none"> a. Promote the effective functioning of the postharvest loss platform b. Establish an agricultural information management system (AIMS) c. Implement the right to information act as it refers to agricultural market information 	<ul style="list-style-type: none"> 2.6.1. Establish an Agricultural Market Information System 2.6.2. Develop commodity trading exchanges

Ultimate Outcome / Impact		Contribute to improved food security and ultimately to poverty reduction through the attainment of food self-sufficiency in basic food commodities and improved incomes of the Ethiopian people	
Intermediate Outcome		Improve food availability, food access, food safety and nutrition, and farmer incomes through reduced postharvest losses along the agricultural value chains in grains in Ethiopia	
Immediate Outcome		Reduce food losses through adaptation/ adoption and implementation of improved postharvest management practices and systems along the agricultural value chains in Ethiopia	
Outputs (SO2)	Main Activities	Objectives	Intervention Areas
	2.7. Packaging and Handling Systems established and implemented	<p>a. Establish bag specifications and standards including the material used in the manufacture of the bag; bag measurements; construction patterns of the bag taking into account the need for fumigation and exposure to the weather elements; sewing or closing of the bags; labelling of the bags; and other such specifications</p> <p>b. Promote the appropriate application and use of different bag designs and structures to prevent the use of wrong packaging which may lead to increased postharvest losses Promote good warehouse husbandry systems facilitated by a smaller and standardised 50 kg bag allowing for efficient handling; reduced spillage and waste; and effective control of storage pests and rodents</p>	<p>2.7.1. Establish packaging standards to international standards including the type, use and quality of the packaging</p> <p>2.7.2. Promote the use of hermetic type bags</p> <p>2.7.3. Support the local manufacture of polypropylene and hermetic bags</p>

Table C

Ultimate Outcome / Impact		Contribute to improved food security and ultimately to poverty reduction through the attainment of food self-sufficiency in basic food commodities and improved incomes of the Ethiopian people	
Intermediate Outcome		Improve food availability, food access, food safety and nutrition, and farmer incomes through reduced postharvest losses along the agricultural value chains in grains in Ethiopia	
Immediate Outcome		Reduce food losses through adaptation/ adoption and implementation of improved postharvest management practices and systems along the agricultural value chains in Ethiopia	
Outputs (SO3)	Main Activities	Objectives	Intervention Areas
3. Improved access to financing and investment into postharvest management	3.1. Access to Financing and Investment in Postharvest Management improved	<ul style="list-style-type: none"> a. Support local postharvest technology manufactures and or artisans with specialised tax rebates on imported raw materials b. Facilitate conditions for cooperatives and unions to purchase and provide postharvest management services to farmers 	<ul style="list-style-type: none"> 3.1.1. Review tax rebates on sub-assembled or locally manufactured machinery/ technologies 3.1.2. Strengthen business training and service support programmes for entrepreneurs 3.1.3. Support PHM technology rental service providers 3.1.4. Develop Lending Guarantee Products in collaboration with the Financing and Insurance sector for cooperatives or unions – as form of collateral for loan access towards PH Management servicing
	3.2. Incentives and Innovative Financing Services promoted	<ul style="list-style-type: none"> a. Promote cooperatives and unions to build their capacity to provide credit for postharvest technological acquisitions by farmers. b. Provide innovative financial services that enable value-chain actors to access postharvest technologies and services c. Provide smart subsidies to facilitate the micro-finance sub-sector and cooperatives to provide cheaper loans to smallholder farmers particularly in areas involving technologies and machinery for postharvest loss management d. Promote cooperatives and unions to build their capacity to provide credit for postharvest technological acquisitions by farmers. 	<ul style="list-style-type: none"> 3.2.1. Strengthen capacity development activities (human as well as material) for credit service. 3.2.2. Promote warehouse receipting system 3.2.3. Strengthen group loan guarantee system 3.2.4. Promote Micro-Financing through enabling financial instruments at local levels 3.2.5. Support low interest financing for PHM technologies. 3.2.6. Promote forward delivery contracting and out-grower systems
	3.3. Clustering of Agri-Business, Farmer Enterprises and Agro-Processors promoted	<ul style="list-style-type: none"> a. Promote the partnering of agricultural value chain actors to form clusters for mutual benefit in creating economies of scale and leveraging financing and investment in agriculture in general and postharvest loss management in particular b. Strengthen farmer organisations / cooperatives in their supporting role in farmer-training, market information, credit and saving services, negotiation skills, and other promotional functions with emphasis on postharvest loss reduction 	<ul style="list-style-type: none"> 3.3.1. Support preparation of bankable business / project proposals involving clusters 3.3.2. Promote the business cluster concept in the agriculture value chain including PH 3.3.3. Support Business Training of Farmer Organisations to better service their members

Table D

Ultimate Outcome / Impact		Contribute to improved food security and ultimately to poverty reduction through the attainment of food self-sufficiency in basic food commodities and improved incomes of the Ethiopian people	
Intermediate Outcome		Improve food availability, food access, food safety and nutrition, and farmer incomes through reduced postharvest losses along the agricultural value chains in grains in Ethiopia	
Immediate Outcome		Reduce food losses through adaptation/ adoption and implementation of improved postharvest management practices and systems along the agricultural value chains in Ethiopia	
Outputs (SO4)	Main Activities	Objectives	Intervention Areas
4. Promote value addition	4.1. Farm Enterprise Input Business promoted	a. Promote coordinated, integrated and targeted smart subsidies for the agricultural input supplier manufacturers to effectively reduce costs for the farming enterprises	4.1.1. Support financing for rural value addition 4.1.2. Support micro-financing institutions in rural areas 4.1.3. Introduce Postharvest technology for processing in Agro-Parks
	4.2. Agro-Processing promoted	a. Promote the partnering of agro-processing and the farming enterprises to develop strong supply links involving technological, financial and human skills advancements support to the farming enterprises b. Promote value addition cooperatives and unions c. Create awareness and promote the desire for quality differentiation through value addition for the benefit of the value chain actors particularly farmers d. Promote small scale rural based agro-processing and value addition to allow for the preservation of crops closer to source of production and therefore reduce postharvest losses in transportation of commodities far afield and storage losses including quality losses associated with unprocessed commodities	4.2.1. Support women-based and youth-based business entrepreneurial programmes for value addition and agro-processing activities 4.2.2. Create agro-processing platform 4.2.3. Support agro-processing business training service providers 4.2.4. Develop local commodity exchanges based on set grades and standards 4.2.5. Promote village level value addition technologies including food processing

ANNEX II: POSTHARVEST MANAGEMENT (PHM) RESULTS FRAMEWORK MATRIX AND INDICATORS

TABLE A: INDICATORS, BASELINES AND TARGETS FOR THE IMPACT LEVEL

POSTHARVEST MANAGEMENT (PHM) STRATEGY IN GRAINS IN ETHIOPIA - RESULTS FRAMEWORK MATRIX					
ULTIMATE IMPACT: Contribute to improved food security and ultimately to poverty reduction through the attainment of food self-sufficiency in basic food commodities and improved incomes of the Ethiopian people					
IMPACT PROXY INDICATORS	BASELINES	TARGETS	VERIFICATION SOURCES		RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
Agricultural value added (Annual Growth Rate)	6.4% (2015) per annum (World Bank)	7% per annum (GTP II estimated 8%)	- - - estimates	National Surveys FAO / World Bank / UN agencies CSA Estimates	Ministry of Agriculture and Natural Resources (MoANR) Central Statistical Authority FAO Stat UN specialised agencies Ethiopia Institute of Agricultural Research
GDP from Agricultural (% of total GDP)	36.7% (2015) (World Bank)	2.5% per annum decrease from baseline values	- - - estimates	National Surveys FAO / World Bank / UN agencies CSA Estimates	
Poverty headcount ratio at \$1.90 a day (2011 - PPP) (% of population)	33.5% (2010) (World Bank)	2.5% per annum reduction from baseline values	- - - estimates	National Surveys FAO / World Bank / UN agencies CSA Estimates	
Population receiving Emergency Food Aid	5.4% (2017) of total population (WFP)	2.5% per annum reduction from baseline values	- - - estimates	National Surveys FAO / World Bank / UN agencies CSA Estimates	
Food Self Sufficiency	13.5% (2014) of food imports to domestic production	10% per annum reduction from baseline values	- - - estimates	National Surveys FAO / World Bank / UN agencies CSA Estimates	
Stunting prevalence/height for age (% children under 5)	40.4% (2014) (FAO Stats)	5% reduction from baseline values	- - - estimates	National Surveys FAO / World Bank / UN agencies CSA Estimates	
Underweight (height for age / weight for age) (% children under 5)	25.2% (2014) (FAO Stats)	5% reduction from baseline values	- - - estimates	National Surveys FAO / World Bank / UN agencies CSA Estimates	

Wasting prevalence (% children under 5)	8.7% (2014) (FAO Stats)	5% reduction from baseline values	- - estimates -	National Surveys FAO / World Bank / UN agencies CSA Estimates	
Prevalence of undernourishment (%) (3-year average)	33.1% (2014) (FAO Stats)	10% reduction from baseline values	- - estimates -	National Surveys FAO / World Bank / UN agencies CSA Estimates	

TABLE B: INDICATORS, BASELINES AND TARGETS FOR THE INTERMEDIATE OUTCOME LEVEL

POSTHARVEST MANAGEMENT (PHM) STRATEGY IN GRAINS IN ETHIOPIA - RESULTS FRAMEWORK MATRIX				
INTERMEDIATE OUTCOME: Improve food availability, food access, food safety and nutrition, and farmer incomes through reduced postharvest losses along the agricultural value chains in grains in Ethiopia				
Component 1: Food Availability				
PROXY INDICATORS	BASELINES	TARGETS	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
Crop production	Million Tonnes per crop (based on FAO Stats) <ul style="list-style-type: none"> • Teff 5.02 • Maize 7.23 (2014) • Wheat 4.23 (2014) • Sorghum 4.34 (2014) • Haricot Beans 0.51 (2014) (based on dry beans) 	10% increase from baseline values	Surveys by MoANR FAO Stats CSA Data publications	MoANR CSA Ethiopia
Crop productivity (yields in MT/Ha cultivated)	Kgs / ha (based on FAO Stats) <ul style="list-style-type: none"> • Teff 1.74 • Maize 3.42 (2014) • Wheat 2.54 (2014) • Sorghum 2.37 (2014) • Haricot Beans 1.59 (2014) – based on Beans in total 	10% increase from baseline values	Surveys by MoANR FAO Stats CSA Data publications	MoANR CSA Ethiopia
Estimated crop losses (%)	% of total production (based on FAO Stats) <ul style="list-style-type: none"> • Teff 12% • Maize 18% (2013) • Wheat 12% (2013) • Sorghum 5 % (2013) • Haricot Beans 13% (based on Beans overall) 	5% decrease from baseline values	Surveys by MoANR FAO Stats CSA Data publications	MoANR CSA Ethiopia
Component 2: Access to Food				
Agricultural commodity Prices	Yearly average (Birr/MT at Addis Ababa Market) <ul style="list-style-type: none"> • Teff 24000 • Maize 6000 • Wheat 12000 • Sorghum 9000 • Haricot Beans 16000 	5 % increase from baseline values	Surveys by MoT, CSA Data publications	MoT, CSA Data publications

	<ul style="list-style-type: none"> • Barley 9000 • Chickpea 30000 • Faba Bean 25000 • Field pea 25000 • Lentils 38000 • Nuge 45000 • Sesame 1800 • Ground nut 1800 			
Transportation costs	<p>Average cost of transporting a tonne of produce (Birr / MT):</p> <ul style="list-style-type: none"> • Farm gate to Primary Market • Primary market to Union level market • Primary market to consumer market <p>(Average to be established)</p>	Maximum of 20 % change from baseline values	Surveys by the MOT and MoNR	MoANR, EGT, ECX,
Component 3: Food Safety				
Percent population knowing good quality standards	<p>% of population by group:</p> <ul style="list-style-type: none"> • Farmers • Traders • Processors • Warehouse Operators 	<ul style="list-style-type: none"> • 80 % of input supplier/ Cluster based/ farmers to processors • 95% of processors • 95 % of the warehouse operators 		MoANR, EGT, ECX,
Estimated annual strategic grain reserve stored annually	218,800 Metric Tonnes of stored strategic grain reserve	500000 Metric Tonnes per year		MoANR, EGT, ECX,
Component 4: Improved Farmers Income				
Estimated increment in income of farmers through quality increment and reduction in loss	<ul style="list-style-type: none"> • 30% of the grain is lost every year • 60 % of product supplied by farmers for whole sellers and processors qualify the quality • The price of commodities at Addis Ababa market> <ul style="list-style-type: none"> - Teff 24000 Birr/MT - Maize 6000 Birr/MT - Wheat 12000Birr/MT - Sorghum 9000 Birr/MT - Haricot Beans 16000 Birr/MT - Barley 9000 Birr/MT - Chick pea 30000 	<p>15% reduction of loss from baseline values</p> <p>90% of the product supplied for wholesalers and processors meet the quality standards</p> <p>20% of commodities price increase over the base line</p>		MoANR, EGT, ECX,

	Birr/MT - Faba Bean 25000 Birr/MT - Field pea 25000 Birr/MT - Lentils 38000 Birr/MT - Nuge 45000 Birr/MT - Sesame 1800 Birr/MT - Ground nut 1800 Birr/MT			
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TABLE C: PILLAR 1: REDUCED (QUANTITATIVE AND QUALITATIVE) FOOD LOSSES

PILLAR / STRATEGIC OBJECTIVE 1: REDUCED (QUANTITATIVE AND QUALITATIVE) FOOD LOSSES						
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
Immediate Outcome 1.1 Effective Postharvest Management Systems Established						
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
1.1.1 Inter-disciplinary national, regional and woreda level PHM Platforms established and strengthened	<ul style="list-style-type: none"> Existence of Postharvest platform Number of Platform Meetings held/ year 	1 National Postharvest platform	US\$122,250	5 (one national and 4 Regional postharvest platforms) 2	MoANR	MoANR / Regional Bureaux of Agriculture / EIAR / Ministry of Education
1.1.2 PHM Units in the MOANR at all levels established and strengthened	<ul style="list-style-type: none"> Number of PHM units established 	4 Case team at Federal level (Postharvest extension, Storage pest managements, Postharvest mechanization, Rural food processing and value addition)	US\$235,000	1 Postharvest handling, value addition and nutrition Directorate established	MoANR	MoANR / Regional BureauX of Agriculture / EIAR / Ministry of Education
1.1.3 PHM Communications and Awareness plan for the advocacy of PHM developed	<ul style="list-style-type: none"> Number of strategies developed Number of published manuals 	1 Strategy published 1 Manual published	US\$188,000	1 strategy implemented 3 More manuals published	MoANR	MoANR / Regional Bureaux of Agriculture / EIAR / Ministry of Education
1.1.4 Annual exhibitions of PHM technologies conducted	<ul style="list-style-type: none"> Number of annual Postharvest extension Exhibition/ Forums conducted 	0	US\$280,000	1 national exhibition/ forum/ year	MoANR	MoANR / Regional Bureaux of Agriculture / EIAR / Ministry of Education
Immediate Outcome 1.2 Adaptive Research and Development in Support of Postharvest Management Systems promoted						
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
1.2.1 PHM attachment /	<ul style="list-style-type: none"> Existence of a 	1	US\$31,000	1	MoANR and	MoANR / Regional

PILLAR / STRATEGIC OBJECTIVE 1: REDUCED (QUANTITATIVE AND QUALITATIVE) FOOD LOSSES						
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
apprenticeship programmes established	PHM attachment programmes				Ministry of Education	Bureaux of Agriculture / EIAR / Ministry of Education
1.2.2 Grant support system through Universities and / or research institutions to sponsor field and laboratory PH estimation and analysis established	<ul style="list-style-type: none"> Number of grant programmes established and fully functional 	0	US\$39,000	1 Postharvest management grant fund system established	MoANR and Ministry of Education	MoANR / Regional Bureaux of Agriculture / EIAR / Ministry of Education
1.2.3 Annual Postharvest Loss Statistical Yearbook launched	<ul style="list-style-type: none"> Existence of a statistical Yearbook covering postharvest losses 	0	US\$199,000	1 Statistical Yearbook	MoANR and CSA	MoANR / Regional Bureaux of Agriculture / EIAR / Ministry of Education / CSA
1.2.4 Cohesive methodologies for PH assessment developed	<ul style="list-style-type: none"> Existence of methodologies for PH assessment 	0	US\$155,000	At least 1 improved methodology adopted	MoANR	MoANR / FAO
1.2.5 Adoption and adaption of affordable PHM technologies from abroad promoted	<ul style="list-style-type: none"> Percentage of farm households adopting improved technologies for storing grain 	0	US\$230,000	At least 20 % increase in the current percentage of the farming household use	MoANR	MoANR / Regional Bureaux of Agriculture / EIAR
1.2.6 Adoption and adaptation of PH methods and techniques to reduce food losses promoted	<ul style="list-style-type: none"> Percentage of farm households adopting improved technologies for storing grain Different types of technologies being used by farmers 	0 11 different sets	US\$75,000	20% 10 new sets	MoANR	MoANR / Regional Bureaux of Agriculture / EIAR / Ministry of Education
1.2.7 Creation of nutritional recipes preparations to preserve foods promoted	<ul style="list-style-type: none"> Number of recipes adjudicated most successful 	0	US\$80,000	1 set (quantum to be determined)	Regional Bureaux of Agriculture	MoANR / Regional Bureaux of Agriculture / EIAR / Ministry of Education
Immediate Outcome 1.3	Production, Harvesting and Storage Postharvest Technologies developed and disseminated					

PILLAR / STRATEGIC OBJECTIVE 1: REDUCED (QUANTITATIVE AND QUALITATIVE) FOOD LOSSES						
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
1.3.1 PHM technologies and associated investment plan to implement the Mechanisation Strategy identified	<ul style="list-style-type: none"> Number of PHM technologies available (at the base year of GTP II) Existence of Investment Plan to implement these technologies 	<ul style="list-style-type: none"> 180 0 harvester and thresher technology X Product storage technology 100 Value addition technology 	US\$75,000	<ul style="list-style-type: none"> 12,90 0 Harvesters and threshers technology 47,90 0 Product storage technology 45,65 0 Value addition technology 	MoANR / ATA	MoANR / Regional Bureaux of Agriculture / EIAR / Ministry of Education
1.3.2 Local manufacture / sub-assembly of PHM technologies and dissemination of prioritised technologies promoted	<ul style="list-style-type: none"> National PHM catalogue of locally manufactured PHM technologies 	0	US\$12,000	1	MoANR / ATA	MoANR / Regional Bureaux of Agriculture / EIAR / Ministry of Education
1.3.3 PHM Technology Demonstration Centres established	<ul style="list-style-type: none"> Number of Centres established to showcase different types of technologies 	0	US\$220,000	1	MoANR, Ministry of Industry	MoANR / Ministry of Industry
1.3.4 PHM Machine Repairs, Maintenance, Training and Service Hubs at the woreda level established	<ul style="list-style-type: none"> Number of hubs established to provide repairs, maintenance, training and services 	1	US\$210,000	1 additional hub	MoANR, Ministry of Industry	MoANR / Ministry of Industry
1.3.5 PHM Machine Repairs, Maintenance, Training and Service Hubs equipped with	<ul style="list-style-type: none"> Number of hubs equipped with relevant PHM machinery 	1	US\$20,000	1 additional hub	MoANR, Ministry of Industry	MoANR / Ministry of Industry

PILLAR / STRATEGIC OBJECTIVE 1: REDUCED (QUANTITATIVE AND QUALITATIVE) FOOD LOSSES						
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
relevant PHM machinery and equipment						
1.3.6 National standard control and enforcement system on the design, manufacture and performance of PHM technology established	Existence of Standards system documents	1	US\$70,000	1	MoANR, Ministry of Industry	MoANR / Ministry of Industry
1.3.7 Feasibility study to establish a national testing and certification centre for all machinery including PHM technologies undertaken	• Existence of feasibility study document	1	US\$26,000	1	MoANR	MoANR / Regional Bureaux of Agriculture / EIAR / Ministry of Education
Immediate Outcome 1.4	Skills, Training and Human Development in postharvest management improved					
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
1.4.1 Grant support at Universities / Research Institutions for the establishment of Postharvest Engineering Programmes established	<ul style="list-style-type: none"> Number of Grant Support systems established Number of universities supported Number of Postharvest Engineering Programmes established 	0 4 0	US\$79,000	1 At least 1 additional university 1	MoANR / Ministry of Education / ATVET	MoANR / Universities / Ministry of Education / ATVET / Regional Bureaux of Agriculture / EIAR
1.4.2 Grant support for business training centres to train farmers / end users in business	<ul style="list-style-type: none"> Value (\$) of grants available to support business training centres Number of training centres supported 	0 0	US\$79,000	1 in each Woreda 1 in each Woreda	MoANR / Ministry of Education / ATVET	MoANR / Universities / Ministry of Education / ATVET / Regional Bureaux of Agriculture / EIAR

PILLAR / STRATEGIC OBJECTIVE 1: REDUCED (QUANTITATIVE AND QUALITATIVE) FOOD LOSSES						
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
management skills established						
1.4.3 PHM training / apprenticeship programmes established in collaboration with the private sector and recognised as an industry qualification	<ul style="list-style-type: none"> Number of programmes developed Number of graduates produced Number of graduates employed by industry 	0 0 0	US\$77,000	10% increase each year on the previous number	MoANR / Ministry of Education / ATVET / Universities	MoANR / Universities / Ministry of Education / ATVET / Regional Bureaux of Agriculture / EIAR
1.4.4 Central Statistical Agency strengthened personnel with PHM experts	<ul style="list-style-type: none"> Number of PHM experts in Central Statistical Agency 	0	US\$22,000	Attain 75% of required capacity	MoANR / CSA / Ministry of Education	MoANR / Universities / Ministry of Education / ATVET / Regional Bureaux of Agriculture / EIAR
1.4.5 Centres of Excellence, training centres, and Extension Service Centres in PHM including on indigenous knowledge in PHM strengthened	<ul style="list-style-type: none"> Number of Centres supported Strengthening strategies employed Level of satisfaction by the Centres on the strengthening interventions Level of satisfaction on the part of beneficiaries 	0 0 0 0	US\$135,000	Increase number of centres by at least 1 in each Woreda in each year	MoANR	MoANR / Universities / Ministry of Education / ATVET / Regional Bureaux of Agriculture / EIAR
1.4.6 Ethiopia Bureau of Standards on standard setting and testing strengthened to include PHM	<ul style="list-style-type: none"> Level of satisfaction on the part of stakeholders 	25	US\$42,000	Raise the level of satisfaction of service provided to at least 75%	MoANR / Ministry of Industry	MoANR / Universities / Ministry of Education / ATVET / Regional Bureaux of Agriculture / EIAR
1.4.7 PHM curriculum for agricultural technical vocational education training (ATVET) program to strengthen the	<ul style="list-style-type: none"> Existence of PHM Curriculum for agricultural technical vocational education training (ATVET) program No of Development Agents trained on 	1 350	US\$78,000	1 additional curricula Increase the trained number by 20% every	MoANR / Ministry of Education / ATVET / Universities	MoANR / Universities / Ministry of Education / ATVET / Regional Bureaux of Agriculture / EIAR

PILLAR / STRATEGIC OBJECTIVE 1: REDUCED (QUANTITATIVE AND QUALITATIVE) FOOD LOSSES						
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
development and knowledge of Development Agents on PHM developed	PHM and Mechanization			year		
1.4.8 PHM packages and manuals incorporated into the Development Agents toolkits	<ul style="list-style-type: none"> Evidence of PHM packages and manuals in the Development Agents toolkit 	40 % of the DA toolkits and extension materials contain appropriate PHM training materials	US\$300,000	100% fully equipped DA toolkits	MoANR / Ministry of Education / ATVET / Universities	MoANR / Universities / Ministry of Education / ATVET / Regional Bureaux of Agriculture / EIAR
1.4.9 Grassroots capacity building training programme on PHM targeting particularly women and youth established	<ul style="list-style-type: none"> Number of women trained Number of Youth Trained 	10% of 17 million women's and youths in rural area	US\$175,000	Increase training coverage of women's and youths in rural area by 40 % over the base year	MoANR / Ministry of Education / ATVET / Universities	MoANR / Universities / Ministry of Education / ATVET / Regional Bureaux of Agriculture / EIAR
1.4.10 Women and Youth entrepreneurs in the provision of services including repair and maintenance of PHM technologies developed	<ul style="list-style-type: none"> Number of Women Entrepreneurs supported Number of Youth Entrepreneurs supported 	0 0	US\$378,000	Increase number by 10% yearly	MoANR / Ministry of Education / ATVET / Universities	MoANR / Universities / Ministry of Education / ATVET / Regional Bureaux of Agriculture / EIAR
1.4.11 Behavioural change to good agricultural practices including improved PHM techniques promoted	<ul style="list-style-type: none"> Annual increase in uptake of PHM technologies 	0	US\$545,000	5% annual increase in uptake of PHM technologies	MoANR / Ministry of Education / ATVET / Universities	MoANR / Universities / Ministry of Education / ATVET / Regional Bureaux of Agriculture / EIAR
Immediate Outcome 1.5	Sustainable Environmental management promoted					
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
1.5.1 Guidelines on the proper sale, use, handling and disposal of agro-chemicals including	<ul style="list-style-type: none"> Existence of guidelines on the proper sale, use, handling and disposal of agro-chemicals including storage chemicals 	3	US\$139,000	3	MoANR / Environment Agency / Ministry of Industry	MoANR / Regional Bureaux of Agriculture / EIAR / Ministry of Education

PILLAR / STRATEGIC OBJECTIVE 1: REDUCED (QUANTITATIVE AND QUALITATIVE) FOOD LOSSES

EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
storage chemicals developed						
1.5.2 Inspectorate authority to enforce guidelines on proper sale, use, handling and disposal of agro-chemicals including storage chemicals strengthened and fully equipped	<ul style="list-style-type: none"> • Presence of implementation strategies • Different types of support given to the Inspectorate 	0	US\$115,000	1 Increase the financial support by at least 10% annually	MoANR / Environment Agency / Ministry of Industry	MoANR / Regional Bureaux of Agriculture / EIAR / Ministry of Education
1.5.3 Training programmes on the use, handling and disposal of agro chemicals including storage chemicals established	<ul style="list-style-type: none"> • Number of Experts trained 	2000	US\$183,000	Increase the number by 10% annually on the previous year	MoANR / Environment Agency / Ministry of Industry	MoANR / Regional Bureaux of Agriculture / EIAR / Ministry of Education
1.5.4 Certified chemical handling enterprises that can provide and certify such services supported	<ul style="list-style-type: none"> • Number of enterprises supported 	0	US\$255,000	Increase the number certified by 2 per year to eventually cover all Woredas	MoANR / Environment Agency / Ministry of Industry	MoANR / Regional Bureaux of Agriculture / EIAR / Ministry of Education
1.5.5 Awareness on the side effects of mis-use of chemicals especially those related to PHM created	<ul style="list-style-type: none"> • Types of Awareness campaign programmes implemented • Number of people reached 	3	US\$135,000	Increase coverage by at least 20% annually till all Woredas are covered	MoANR / Environment Agency / Ministry of Industry	MoANR / Regional Bureaux of Agriculture / EIAR / Ministry of Education

TABLE D: PILLAR II: IMPROVED AGRICULTURAL INPUT AND OUTPUT MARKET EFFICIENCIES

PILLAR / STRATEGIC OBJECTIVE 2: IMPROVED AGRICULTURAL INPUT AND OUTPUT MARKET EFFICIENCIES						
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
Immediate Outcome 2.1 Sustainable and affordable PH systems promoted						
2.1.1 Use of improved PH handling technologies promoted	<ul style="list-style-type: none"> Number of PH handling technologies promoted and used by farmers 	0	US\$80,000	10% increase each year on the previous numbers established in year 1	MoANR / ATVET/ EIAR / Regional Bureau of Agriculture	MoANR / Regional Bureau of Agriculture / EIAR /ATVET
2.1.2 Warehouse receipt system ensuring that trust in the system is built throughout promoted	<ul style="list-style-type: none"> Existence of warehouse receipts system Number of farmers participating in the warehouse receipts system Volume of grain stored under the system 	1 0 0	Covered under sub-activity 3.2.2	10% increase each year on the previous year 10% increase each year on previous year	MoANR / ATVET/ EIAR / Regional Bureau of Agriculture	MoANR / Universities / Regional Bureau of Agriculture / EIAR /ATVET
2.1.3 Domestic production of improved PH technologies supported	<ul style="list-style-type: none"> No of improved PH technologies domestically produced Types of technologies produced domestically 	More than 10 set of technologies Number of existing crop cutters, harvesters, multi-crop threshers, decorticators, silos, hermetic bags, maize shellers	US\$80,000	10% increase each year	MoANR / ATA / EIAR / Ministry of Industry	MoANR / ATA / Regional Bureau of Agriculture / EIAR / Ministry of Industry
2.1.4 Investment incentives, tax breaks and other forms of support for local manufacturers of PHM technologies established	<ul style="list-style-type: none"> Types of support incentives/ packages developed Number of manufacturers supported through incentives 	0	Covered under sub-activity 3.1.1	6 financial, technical, logistics, legal and infrastructure and marketing support packages	MoANR / Ministry of Industry	MoANR / Regional Bureaux of Agriculture / EIAR / Ministry of Industry
2.1.5 Agro-dealers for the distribution of PHM technologies promoted	<ul style="list-style-type: none"> Evidence of agro-processing initiatives Number of agro-dealers supported 	11 Agro-processing parks under development 0	US\$185,000	10% increase each year	MoANR / ATA / EIAR / Ministry of Industry / Regional Bureaux of Agriculture	MoANR / Regional Bureau of Agriculture / EIAR / Ministry of Industry
Immediate Outcome 2.2 Effective storage management systems implemented						
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS /	TARGETS	VERIFICATION SOURCES	RESPONSIBLE

PILLAR / STRATEGIC OBJECTIVE 2: IMPROVED AGRICULTURAL INPUT AND OUTPUT MARKET EFFICIENCIES						
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
			INVESTMENTS	(by 2022)		INSTITUTIONS / IMPLEMENTATION PARTNERS
2.2.1 Warehouse accreditation and certification systems developed	<ul style="list-style-type: none"> Existence of Warehouse Accreditation and Certification System Number of warehouses accredited 	0 0	US\$65,000	1 system in place At least one in each Woreda	Ministry of Industry / MoANR/ MoT	MoANR / Regional Bureau of Agriculture/ MoT/
2.2.2 Warehouse accreditation and certifying agency established	<ul style="list-style-type: none"> Existence of Warehouse accreditation agency 	0	US\$25,000	1	National warehouse administration Authority Report	MoANR / Regional Bureaux of Agriculture
2.2.3 Development of high standard warehouse facilities particularly at the primary market level supported	<ul style="list-style-type: none"> Number of high quality warehouses developed 	0	US\$25,000	At least 2 centres established each year	National warehouse administration Authority Report	ECX, OCX, National warehouse administration Authority, Private sector
2.2.4 Grain handling, warehouse management and operational guidelines that take into account food safety standards developed	<ul style="list-style-type: none"> Existence of Grain handling, warehouse management and operational guidelines taking into account safety standards 	1	US\$50,000	2	National Warehouse Administration Authority Report	ECX, OCX, National warehouse administration Authority
2.2.5 Integrated pest management systems for storage pests strengthened	<ul style="list-style-type: none"> Strengthening strategies employed 	1	US\$25,000	1	National warehouse administration Authority Report	ECX, OCX, National warehouse administration Authority, Private sector
2.2.6 Warehouse keepers trained on grain handling and management systems	<ul style="list-style-type: none"> Number of warehouse keepers trained Number of warehouses with trained keepers 	0 0	US\$108,000	10% increase each year	National warehouse administration Authority Report	ECX, OCX, National warehouse administration Authority, Private sector ATVET

PILLAR / STRATEGIC OBJECTIVE 2: IMPROVED AGRICULTURAL INPUT AND OUTPUT MARKET EFFICIENCIES						
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
2.2.7 Registration, handling, management and control system of storage chemicals modernised	<ul style="list-style-type: none"> Existence of modern referral laboratories for testing, Registration, handling, management and control of chemicals 	0	US\$65,000	1	MoANR / Regional Bureaux of Agriculture	MoANR / Regional Bureaux of Agriculture / EIAR
Immediate Outcome 2.3 Transport systems and networks improved						
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
2.3.1 Local manufactures of small sized agricultural and farm level transport machinery and equipment supported	<ul style="list-style-type: none"> Number of manufacturers supported Number of support packages introduced 	0	Covered under sub-activity 3.1.1	(financial, technical, logistics, legal and infrastructure and marketing support packages)	MoANR / Ministry of Industry	MoANR / Regional Bureau of Agriculture / EIAR
2.3.2 Alternative improved farm transport systems promoted	<ul style="list-style-type: none"> Types of transport systems promoted Number of famers using alternative transport systems 	0	US\$25,000	10% increase in number of famers accessing better transport	MoANR / Ministry of Industry / Ministry of Transport	MoANR / Regional Bureau of Agriculture / Ministry of Industry / Ministry of Transport
2.3.4 Design of appropriate ICT applications for ease of information transfer even by mobile phones promoted	<ul style="list-style-type: none"> Types of user friendly information systems available Number of farmers using the systems 	0	US\$30,000	10% increase per year in Number of farmers accessing information by mobile phone	MoANR / Ministry of Industry	MoANR / Regional Bureau of Agriculture / EIAR
Immediate Outcome 2.4 Grades and standards established and implemented						
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
2.4.1 Grain Grades and Standards updated	<ul style="list-style-type: none"> Number of Updated Grain Standards 	7 Crops	US\$163,000	20	MoANR / Ethiopian Standards Bureaux	MoANR / Ethiopia Standards Bureaux

PILLAR / STRATEGIC OBJECTIVE 2: IMPROVED AGRICULTURAL INPUT AND OUTPUT MARKET EFFICIENCIES							
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS	
2.4.2	Grades, Standards and Quality certification system strengthened	• % increase in compliance each year	0	US\$115,000	10 % increase in compliance each year	MoANR / Ethiopian Standards Bureaux	MoANR / Ethiopia Standards Bureaux
2.4.3	Grain grades, standards and quality testing and training centres established	• Number of centres established	8	US\$70,000	At least one in each Woreda	MoANR / Ethiopian Standards Bureaux	MoANR / Ethiopia Standards Bureaux
2.4.4	Establishment of certified grades, standards and quality superintendent institutions supported	• Number of institutions supported	0	US\$35,000	At least one in each Woreda	MoANR / Ethiopian Standards Bureaux	MoANR / Ethiopia Standards Bureaux
2.4.5	Laboratory technicians on grain grades and standards and quality testing trained	• Number of technicians trained	60	US\$95,000	At least 5 in each Woreda at relevant testing centres	MoANR / Ethiopian Standards Bureaux	MoANR / Ethiopia Standards Bureaux
Immediate Outcome 2.5		Food Safety Standards established and implemented					
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS	
2.5.1	Food and Safety Inspectorate revived to implement, monitor and enforce food safety standards	• Existence of functional Food and Safety Inspectorate • Different types of revival strategies employed	3 0	US\$50,000	1 1	MoANR / Ministry of Industry / Ministry of Health	MoANR / Ministry of Health / Regional Bureaux of Agriculture/ FDA, Ethiopian Standard Agency
2.5.2	Food safety inspectorate fully equipped to enable full functionality	• No of food safety inspection laboratories established	3	US\$110,000	4 Quarterly reports/year	MoANR / Ministry of Industry / Ministry of Health	MoANR / Ministry of Health / Regional Bureaux of Agriculture/ FDA, Ethiopian Standard Agency

PILLAR / STRATEGIC OBJECTIVE 2: IMPROVED AGRICULTURAL INPUT AND OUTPUT MARKET EFFICIENCIES						
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
2.5.3 Food safety standards, and warehouse and transportation food safety related standards reviewed and updated	• Existence of updated standards	0	US\$123,000	All grain crops	MoANR / Ministry of Industry / Ministry of Health	MoANR / Ministry of Health / Regional Bureaux of Agriculture/ FDA, Ethiopian Standard Agency
2.5.4 Food safety inspectors on food safety trained	• Number of Inspectors trained	100	US\$91,000	Each Woreda to have at least 2 trained Inspectors	MoANR / Ministry of Industry / Ministry of Health	MoANR / Ministry of Health / Regional Bureaux of Agriculture/ FDA, Ethiopian Standard Agency
Immediate Outcome 2.6 Agricultural Market information system developed						
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
2.6.1 Agricultural Market Information System developed	Existence of market information system	2 in existence i.e. ECX and OCX	US\$223,000	1 more market information system	MoANR / Commodity Exchanges	MoANR / Regional Bureau of Agriculture / EIAR / Universities / Commodity Exchanges
2.6.2 Commodity trading exchanges supported	Existence of Commodity Exchange	2	US\$30,000	At least 1 commodity exchange or branch in each Woreda	MoANR / Commodity Exchanges	MoANR / Regional Bureaux of Agriculture / EIAR / Universities / Commodity Exchanges
Immediate Outcome 2.7 Packaging and Handling Systems established and implemented						
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
2.7.1 Packaging standards aligned to international standards including the type, use and quality of	• Existence of standards that are aligned to international standards	7 Internationally aligned standards for 7 crops	US\$80,000	All crops will have an internationally acceptable standards	Report from Ministry of Trade and Chamber of commerce	Ministry of Industry, Ethiopian Chemical Industry Authority, Private sector,

PILLAR / STRATEGIC OBJECTIVE 2: IMPROVED AGRICULTURAL INPUT AND OUTPUT MARKET EFFICIENCIES

EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
the packaging established						Investment Agency and Ministry of Trade
2.7.2 Use of hermetic type bags promoted	<ul style="list-style-type: none"> More than 50 thousands bags 	To be established	US\$120,000	10% increase annually in number of farmers using hermetic bags	MoANR / GrainPro	MoANR / Regional Bureaux of Agriculture
2.7.3 Local manufacture of polypropylene and hermetic bags supported	<ul style="list-style-type: none"> Number of local polypropylene and hermetic bags manufacturers Volume of polypropylene and hermetic bags produced locally 	1	US\$36,000	1 additional manufacturer	Report from MoI and MoT	Ministry of Industry, Ethiopian Chemical Industry Authority, Private sector, Investment Agency and Ministry of Trade

TABLE E: PILLAR III: IMPROVED ACCESS TO FINANCING AND INVESTMENT INTO POSTHARVEST MANAGEMENT

PILLAR / STRATEGIC OBJECTIVE 3: IMPROVED ACCESS TO FINANCING AND INVESTMENT INTO POSTHARVEST MANAGEMENT						
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
Immediate Outcome 3.1						
Access to Financing and Investment in Postharvest Management improved						
3.1.1 Tax rebates on sub-assembled or locally manufactured machinery/ technologies reviewed	<ul style="list-style-type: none"> Number of domestic Manufacturers granted tax rebates 	0	US\$50,000	All domestic manufacturers	Ministry of Finance / Exchequer / MoANR	Ministry of Finance / MoANR / Ministry of Industry, Custom and Revenue Authority
3.1.2 Business training and service support programmes for entrepreneurs strengthened	<ul style="list-style-type: none"> Number of programmes supported 	0	US\$108,000	1	MoANR / Ministry of Commerce / Ministry of Education	MoANR / Regional Bureaux of Agriculture / Ministry of Education
3.1.3 PHM technology/ equipment hire service providers supported	<ul style="list-style-type: none"> Number of rental service providers supported Number of support packages 	500 0	US\$90,000	At least 2 in each Woreda 6 (Financial, technical, logistics, legal and infrastructure and marketing support packages)	MoANR / ATVET	MoANR / Regional Bureaux of Agriculture / ATVET
3.1.4 Development of Lending Guarantee products supported	<ul style="list-style-type: none"> Types of Lending Guarantee products produced Improvement of existing Lending schemes including revision on the interest rate on RUSACO 	5 4	US\$100,000	5 4	MoANR / Financial Institutions/ Insurance Institutions	MoANR / Regional Bureaux of Agriculture / Financial Agencies
Immediate Outcome 3.2						
Incentives and Innovative Financing Services promoted						
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
3.2.1 Capacity development	<ul style="list-style-type: none"> Number of 	4 in the four major	US\$45,000	4 in the four major	MoANR / MFIs /	MoANR / MFIs / Regional

PILLAR / STRATEGIC OBJECTIVE 3: IMPROVED ACCESS TO FINANCING AND INVESTMENT INTO POSTHARVEST MANAGEMENT						
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
for credit service strengthened	Micro financing institutes supported	regions		regions	Regional Bureaux of Agriculture, National Bank of Ethiopia, Federal and Regional Cooperative agencies	Bureaux of Agriculture, National Bank of Ethiopia, Federal and Regional Cooperative agencies
3.2.2 Warehouse receipting system promoted	<ul style="list-style-type: none"> Warehouse receipting system established 	1	US\$80,000	1	MoANR / MFI, Cooperative agencies / Regional Bureaux of Agriculture, Warehouse Administration Authority	MoANR / MFI, Cooperative agencies / Regional Bureaux of Agriculture, Warehouse Administration Authority
3.2.3 Group loan guarantee system promoted	<ul style="list-style-type: none"> Number of schemes developed Number of farmers participating in Group loan guarantee schemes 	1 To be determined	US\$70,000	At least 5 in each Woreda 10% increase in number for farmers participating yearly	MoANR / Regional Bureaux of Agriculture Financial Institutions	MoANR / Regional Bureaux of Agriculture Financial Institutions
3.2.4 Micro-Financing through enabling financial instruments at local levels promoted	<ul style="list-style-type: none"> Types of instruments used at local level Number of famers accessing microfinance 	1 less than 5 % lending for PHM	US\$85,000	5 instruments developed 10% increase annually in Number accessing financial instruments	MoANR / Chamber of Commerce / Association of Micro-Financing Institutions	MoANR / Regional Bureaux of Agriculture / Central Bank
3.2.5 Low interest financing for PHM technologies supported	<ul style="list-style-type: none"> Low interest rates for financing PHM technologies 	18% by RSCOs & 11.5 % by Commercial banks	US\$75,000	1 to 2 percentage points below commercial lending rates	MoANR / Chamber of Commerce / Association of Micro-Financing Institutions	MoANR / Regional Bureaux of Agriculture / Central Bank
3.2.6 Promote forward delivery contracting and out-grower systems	<ul style="list-style-type: none"> Number of out-grower schemes in place 	30	US\$35,000	10% annual increase in Number of schemes per woreda	MoANR / Chamber of Commerce & Industry / Farmers' Cooperative Union	MoANR / Chamber of Commerce & Industry / Farmers' Cooperative Union
Immediate Outcome 3.3 Clustering of agri-business, farmer enterprises and agro-processors promoted						
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION

PILLAR / STRATEGIC OBJECTIVE 3: IMPROVED ACCESS TO FINANCING AND INVESTMENT INTO POSTHARVEST MANAGEMENT

EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
						PARTNERS
3.3.1 Preparation of bankable business / project proposals involving clusters supported	<ul style="list-style-type: none"> Number of bankable proposals developed 	0	US\$240,000	At least 10 from each Woreda	MoANR / Chamber of Commerce / Farmers' Cooperative Union	MoANR / Chamber of Commerce / Farmers' Cooperative Union
3.3.2 Business cluster concept in the agriculture value chain including PH promoted and supported	<ul style="list-style-type: none"> Number of clusters developed 	0	US\$790,000	At least 10 from each Woreda	MoANR / Chamber of Commerce / Farmers' Cooperative Union	MoANR / Chamber of Commerce / Farmers' Cooperative Union
3.3.3 Business Training of Farmer Organisations to better service their members supported	<ul style="list-style-type: none"> Number of training programmes undertaken Number of farmers trained 	0	US\$365,000	At least 2 from each Woreda	MoANR / Farmers' Cooperative Union	MoANR / Farmers' Cooperative Union

TABLE F: PILLAR IV: PROMOTE VALUE ADDITION

PILLAR / STRATEGIC OBJECTIVE 3: PROMOTE VALUE ADDITION						
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
Immediate Outcome 4.1		Farm Enterprise Input Business promoted				
4.1.1 Financing for rural value addition supported	<ul style="list-style-type: none"> Financing mechanisms put in place Number of Rural value addition programmes supported Amount of money disbursed for rural value addition 	0 0 0	US\$180,000	10% annual growth in all aspects	MoANR / Central Bank / Ministry of Finance / Farmers' Cooperatives	MoANR / Central Bank / Ministry of Finance / Farmers' Cooperatives
4.1.2 Micro-financing institutions in rural areas supported	<ul style="list-style-type: none"> Number of micro financing institutions supported 	4 Micro finances in the four major regions	US\$120,000	At least 3 in each Woreda	MoANR / Central Bank / Ministry of Finance / Farmers' Cooperatives	MoANR / Central Bank / Ministry of Finance / Farmers' Cooperatives
Immediate Outcome 4.2		Agro-processing promoted				
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
4.2.1 Women-based and Youth-based business entrepreneurial programmes for value addition and agro-processing activities supported	<ul style="list-style-type: none"> Number of Women-based and Youth-Based business entrepreneurial programmes for value addition and agro-processing supported 	15	US\$205,000	15% annual increase in numbers promoted in each Woreda	MoANR / Ministry of Youth and sport / Chamber of Commerce / ATVET / Cooperative agency,	MoANR / Ministry of Youth and sport / Chamber of Commerce / ATVET / Cooperative agency,
4.2.2 Agro-processing platform created	<ul style="list-style-type: none"> Existence of Agro-processing platform 	4	US\$115,000	1	MoT, MoI, Cooperative agencies, Investment Agency, Chamber of commerce	MoT, MoI, Cooperative agencies, Investment Agency, Chamber of commerce
4.2.3 Agro-processing business training service providers supported	<ul style="list-style-type: none"> Number of business training service providers trained 	0	US\$90,000	10% annual increase in numbers supported in each Woreda	MoANR / Ministry of Youth / Chamber of Commerce / ATVET / Ministry of Education	MoANR / Ministry of Youth / Chamber of Commerce / ATVET / Ministry of Education

PILLAR / STRATEGIC OBJECTIVE 3: PROMOTE VALUE ADDITION						
EXPECTED OUTPUTS	OUTPUT PROXY INDICATORS	BASELINES	INTERVENTIONS / INVESTMENTS	TARGETS (by 2022)	VERIFICATION SOURCES	RESPONSIBLE INSTITUTIONS / IMPLEMENTATION PARTNERS
4.2.4 Local commodity exchanges based on set grades and standards developed	<ul style="list-style-type: none"> Existence of local commodity exchange 	2(ECX & OCX)	US\$230,000	5 (ECX and 4 in each region)	MoANR / Commodity Exchanges Authority, MoT	MoANR / Regional Bureaux of Agriculture / Commodity Exchanges Authority, MoT
4.2.5 Village level value addition technologies including food processing promoted	<ul style="list-style-type: none"> Number of village level value addition agrifood businesses promoted 	0	US\$340,000	5% annual increase in number of farmers engaged in the supply of input, marketing of processed products and value addition over the base year	MoANR / Regional Bureaux of Agriculture / Farmers' Cooperation Unions, Cooperative Agencies	MoANR / Regional Bureaux of Agriculture / Farmers' Cooperation Unions, Cooperative Agencies

DEFINITION OF SELECTED TERMS / GLOSSARY

Urban Dwellers' Association (Kebele): is the lowest administrative unit in urban centre with its own jurisdiction. It is an association of urban dwellers (commonly known as *kebeles*) formed by the inhabitants, and usually constitutes a part of the urban centre.

Farmers' Association Area: is the lowest administrative unit in a settled rural area with its own jurisdiction. It is an association of rural dwellers formed by the inhabitants of a given area whose members are engaged either in agricultural and/or non-agricultural activities.

Major Urban Centres: Large urban centres in the country as designated by the Central Statistical Authority (CSA) for the conduct of the Population and Housing Census of Ethiopia

"Other" Urban Centres: urban centres in the country other than those designated "major" urban centres by the CSA.

Household: Constitutes a person or group of persons, irrespective of whether related or not, who normally live together in the same housing unit or group of housing units who have common cooking arrangements.

Iqub: Type of saving or revolving fund arranged by members of a community

Region: represents the second tier of government in the administrative structure of the Federal Democratic Republic of Ethiopia (FDRE)

Woreda: The fourth tier of elected government in the administrative structure of the Federal Democratic Republic of Ethiopia (FDRE)

Zone: The third tier of government in the administrative structure of the Federal Democratic Republic of Ethiopia (FDRE). This structure has not been explicitly recognized as an administrative structure in the Constitution.

Reporting Level: refer to an administrative entity (rural or urban) or any other entity representing group of zones in larger regions (Oromiya, Amhara, and SNNPR) or major urban centres or 'representatives' of 'other' urban areas in each regional state for which it is deemed reliable to generate and report indicators based on the national sample (HICE survey data sets).

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