Post-harvest Management Policy and Strategies in Mozambique and Sub-Saharan Africa

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By

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Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN)

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Post-harvest Management Policy and Strategies in Mozambique and Sub-Saharan Africa

Lucas Daniel Tivana\textsuperscript{1}, Anabela Casimiro Chambule\textsuperscript{2}, Mavis Madzara\textsuperscript{3} and Isabel Monjane\textsuperscript{4}

**SUMMARY**

The Agriculture Sector in Sub-Saharan Africa (SSA) is characterized by devastating postharvest losses (PHLs). The study reviewed policies, strategies and development programmes related to postharvest management (PHM) in Mozambique and SSA. This was achieved through desktop research, key informant interviews and a national policy dialogue. Although the related agriculture policies, strategies and action plans, make reference to the importance of developing post-harvest technologies, Mozambique has not yet developed a specific stand-alone policy and strategic plan for PHM. The Mozambique Strategic Plan for Agriculture Development Sector 2011-2020 (PEDSA) contains a PHM strategy. The Southern African Development Community (SADC) Agricultural Policy of 2013 proposed to promote investment, at national and regional levels, of storage and agro-processing infrastructures to circumvent the negative impacts of food price volatility, seasonality and erratic availability of food. In addition to Government institutions, the Food and Agriculture Organisation (FAO) and international non-governmental organisations (NGOs) undertake PHM development initiatives in Mozambique. Implementation has been slow at times. For example, the adoption of the mud-brick silos has been very slow due to the poor financial conditions of the rural farmers. The FAO has been promoting the use and construction of metal silos, but these efforts have not been successful for the following reasons: (i) local artisans lack the requisite skills and capital; and (ii) the scarcity of appropriate metal sheets on the local market prevented the construction of metals silos. The lack of a specific standalone PHM policy and strategy weakens collaborations between institutions. There is no relevant research initiative of PHM in Mozambique. There is a general lack of skilled PHM service providers in SSA and SADC region. Post-harvest aspects are under-represented in most agricultural research and development strategies. The development of PHM in SADC is negatively affected by a lack of investment in infrastructure, such as roads, transportation and local-oriented food industries; policy gaps; lack of training institutions for PHM; and a lack of capacity by farmers to access financing. The impact of agricultural research results is weak because research activities are mainly funded by donors and carried out by isolated individual researchers or research groups with little collaboration with and access to farmers. Additionally, there is weak link between university research programmes with public, private, NGOs and farmers development programmes. The key recommendations of this Report include: (i) establishing National Post-Harvest Steering Committees; (ii) increased advocacy by PHM key institutions and champions in an effort to influence policy makers to improve actions related to PHM in the Comprehensive Africa Agriculture Development Programme (CAADP) and PEDSA; (iii) increased collaboration between researchers, extension services, farmers organizations and universities to address gaps in PHM policies and strategies; (iv) quantifying PHLs and promoting reliable data collection; , (v) improving PHM research and technology transfer at regional universities and research institutions; (vi) promoting relevant and low cost PHM technologies that can add value to smallholder farmers outputs, are accessible to women and attractive to the youth, and aligned to local customs.

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**LIST OF ACRONYMS**

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<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>AFAAS</td>
<td>African Forum for Agricultural Advisory Services</td>
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<tr>
<td>CAADP</td>
<td>The Comprehensive Africa Agriculture Development Programme</td>
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<tr>
<td>CEPAGRI</td>
<td>Agricultural Promotion Centre</td>
</tr>
<tr>
<td>CITTAU</td>
<td>Centre for Research and Technology Transfer of Umbeluzi</td>
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<tr>
<td>DNEA</td>
<td>National Agriculture Extension Directorate</td>
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<tr>
<td>FANR</td>
<td>Food, Agriculture and Natural Resources</td>
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<td>FANRPAN</td>
<td>Food, Agriculture and Natural Resources Policy Analysis Network</td>
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<td>FAO</td>
<td>Food and Agriculture Organization</td>
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<td>GPFS</td>
<td>Global Program Food Security</td>
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<td>HSI</td>
<td>HELVETAS Swiss Inter-cooperation</td>
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<td>ICM</td>
<td>Mozambique Cereal Institute</td>
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<tr>
<td>IFAD</td>
<td>International Fund for Agricultural Development</td>
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<tr>
<td>IIAM</td>
<td>Mozambique Agriculture Research Institute</td>
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<tr>
<td>IPEME</td>
<td>Promotion of Small and Medium Enterprises</td>
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<tr>
<td>MCT</td>
<td>Mozambique Ministry of Science and Technology</td>
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<tr>
<td>MDG</td>
<td>Millennium Development Goal</td>
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<tr>
<td>NEPAD</td>
<td>The New Partnership for Africa’s Development</td>
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<td>NORAD</td>
<td>Norwegian Agency for Development Cooperation</td>
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<tr>
<td>PAEI</td>
<td>Mozambique Agrarian policy and Implementation Strategy</td>
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<td>PAPA</td>
<td>Action Plan for Food Production</td>
</tr>
<tr>
<td>PARPA</td>
<td>Action Plan for Absolute Poverty Alleviation</td>
</tr>
<tr>
<td>PARP</td>
<td>Action Plan for Poverty Alleviation</td>
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<td>PEDSA</td>
<td>Mozambique Strategic Plan for Agriculture Development Sector</td>
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<td>PHL</td>
<td>Postharvest losses</td>
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<td>PHM</td>
<td>Postharvest Management</td>
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<td>PHM-SSA</td>
<td>Postharvest Management project in Sub-Saharan Africa</td>
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<td>PNISA</td>
<td>National Agricultural Sector Investment Plan</td>
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<td>ProAgri</td>
<td>National Programme for Agricultural Development</td>
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<td>SADC</td>
<td>Southern Africa Development Community</td>
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<td>SDC</td>
<td>Swiss Agency for Development and Cooperation</td>
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<tr>
<td>SETSAN</td>
<td>Technical Secretariat for Food and Nutrition Security</td>
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<tr>
<td>SIDA</td>
<td>Swedish International Development Agency</td>
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<td>SSA</td>
<td>Sector in Sub-Saharan Africa</td>
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<td>UNAC</td>
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1. INTRODUCTION

Mozambique has a population of about 23 million people with the majority (nearly 70%) depending on agriculture for their livelihood. The Mozambican economy is based on agriculture with the sector accounting for about 23% of the GDP and employing about 80% of the workforce. Most of the farmers (98%) practice the rain fed agriculture. Since 2003, the agricultural sector has been growing at a rate of between 5% and 11%. The large variation in the agricultural growth rate is due to the effect of erratic climate conditions. Notwithstanding this growth, Mozambique remains a net food importer of mainly rice, wheat and processed food, which is largely supplied to the urban areas (PEDSA, 2011). However, Mozambique has enormous agricultural potential for food production both for the domestic and export markets. It has about 36 million hectares of arable land, of which only about 10% is utilised. In addition to this, about 3.3 million hectares are estimated to have irrigation potential. However, currently less than 100 thousand hectares (<3%) is used for irrigation and 97% of irrigation potential land is idle.

The country still faces high food and nutrition insecurity. More than 30% of children under the age of 5 years suffer from chronic malnutrition (SETSAN, 2008). The high food and nutrition insecurity is partially due to high PHLs, which are estimated to amount to 30% (SETSAN, 2008). The majority of farmers grow and store their food products. However, due to poor post-harvest handling (PHH) practices and unsuitable storage conditions, the food products only last for three months after which they deteriorate and are lost. Short seasonal commercialization exacerbates food insecurity. The high surplus of food products, which are available during harvesting periods, causes a drop in producer prices resulting in lower incomes for the farmers. This reduces their purchasing power for processed food in the lean season.

According to the National Farmers Union (UNAC), most farmers in the smallholder sector depend on the informal market to sell their agricultural food surplus. There has been some improvements made with regard to rice. Processing companies are promoting formal marketing of rice and farmers are increasingly considering rice as a cash crop. The formal market is well established for export crops, such as tobacco, cotton and sugarcane. The improvement of PHM, especially in storage, can significantly increase food security and the incomes of small farmers.

In an effort to reduce PHL, the public, civil and private sectors have to undertake interventions that are aimed specifically at improving post-harvest management (PHM), especially for the small-scale farmers of basic commodities. The improvement of PHM technology targeting the small-scale farmers in Mozambique would make them more food secure and allow them to dedicate themselves to cash crops and other income earning activities. In this way improved PHM, such as on-farm storage, can become a vehicle for the poverty alleviation (Coulter and Schneider, 2004). This study therefore provides an assessment of past and current policies, strategies and development programmes related to PHM in Mozambique, as well as their linkages to regional and international interventions.

The specific objectives of the study were to:

i) Review the existing post-harvest management policies and strategies in the context of Mozambique, the Sub-Saharan Africa (SSA) and Southern Africa Development Community (SADC) region;
ii) Identify the past and current PHM development and research initiatives in Mozambique;

iii) Analyse gaps in the existing policy frameworks and provide an indication of whether existing policies meet the needs/challenges faced by smallholder farmers; and

iv) Identify relevant policy recommendations.

The Study was guided by the following research questions:

- What are the major Post-harvest Loss Management (PHLM) policy gaps and key challenges to implementing policies in the country?
- What are the major gaps in institutional arrangement and what key institutional arrangement can be recommended?
- What opportunities remain untapped, why and how could they be explored?

2. RESEARCH METHODOLOGY

2.1 Research Design and Philosophy

The study was conducted in Mozambique. The research design followed a qualitative approach because the Study sought to analyse and explain phenomena of PHLM using valid and reliable data. Therefore, qualitative research, as a method of inquiry, was undertaken to gather an in-depth understanding of the PHLM and existing policies, programmes, projects and strategies, challenges and opportunities that could be tapped for improvement and the reasons that govern them. The qualitative tools that were employed were sensitive and flexible to gather relevant data in order to answer the research questions under investigation. Consequently, the study managed to decipher, examine and interpret meaningful patterns or themes that emerged out of the data, as determined by the research questions used. Descriptive and explanatory research was used to answer the research questions. The research question guided the consideration and description of the facts and phenomena of PHLM, which was followed by an explanation of the trends.

2.2 Research Strategy

The phenomenological research strategy provided an understanding of the themes and patterns, which were portrayed by knowledgeable and experienced key participants drawn from key stakeholders in the country. The participants were asked semi-structured questions, but they were allowed to add any additional information that they thought was supposed to be known about the subject. This phenomenological approach allowed a search for meanings from appearances and to arrive at the core meaning through intuition and reflections based on the experiences of the selected experts in the field. It led to many ideas regarding the problem, prompted judgements and ultimately brought out recommendations of some innovative and generic solutions to the PHLM in Malawi and SSA.

2.3 Target Population and Sampling
The target population was stakeholders in PHLM and smallholder agricultural production in Mozambique. The non-probability sampling method was employed for the study because it was convenient and economical. The purposive or judgemental sampling technique was applied because of its flexibility. Individuals who would provide the most valuable information were selected from different and relevant organisations. Ten stakeholder institutions were sampled from the database which was obtained from the Ministry of Agriculture. The individual participants were nominated by their superiors in each organisation.

2.4 The Research Instruments

2.4.1 Document analysis and literature review

Document analysis and review of the literature were used to identify the policy gaps and to align the research problems with existing empirical knowledge. This process entailed a thorough review of relevant data and literature, which is related to PHLM and agricultural production, and therefore capable of revealing various opinions on the subject. The documents reviewed include:

i) Decrees that have been approved by the Government of Mozambique since 1995 related to policies and implementation strategies for the agriculture sector or related areas,

ii) Government approved programmes for the agriculture development

iii) Reports of agricultural projects implemented by the Government and NGOs.

iv) SADC, NEPAD policies and strategies for the agriculture sector

The policies related to PHM in Mozambique were analyzed in relation to the SADC region, as well as African Union agriculture policies, programmes and strategies such as the Comprehensive Africa Agriculture Development Programme (CAADP). Key documents were reviewed during September to December 2013. Semi-structured interviews were designed to address the information gap.

2.4.2 In-depth Interviews

The interviews were conducted with key actors and informants with adequate knowledge in the field of PHM technology development, and policy formulation and implementation in Mozambique. In order to obtain reliable information about PHM in Mozambique, contacts were established with 10 relevant institutions, which to various extents are dealing with PHM: (1) Technical Secretariat for Food and Nutrition Security (SETSAN), (2) National Agriculture Extension Directorate (DNEA), (3) Agricultural Promotion Center (CEPAGRI), (4) Mozambique Agriculture Research Institute (IIAM), (5) National Industry Directorate (NID), (6) Institute for the Promotion of Small and Medium Enterprises (IPEME), (7) The National Farmers Union (UNAC), (8) Josina Machel Farmer Association (Inhambane), (9). Centre for Research and Technology Transfer of Umbeluzi (CITTAU), and (10) Eduardo Mondlane University-Faculty of Engineering.

The interviews constituted the basic form of data collection for primary data. The questions were aligned with the research problems. The main questions which were posed to the interviewees were:

- What is the main area of activities of the organization?
- Is there any activities related to PHM?
- Has the organization participated in a programme or project related to PHM?
- Has the organization ever had a role in the project or programme targeting the reduction of PHLs?
- Is there any policy or strategy related to PHM?
- What are the main constraints for the reduction of PHL?
- Was the organization involved in PEDSA elaboration?

The last section of the interview guide was left open-ended to allow respondents to make any additional comments. Face-to-face interviews provided the opportunity to use probes to clear up vague answers and to request elaboration when responses were not complete. The interviewers and research assistants were experienced and able to conduct the interviews in Portuguese. Therefore, interviews provided a versatile and flexible way of collecting data and allowed questions to be changed, depending on the background, experience and expertise of the interviewee, and to seek elaboration when necessary. To yield quality responses, three different interview guides were used to ensure that participants were asked questions that were relevant to their organisation, experience or background.

### 2.4.3 National Dialogue

The findings from the reviewed documents and output from the stakeholder’ interviews were presented and discussed at the National Workshop Dialogue in Maputo, Mozambique, which was held from the 19th to the 21st May, 2014. The Dialogue aimed at sharing the results, validating the information on past and current policies and strategies related to PHM, and identifying relevant recommendations address the gaps in PHM. Several stakeholders were present at the workshop, including farmer’s organizations, private sector, NGOs, international organisations, academia, and government institutions from national to district levels. The Permanent Secretary in the Ministry of Agriculture and other high ranking government officials participated in the workshop.

### 2.5 Data Analysis and Validation

The data was analysed using content analysis to establish emerging themes, patterns and trends. The themes were identified by word analysis, comparing and contrasting responses from different participants, intentional analysis and physical manipulation of texts. The existing information was consulted and used to review field notes. The secondary data was tabulated. Triangulation was applied through the use of repeated questions to validate the information obtained. The in-depth interviews with key informants also allowed content validity, because they shared their personal opinions on the topic, which allowed eventual judgements on the statements obtained. Further validation was made possible by a literature study of documented information from reliable sources. To ensure that reliable data was collected, methodological coherence was used to ensure congruence between the research questions and components of the methods. For example, by modifying and changing questions during the interviews with highly knowledgeable people. Data collection and analysis were done concurrently to enable a mutual interaction between what was known and what the researcher needed to know. The results of the study were validated at the National Dialogue.
3. STUDY FINDINGS

3.1 PHM Policies and Strategies in SSA and SADC

Agriculture development in SSA countries is guided by the Comprehensive Africa Agriculture Development Programme (CAADP), at continental level, and by the SADC Agricultural Policy at regional level. The CAADP is led by African governments and provides an important instrument for guiding African countries towards accelerating agricultural and economic growth and eliminating poverty and hunger. It is also the main strategy orientating African governments towards achieving the Millennium Development Goal (MDG). CAADP defines four major intervention areas or pillars for accelerating agricultural growth, reducing poverty and achieving food and nutrition security. These pillars are:

- Pillar I. Extending the area under sustainable land management and reliable water control systems;
- Pillar II. Improving rural infrastructure and trade capacities for market access;
- Pillar III. Increasing food supply, reducing hunger, and improving responses to food-emergency crises; and
- Pillar IV. Improving agriculture research and technology dissemination and adoption.

The four pillars are important for accelerating agricultural growth but Pillars II, III and IV are more related to the improvement of PHM in Africa than Pillar I.

Pillar II - the main objective of the pillar is the development of rural infrastructure to facilitate the trade of agricultural produce on local, regional and global markets. This includes infrastructure aimed at facilitating improved post-harvest management. The creation of public and private partnerships for the development of small-scale infrastructure in rural areas, such as post-harvest and storage facilities, is recommended as a way of integrating smallholder farmers into the local and export value chains.

Pillar III - recognizes that the improvement of food security is linked to improving access to postharvest facilities and markets. Many households in Africa remain poor and relatively undeveloped due to a lack of good infrastructure. Rural farmers, even with bumper harvests, have limited access to markets because of poor road infrastructures. Earnings from the sale of agricultural commodities or assets are meagre, as small-scale farmers often have to rely on middlemen with whom they have relatively little bargaining power. The lack of storage and processing facilities leads to product and income losses. Value adding processes, which may increase the significance and value of agricultural produce and boost rural growth, are lacking in African agriculture. CAADP Pillar III highlights the following PHM options for raising food security:

i) Development of post-harvest technologies at community and household level to increase the shelf life of commodities;
ii) Promotion of low-cost and sustainable processing technologies for quality and nutritious foods among the poor and vulnerable farmers; and
iii) Promotion of low-cost and sustainable marketing technologies for quality and nutritious foods favoured by the poor and vulnerable.

Pillar IV- focuses on improving agricultural research and technology dissemination and adoption. The main link of this pillar to PHM is related to the transfer of technology from
national research results and international technologies to the rural small-scale farmer’s social and economic environmental conditions. Research will help to evaluate and identify factors that facilitate the adoption of certain post-harvest technologies, as well as to evaluate the impact of newly adopted technologies on poverty alleviation.

*SADC Agricultural Policy of 2013* is in line with the CAADP objective of promoting sustainable and equitable African economic growth and socio-economic development to facilitate the attainment of the MDGs in Africa. The SADC Policy *inter alia* proposes promoting national and regional investments in storage and agro-processing infrastructure in an effort to deal with price volatility, seasonality and the unpredictability in food availability. The Policy acknowledges that agro-processing development may provide positive impacts on rural and urban employment, offer market access, create business linkages between small to medium enterprises, enhance food security, contribute to the much needed industrialisation and exploitation of underutilized natural resources and agro-processing capacity in the region, and improve overall competitiveness and trade balances.

The Mozambique Government is committed to the African Union and SADC development strategies and policies. Most of the recent Mozambican agriculture sector policies and strategies are in line with the CAADP (CAADP, 2011) and SADC Agriculture policies and strategies.

### 3.2 Implementation of PHM Programme and projects in Mozambique

The Integrated Food Security Programme of Sofala was implemented by the German Federal Enterprise for International Cooperation (GTZ today GIZ) in collaboration with Sofala and Manica Provincial Agriculture Directorates. The aim was to improve storage structures at the small-scale farmer level. The programme promoted improved grain drying cribs and mud-brick silos. The mud-brick silos are able to protect the stored grains against insects, including the Large Grain Borer (LGB), rodents (e.g., rats), fire as well as thieves. In addition, it stores the grains for longer periods, which enables farmers to obtain higher lean-season prices. At the same time, the project promoted the utilization of storage grain pesticides, such as Acetellic Super Dust and Phosphine. The project has trained mud-brick silo builders, who also acted as silo promoters. However, the construction rate of the silos in the project areas was much lower than envisaged (GTZ, 2006). According to a 2013 presentation made by Manuel Ali of the DNEA about 5000 mud-brick silos have been constructed by the farmers between 2008 and 2013 (GTZ, 2006).

The Food and Agriculture Organisation’s (FAO) Special Programme for Food Security promoted the use of metal silos, which were successfully introduced by Helvets in Latin America. The programme was undertaken in the Inhambane, Sofala, Manica and Tete provinces. About 20 artisans were trained to make the metal silos and some silos were sold, but the project was not successful. Various factors contributed to the limited success of the project, including: poor selection of local artisans, poor selection of trainers, artisans lacking entrepreneurial skills and capital, and the scarcity of metal sheets of the appropriate thickness on the local market (Coulter and Schneider, 2004).

**Helvetas Swiss Cooperation** has been promoting improved silos in Cabo Delgado and Nampula that are made from a mixture of local materials (wood and clay) and small pieces of metal. The metal piece is to be applied as the silo lid. Farmers were considering the metal lid to be too expensive. Therefore, there was need to use locally available materials in making
the lids. Most of the improved silos were recommended for the storage of seed but the silos only last for one year. Most of the farmers are willing to adopt the technology, because they do not require purchasing new materials. According to the Helvetas-Mozambique 2012 Annual Report, the programme is still being implemented under The Food Security and Agro-Business National Programme.

### 3.3 PHLM Policy Framework in Mozambique: effectiveness and equity

The policies and strategies approved by the Government of Mozambique for the agricultural, industry, and science and technology sectors refer to the importance of reducing PHL, as one of the strategies for poverty alleviation, improved food and nutrition security and increased export of food products. The Agrarian Policy and Implementation Strategy (PAEI) approved in 1995, which still serves as the main guide for the formulation of agriculture development programmes, refers in its pages 24 (ii, iv-a, d), 27 (ii) and 35 sections, to the need for the establishment of rural public, private and NGO partnerships for the promotion of PHM best practices and the establishment of agro-processing units in rural areas as strategies to increase the marketing and export of agricultural surpluses.

The programmes and strategies for agriculture development in Mozambique have been guided by the PAEI of 1995 and periodical government action plans for poverty alleviation. Relevant programmes and strategies are summarized in Table 1 below. They are consistent in stating that rural development is necessary for poverty alleviation in Mozambique and can only be achieved by the transformation of subsistence agriculture into sustainable commercial agriculture and solid national self-sufficient food production. At the outset, these guiding instruments were more geared towards increasing food crop production and productivity and placed less emphasis on post-harvest activities. Recent instruments, such as the Strategy and Action Plan for Food and Nutrition Security (ESAN) and the Strategic Plan for the Development of the Agricultural Sector (PEDSA), increasingly give importance to PHM and the need to the reduce PHL.

The Industrial Policy of Mozambique, which was approved in 2007, also promotes post-harvest activities. The Policy promotes industrialization in Mozambique and the development of the food industry. The Industrial Policy advocates the following criteria for granting approval for investments: the use of national raw materials, promotion of competitiveness of domestic products, substitution of imports and promotion of exports (improvement on contribution to target positive net balance of payments), and the promotion of employment and development of rural areas. The development of the food industry involves, as a necessity, the promotion of good post-harvest practices.

The Science and Technology Policy of 2003 lists agriculture as one of its priority areas, as well as in its implementation strategy. The Policy identified the reduction of PHL as one of its areas of major intervention in research, innovation and technology transfer.

While several agriculture policies, strategies and action plans make reference to post-harvest technologies, Mozambique lacks a specific policy and strategy for PHM. In the Mozambique Strategic Plan for the Development of Agricultural Sector (PEDSA 2011-2020), it is indicated that PHM will be implemented as a sub-programme of the food production promotion programme.
The Study was able to find evidence of gender mainstreaming in all of the agricultural policies and strategies that it reviewed. Stakeholder interviews confirmed this aspect. Most recent agriculture policies and strategies reinforced the need for agricultural services to target women, Youth, physically disabled people and persons living with HIV/AIDS.

3.4 PHM related policies in Mozambique

The Study identified the following main policies related to PHM in Mozambique:

a) Agriculture Policy and Implementation Strategy (PAEI) approved by the Council of Ministers (Resolution No. 11 of 1995) and published in the Government Official Bulletin on 28 February 1996.


a) **Agriculture Policy and Implementation Strategy (PAEI)**

This is the only agricultural policy adopted in Mozambique since 1995. It has been the main instrument guiding the formulation of strategies and programmes in the agricultural, livestock and forestry sectors in Mozambique.

Its main objectives are to revive agricultural production to make Mozambique food self-sufficient and promote commercialization and export of agricultural commodities. It is based on the following general objectives:

- The transformation of agriculture from subsistence to an increasingly integrated functional agriculture production, distribution and processing;
- The development of the agrarian sector, which produces surplus to the market; and
- The development of an efficient and participatory corporate sector in agricultural development.

The Policy recognizes that improved PHM is needed in order to achieve food self-sufficiency, a developed agro-industry, better rural employment and higher quality food raw materials. The Policy encourages the establishment of production support centres. The centres should guarantee the provision of services to small-scale farmers in areas, such as primary processing of agricultural products. The PAEI identifies maximizing local processing of raw materials as a strategy for promoting exports. It also advocates for the promotion of innovation and research to improve PHM technologies, such as simple storage and processing facilities. The PAEI emphasizes the promotion of rural storage infrastructure rehabilitation and the conservation of agricultural surpluses by involving the community and the private sector in the construction and management processes.

b) **Industrial Policy and Strategy of 2007**

The Industrial Policy and Strategy of 2007 has indicative priorities for industrial development, through promotion of investment in the food industry. Development of the national food industry may motivate the development of rural areas. The Industrial Policy and Strategy of 2007 is aligned to the agricultural policy, PAEI, as both policies advocate for poverty alleviation through improving agricultural production for domestic and international markets. The development of agriculture should be accompanied by the development of agro-industries, such as the food industry.
Both policies advocate for the tax incentives and funding opportunities for the establishment of small units of agro-processing and agro-industries in rural areas to be established and fixed. The Industrial Policy and Strategy of 2007 also has incentives for the development of the food industry, which maximize competitive advantages to meet the challenges of economic integration within the SADC region.

3.5 PHM-related strategies in Mozambique

Programmes and agricultural development strategies undertaken by the agriculture sector are aligned with the national agricultural policy, PAEI, as well as with other multi-sectorial national programmes, plans and strategies, such as the Action Plan for Absolute Poverty Alleviation (PARPA) and Action Plan for Poverty Alleviation (PARP). They are also aligned with international, continental and regional initiatives, such as the MDGs, the CAADP and FANR of SADC. Although there is no specific PHM programme or strategy, former and current programmes and strategies have addressed the importance of improving PHM practices, in order to reduce PHL, extending food availability throughout the year and increasing household incomes of small scale farmers. Table 1 summarizes the relevant current and former action plans, programmes and strategies for the agriculture sector and multi-sectorial development in Mozambique, which to some extent are related to PHM.

Table 1: Summary description of the relevant programmes, strategies and action plans for the agriculture sector in Mozambique

<table>
<thead>
<tr>
<th>Programme strategies</th>
<th>Main objectives, main approaches, approaches for PHM</th>
<th>Implementation period</th>
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<tbody>
<tr>
<td>1. Action Plan for Absolute Poverty Alleviation (PARPA I &amp; II), Mozambique Government</td>
<td>It was multi-sectorial action plan approved by the Government of Mozambique. Among several of its objectives, which make reference to the agriculture sector (Economic Development), it describes rural development as a priority to stimulate structural transformation of agriculture, implying higher productivity and greater competitiveness in the international market. This plan was the guide for strategies and programmes of various sectors such the National Programme for Agriculture Development.</td>
<td>I – 2001-2005 II – 2006-2009</td>
</tr>
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<td>2. National Programme for Agricultural Development (ProAgri I &amp; II)- Ministry of Agriculture, Mozambique</td>
<td>It had as a general objective, the reduction of poverty and improvement of food security in Mozambique. Specific objectives were: i) to support small farmers in developing their activities related to agriculture and natural resources, ii) stimulate the increase of agricultural production, sustainable use of natural resources and development of agro-industries for domestic and export markets and iii) sustainable management and conservation of natural resources and taking into consideration the interests of</td>
<td>I (1996-2005) II (2007-2010)</td>
</tr>
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</table>
| 3. Agricultural Marketing Strategy (I & II), Ministry of Industry and Commerce, Mozambique | It aimed at: the expansion of the commercial agriculture (inputs and output) throughout the country, the development of functional marketing systems for agricultural products, and the promotion of food security and exports. Among other issues, the strategy assumes the need to improve storage and processing technologies in agricultural production as a means of reducing post-harvest losses. | I - 2000 – 2004
II - 2006-2009 |
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<td>4. Master Plan for Rural Extension, Ministry of Agriculture</td>
<td>This plan was designed as an implementation plan for the agrarian policy and as an operational plan for ProAgri. Its main objective is to coordinate the provision of extension services by the public and private sectors, and NGOs to small-scale farmers (both men and women) with purpose of improving food security, economic growth and poverty alleviation, especially in rural areas. This action plan indicates that, among other activities, the extension would provide the necessary attention to the storage and processing activities along the product value chain.</td>
<td>2007 – 2016</td>
</tr>
<tr>
<td>5. Strategy and Action Plan for Food and Nutrition Security (ESAN)- 2008-2015, Ministry of Agriculture, Mozambique</td>
<td>This strategy aims at ensuring that all citizens, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs for active and healthy life styles and realize their right to adequate food. Among the specific objectives to be achieved, it has as a priority of ensuring food self-sufficiency by reducing PHL at the farmers/household levels.</td>
<td>2008-2015</td>
</tr>
<tr>
<td>6. Action Plan for Poverty Alleviation (PARP), Mozambique Government</td>
<td>It is an inter-sectoral plan approved by the Government, whose first priority is to increase crop production and productivity. The plan recognizes that the facilitation of market access in agricultural production is necessary to improve the PHM, promote the construction of local storage infrastructure, revitalize the Mozambique Cereals Institute, promote agro-processing industry and stimulate market linkages between small-scale farmers and agro industry through production contracts.</td>
<td>2011-2014</td>
</tr>
<tr>
<td>7. Strategic Plan for the Development of the</td>
<td>This strategy aims to contribute to the sustainable and competitive increase in</td>
<td>2011-2020</td>
</tr>
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</table>
Agricultural Sector (PEDSA), Ministry of Agriculture for food and nutritional security and the income of small-scale farmers ensuring social and gender equity. One of its strategies is to improve market infrastructure to facilitate the collection, storage and post-harvest handling of agricultural products to meet internationally accepted standards, thus increasing trade in agricultural products. This plan is based on PARP.

**PARPA (2001-2009).** Mozambique continues to rank as one of the poorest countries in the world (ranking 185 out of 187 according to the 2013 UNDP Human Development Report). The Government, concerned about the high level of poverty, has developed the multi-sectorial action plan for the Alleviation of Absolute Poverty (PARPA 2000-2009). Many sectorial programmes were partly guided by the Plan. The plan, among other strategies and programmes, aimed at revitalizing the agriculture sector, upon which the livelihoods of nearly 70% of the Mozambican population depend.

**ProAgri (1996-2010).** ProAgri was the first major programme that responded to the implementation of the agricultural policy, as well as the Government's programme for absolute poverty alleviation (PARPA I and II). At the institutional level, ProAgri intended to aggregate multiple individual projects of the agriculture sector into one programme in which the government and various donors would allocate their funds. At the production level, it had as a goal, the provision of services to the household sector, which is the main producer of food crops in Mozambique and a significant contributor in the production of export crops. This programme would improve the functionality of public institutions in the agricultural sector, from the national level, through the Provincial to the District level. Extensive services are now better organised and structured as a result of the improvements to the institutional agriculture sector. The programme managed to revitalize the private commercial sector and increased the production of crops for export, including sugar, tobacco, cotton and Chestnut. However, the support services for the small-scale farmer sector fell short of expectations and food production remains insufficient in Mozambique (ORAM and ROSA, 2010; Mozambique .Ministry of Agriculture, 2011) and PHL for food products remain high.

**Master Plan for Rural Extension (2007-2016) -** The Master Plan for Rural Extension was created as a result of the restructuring of the agriculture extension services under the ProAgri. The Plan is of great importance as it aims to control and coordinate all agricultural extension services provided by various stakeholders, including the agricultural public service, private sector and NGOs. It also stimulates the improvement of linkages between research/innovation, extension services and farmers. Small-scale farmers are the main target group. Among other services, the Plan gives priority to support services offered to smallholder farmers in the improvement of food storage and local processing of agricultural products. These services remain underfunded notwithstanding efforts by the NGOs, Helvets and GTZ (SETSAN, 2008).

**Agricultural Marketing Strategy (2000-2009) -** As a follow-up to the implementation of PARPA and in an effort to align with strategies with the ProAgri., the Ministry of Industry and Trade created the Agricultural Marketing Strategy. The Strategy *inter alia* sought to improve the systems of agricultural food products storage and access to market. The Strategy
sets priority actions, such as the construction, rehabilitation and maintenance of warehouses, including silos, re-structuring and revitalizing of the Mozambique Cereals Institute (ICM). The ICM formerly was responsible for the purchase of cereal grain from farmers and supplying to the milling industry. The priority actions are aimed at reducing PHL and building up the physical reserve of cereals for food security. However, the Strategy has not yet had the desired positive impact for small-scale farmers. This may be attributed to many factors, such as poor road networks, lack of a specific policy and strategy for PHM, lack of qualified advisor and technicians on PHM, and weak marketing channels.

**Strategy and Action Plan for Food and Nutrition Security (ESAN, 2008-2015).** The Government established the Technical Secretariat for Food and Nutrition Security (SETSAN) in response to, among other national policies and international agreements, the national commitments to reduce the level of food insecurity and malnutrition by half by the year 2015 and to achieve the Millennium Development Goals (MDGs), the Human Right to Adequate Food in Mozambique, and the PARPA. SETSAN, as a strategy for the implementation of PARPA, has responsibility to coordinate the Strategy and Action Plan for Food and Nutrition Security (ESAN) which, among other issues, it was established to achieve the desired food security, to disseminate information on food preservation during post-harvest to smallholder farmers and reduce PHL from 30% (2008) to 10% (2015). ESAN also recommends the involvement of district authorities, civil society and private sector in its implementation. However, there is still no evaluation report to assess the current state of the plan.

**Plan for the Poverty Alleviation (PARP 2011-2014).** With the end of the period of implementation of the PARPA, the Government revised the Action Plan and adopted the Action Plan for the Poverty Alleviation (PARP 2011-2014). The Plan aims to operationalize the Government's Five Year Programme (2010-2014). PARP is the main guiding instrument for the public, private and civil society in fighting poverty. It reinforces the weight of agricultural development in fighting poverty and recognizes the promotion of services that target the smallholder farmer through, among other services, the expansion of technical assistance services. The PARP establishes, as the first priority objective, the increase in agricultural productivity. In addition to actions to be implemented in the agricultural sector, it provides clear guidelines on the development of concrete plans to improve the roads, food storage, improve access to national and international markets as well to agro-industrial access to agricultural production. The Strategic Plan for the Development of Agricultural Sector (PEDSA 2011-2020) is guide partially from PARP development lines.

**Strategic Plan for the Development of Agricultural Sector (PEDSA 2011-2020).** The fundamental strategy of PARP is based on agriculture through PDSA. PEDSA represents a reformulation of ProAgri in the broadest sense. It brings together a wide range of agricultural strategies and programmes including: the Green Revolution Strategy, the Priorities of the Agricultural Sector, Research Strategy, the National Agricultural Extension Programme, the Forestry Strategy, the National Forests Plan, the Irrigation Strategy, the Action Plan for Food Production, and the Strategy and Action Plan for Food and Nutrition Security. The overall objective of PEDSA is to contribute to sustainable and competitive increase of food security and incomes of smallholder farmers ensuring social and gender equity. As highlighted in its second of four pillars, its challenge is to improve access to markets for smallholder farmers’ agricultural products; network infrastructure; post-harvest handling, especially with regard to storage, preservation and processing of food agricultural products; as well to improve access to market information. PEDSA seeks to increase the involvement of the banking sector to improve access to financial services, credit and insurance for smallholder farmers. It also
aims to increase and harmonise investments in infrastructure and services to facilitate the reduction of transaction costs and encourage the participation of the household sector in the market. In this plan, the importance of PHM is increasingly enhanced. The PEDSA guides the establishment of a PHM programme under the Action Plan for Food Production (PAPA). The PAPA was created in 2008 and was supposed to be implemented for a period of 3 years with the purpose of decreasing the importation of food products by increasing the national production of food. However, its implementation was complex, slow and the allocation of funds was weak. As a result, PAPA was integrated into the PEDSA in 2011. The PHM component in PAPA is described as part of agriculture marketing, which only focused on agriculture surplus (part of the production that the farmers will not need for their own consumption). The PAPA recognizes the need to reduce PHL but it lacks a clear strategy on this aspect, especially at the household level. The budget provision for PHM allocates funds towards the construction of large warehouses and silos targeting only the storage of surplus. Although it mentions the need to promote small improved silos, it lacks proper action planning and funding to improve the storage of food at the household levels. Large amounts of PHL occur at the household level.

To finance the implementation of PEDSA, the Government in April 2013 launched the National Agricultural Sector Investment Plan (PNISA). The PNISA is planned to be implemented during the 2013-2017 period. The budget allocation for PHM in the PNISA, once again, lacks a clear action and funding plan for the reduction of PHL at the smallholder farmers’ level. Funds are directed towards the construction of large silos and warehouses as part of a strategy to improve the marketing of agriculture products. While the PHM is mentioned in different PEDSA pillars and priority programmes, as well in the PNISA main components, there is weak harmonization of actions and budgets to finance the improvement of PHM, especially for the reduction of the largest PHL that occur at the level of smallholder farmers. Therefore the creation of a specific policy and strategy for PHM may improve planning and budgeting for PHM.

3.6 Key Institutional Frameworks

3.6.1 Actors developing activities related to PHM

Some public organizations are involved in the development of PHM related activities. The National Agriculture Extension Directorate (DNEA) is the most relevant institution for the implementation of actions aimed at reducing PHL. The DNEA is a division of the Ministry of Agriculture with the responsibility of coordinating all activities of farmers’ assistance, both at the household level and at the commercial private sector. The DNEA is the main implementer of SETSAN recommendations to reduce PHL to 10% by 2015.

The Agricultural Promotion Centre (CEPAGRI), National Industry Directorate and Institute for the Promotion of Small and Medium Enterprises (IPEME) are involved in the promotion of technologies to reduce PHL. The CEPAGRI was created by the Government to promote the development of the agricultural and agro–industry private sectors. CEPAGRI has created two instruments to operationalize the PEDSA, namely the Agro - Business Master Plan and Strategic Plan for Agriculture Mechanization. The Institution establishes service centres, which provide common services to small and large commercial farmers. The services include the provision of tractors, installation of cooling systems in the wholesale markets and provision of vegetable processing units. However, CEPAGRI lacks action plans or programmes that are specifically geared at providing services aimed at reducing PHL for
cereals by smallholder farmers, such as the promotion of improved small silos. CEPAGRI recognizes the problem of weak flow of production, the inefficiency of existing conservation systems and poor involvement of private sector in the marketing of surplus production in the smallholder farming sector in Mozambique. CEPAGRI intends to create a commodity exchange in an effort to improve market access.

The National Industry Directorate of the Ministry of Industry and Trade has been mandated to formulate industrial policies and strategies in Mozambique. With regard to the agro-industry, the National Industry Directorate has prepared a strategy for small and medium enterprises for the promotion of small and medium agribusiness in rural areas. The Strategy is implemented by the Institute for the Promotion of Small and Medium Enterprises (IPEME), which was created by the Government to promote the establishment of small agro-processing units in rural areas with high agricultural potential. There are ongoing efforts to revitalize the Institute of Cereals Mozambique, an institution with a great deal of storage infrastructure, which is now dysfunctional. There is currently no specific programme to improve conservation of food at the household level. Poor road infrastructure undermines the marketing of cereals from the smallholder farmers and should be improved. The local industry also prefers imported cereals as the quality of local produce are undermined by the poor quality and homogeneity of grains. In an effort to increase local production, the Industry Directorate has recommended the promotion, at the farmer level, and the standardization of the production of cereals and good PHM practices.

Currently, there is no National Steering Committee on PHM that could advocate for the development of PHM specific policies. Establishing solid institutional arrangements could improve the development of PHM policies and strategies. The following stakeholders could form part of Steering Committee: (i) the National Directorate for the Agriculture Extension (DNEA), which is the main stakeholder for PHM strategies implementation. The DNEA is structured with Provincial and District branches. (ii) Academia and the Agriculture Research Institute could contribute towards research. (iii) the Ministry of Science and Technology could play a role in technology transfer. (iv) the IPEME could contribute towards the creation of small enterprises that could offer PHM related services. (v) UNAC could facilitate the strengthening of the linkages between smallholder famers and PHM services providers. Civil society stakeholders have for a long time been the traditional implementing partners of agricultural strategies.

3.6.2 The impact of on-going PHM activities to the farmers.

Two farmer organizations (FOs) were involved in this study, namely the Josina Machel Farmers Association in the Inhambane Province and the National Farmers Union (UNAC). The Josina Machel Farmers Association is dedicated to the production, processing and marketing of food products, including, cassava, rale (garri), fruit and coconut. Its biggest selling product is processed cassava, rale similar to garri. Extension service providers usually collaborate with the Association to promote new crop production technologies, distribute new crop varieties, and promote the utilization of fertilizers and pesticides. The Association does not advocate for improved storage conditions, such as silos. Their food products are mainly stored in bags. Some farmers keep their produce in silos made from local materials. The Association representative also stated that they could store maize and peanuts grain for more than three months but cowpea only lasts for three months after harvesting. Members of the Association store their seed in glass bottles after treating it with ashes or chillies. The Association is willing to participate in PHM programmes.
The UNAC is an organization that brings together farmers' associations, mainly small farmers. It was founded in 1987 and legally recognized by the Government in 1994. Currently, the Organization has about 86,000 affiliated members nationwide and majority of them are women. UNAC has participated in the formulation of policies and strategies for the agriculture sector. For example, UNAC was actively involved in the drafting of the PEDSA. The UNAC has identified poor storage conditions of harvested products at farmers’ level as a major weakness in PHM. Poor storage conditions force small farmer to sell their products at low prices, thus obtaining low gains. Among cereals, maize is the crop that farmers produce mainly for their own consumption because it is not profitable for them to sell maize. The poor quality of traditional barns means that the quality of maize and cowpea reduces after three months from the date of harvest, creating the chronic problem of food insecurity.

3.7 National PHM Research

There is a general lack of skilled PHM service providers in SSA and the SADC region. South Africa is an exception. PHM is developed, the infrastructure and food industry is well-developed, and commercial farmers are well organized in South Africa. In the rest of SSA and the SADC region, many of the agricultural extension services are oriented towards the technologies that improve crop production. Post-harvest aspects are under-represented in most of the agricultural research and development strategies. Most of the agricultural research and education investment are directed at pre-harvest agricultural development (crop science, crop protection, agri-economy). The development of PHM in the SADC region is negatively affected by a lack of investment in infrastructure, such as roads, transportation and local oriented food industries.

The Study could not find evidence of research initiative on PHM in Mozambique. Most PHM research is linked to post-graduate studies at Eduardo Mondlane University. The Mozambique Agriculture Research Institute (IIAM) falls under the Ministry of Agriculture. IIAM is the largest agricultural research institution in Mozambique. There are agricultural policies and strategies recognizing the importance of agricultural research. The IIAM faces many constraints, such as a shortage of qualified researchers, a lack of funds, and inadequate research infrastructure. Notwithstanding these limitations, the IIAM has seen a significant development of capacity since the end of the civil war in 1992.

The main previous research activities in Mozambique were directed to increase production and productivity of maize and cassava, two major food crops in Mozambique. Research priorities have been expanded to include other crops such as rice, sweet potato and vegetables. Research still largely focusses on increasing production and productivity, which is only one element of the crop production value chain. There are limited national research programmes that specifically target PHM. Some existing post-harvest activities run parallel with the prioritized crop research programmes, such as maize and cassava. Studies have been conducted to assess the impact of the use of certain pesticides in maize grain storage and for cassava processing. The IIAM intends to promote research in this cross-sectorial area, because a good harvest must be followed by good post-harvest practices, such as drying and storage. The Agrarian Centre for Research and Technology Transfer of Umbeluzi (CITTAU) is an institution created by the Ministry of Science and Technology and the Ministry of Agriculture. It is funded by the Chinese Government and it is promoting the technology transfer of crop production and productivity improvement. The centre provides training to
agricultural advisors and to farmers associations or unions. However, CITTAU does not have any programme that specifically relate to PHM. CITTAU is willing to act as a training centre for PHM practices. The Faculty of Engineering at the Eduardo Mondlane University is currently running the first year of a Master’s Degree in Food Technology. The programme is interested in involving students in their project work in rural areas. The Faculty could become a key stakeholder to any PHM programme. The Mechanical Engineering Department is also willing to participate in the design of improved small metal silos.

The PEDSA recognised the need to improve the coordination between the different providers of extension and research services. And it recommends the investment in research and extension coordination activities. In the PEDSA, research strategies related to the PHM are prioritised. However, clear strategies to strengthen the links between Agricultural Public Services/NGOs and Science and Technology Sector/Universities are missing. For example, the establishment of Science and Technology Centre/parks by Ministry of Science and Technology (MCT) is an isolated action which is not linked to the establishment of Agricultural Service Centres by CEPAGRI and Farmers Unions. For the PHM programme to be successful there is need for a well-functioning agricultural innovation and research institutional coordination system.

It is recommended that Mozambique develops a stand-alone policy and strategy to anchor all PHM activities. This will improve coordination of activities by research institutions and NGO’s and avoid a duplication of efforts.

4. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations were drawn from the study.

4.1 PHLM Policy and Implementation Challenges

a) In Mozambique, and the majority of SSA countries, PHL are high, at around 26 to 36% of the total production and the large amounts of PHL occur at the household level.

b) Most of the policy instruments governing agriculture in SSA, as well as in Mozambique, make reference to the importance of reducing PHL, as one of the strategies for poverty alleviation, improved food and nutrition security and increased export of food products.

c) The current Mozambique Strategic Plan for the Development of Agriculture Sector (PEDSA 2011-2020), as well its financial plan, make reference to the need to improve post-harvest handling, especially with regard to storage, preservation and processing of food agricultural products, as well as the improvement of access to market information. It mentions the need to promote small improved silos but proper action planning and funding to improve the storage of food at the household level are neglected.

d) The development of PHM in Mozambique, as well as in many SSA countries, faces many constraints, including:

i) Lack of specific policy or strategy for the development of PHM;

ii) Absence of institutional arrangements and frameworks for PHM;

iii) Few training institutions for PHM service providers;

iv) Lack of access to financing by small-scale farmers and traders; and

v) Poor accessibility of construction materials, poor roads, and weak marketing channels.
4.2 Key Recommendations

a) Create a National Post-Harvest Steering Committee to be led by the DNEA and with active participation by farmers.
b) The PHM key institutions and champions should undertake advocacy efforts to influence policy makers to improve actions related to PHM in the CAADP and PEDSA.
c) The researchers, the Agriculture Advisory Services, Farmers organizations and universities should collaborate to strongly address policies and strategies related to PHM.
d) The statistics of the actual PHL in Mozambique are not clear. It is therefore recommended that PHL data collection centres be established with the mandate of collecting data suitable for the Mozambican conditions.
e) Research and technology transfer related to PHM needs to be improved at Universities and Research Institutions.
f) Low cost PHM technologies that add value to agriculture products at farmer level should be promoted.
g) Promotion of PHM technologies that are accessible to women and men, as well as attractive to the youth, but always aligned to local customs.

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