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POST HARVEST LOSSES AND FOOD SECURITY IN NIGERIA: AN EMPIRICAL REVIEW

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ABSTRACT: Given the renewed impetus by the Nigerian Government to diversify the economy through improvement in agricultural productivity, there is the need to put in place measures that will ensure that the anticipated increase in production will not result in colossal waste. Towards this end, this paper examines critically the causes and extent of post-harvest loss in Nigeria and strategies that should be put in place to reduce such loss. The underlying assumption is that reduction in post-harvest loss will ensure improved food security which will lead to the attainment of SDG 2 in Nigeria.

KEYWORDS: Post harvest, Food losses, Food security, Agricultural productivity.

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INTRODUCTION

For Nigeria to attain the Sustainable Development Goal 2, adequate attention must be paid to reducing post-harvest food loss among other strategies. This can be considered as one of the short run strategies given the current level of productivity and production technologies in the country. Each year, a significant proportion of food produced for human consumption across the world is lost or wasted. Annual world food losses have been estimated at about 1.3 billion tonnes by the FAO (2011); and in sub-Saharan Africa, annual food losses exceed 30 percent of total crop production representing more than USD$4 billion in value every year. In the light of rising food prices, growing pressure on natural resources and severe famine in parts of eastern and western Africa and particularly in Nigeria in recent years due to the activities of terrorists (Boko Harram) in the northeast, avoidable loss and waste of food can no longer be tolerated. Ahmed (2013) reported that post-harvest losses are making Nigeria farmers poorer and that for a very long time, Nigerian farmers have lamented without getting meaningful assistance. In developing countries such as Nigeria, 90 percent of wastage occurs from food loss within the value chain. This directly impacts production through foregone income and poor consumption through reduction in food availability, increased prices, and decreased nutritional content (Rockefeller Foundation, 2015). According to the Rockefeller Foundation, food crops account for the primary source of food loss in developing countries. Together, food crops (e.g., grains, fruits, vegetables, tubers, pulses) and dairy comprise 92 per cent of developing world losses, with the remaining 8 percent occurring in meat (4%) and fish (4%). Meat and fish are a small part of overall food loss and are comparable to other crops as a percentage of production in their category.

Although support for agricultural improvements by the current administration in Nigeria and some parts of Africa can be described as robust, nevertheless, only 5 percent of investments in agricultural research over the past 30 years have been directed toward preventing postharvest losses (Kader & Roller, 2004; Kader, 2005). This neglect is due largely to lack of awareness among many actors in the food chain. Both buyers and farmers view loss as a cost of doing business but are not aware of the full extent of the losses. Now, many in the food security world are waking up to the fact that not only are significant losses occurring, but these losses compromise both the profitability and the long-term sustainability of value chains.

Aside, the world's natural resources, such as soil, water, fossil energy and nutrients, are limited, and must be used in a more efficient and responsible manner. Food losses and waste in low-income countries have been attributed to financial management and technical limitations in harvesting, storage, and processing techniques and economically, food losses have a direct and negative impact on the income of both farmers and consumers. Food security is a major concern in a large part of the developing world. Food production must clearly increase significantly to meet the future demand of an increasing world population. In Nigeria several efforts are being devoted to increasing productivity as a way of achieving increased output and food security, however, the solution requires more than an expansion of agricultural production. Improving farm management practices to reduce post-harvest loss will not only increase the available food for consumption annually by millions of tonnes, but will achieve this without incurring the additional labour, land, materials, resources, and biofuel expansion required with increased production.

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In Nigeria, part of the strategies to reduce post-harvest food loss by the federal government is by assisting farmers in mopping up excess farm produce and storing them at strategic reserves, which are sold to people at reduced prices during periods of food scarcity. Given the current post-harvest loss rates of up to 60% for perishable crops, Nigeria needs to rapidly introduce new storage solutions across its agricultural system. At the national level, the Nigerian Government has recently invested ₦66 billion to establish 33 silo complexes, 25 grain aggregation centres, and 9 units of Blumberg warehouses, which have now been privatized by way of concession. The project, which is at varying degrees of completion or deliverables, aims to keep 5% of national output in storage. In addition, if successful, the project will help sustain national food security in terms of food price stabilization, market, and macroeconomic stability. It also aims at delivering food in periods of national disaster as well as food aid to regional markets

Farmers and stakeholders have, however, argued that provision of storage facilities alone may not be enough to completely tackle the problems of post-harvest losses in Nigeria. Against this backdrop, this paper considers critical assessment of the causes and extent of post-harvest loss in Nigeria as well as efforts being made to reduce losses. It also attempts to draw lessons of experience from other countries through extensive review of literature on options for minimizing post-harvest loss.

CONCEPTUAL AND METHODOLOGICAL APPROACHES TO ESTIMATION

Concept of Post-Harvest Food Loss and Intersection with Food Security

If harvesting covers the period when the various products grown are removed from the field, after maturity, the post-harvest period, therefore, runs from exit from the field to the time of culinary preparation. For various reasons, but especially to allow the straw and grain to dry fully, harvesting may be delayed sometimes for months, as it happens particularly with maize and rice and in these cases, some people prefer to speak of "post-production" to indicate the link between harvesting and post-harvest operations. Food loss refers to total modification or decrease of food quantity or quality which makes it unfit for human consumption.

Conceptually, FAO (2011) used the term food loss to encompass both food loss and food waste and noted that loss or wastage occurs along the entire food value chain but varies in extent depending on the product and region. The point at which food loss occurs is also different for different parts of the world. For example, in developed countries, food loss arises at the consumer stage and concerns food which is processed and ready to eat whereas in developing countries, food losses occur at the post-harvest stages, during marketing and processing (Godfray et al., 2010). According to Rockefeller Foundation (2015), “food waste or loss is measured only for products that are directed at human consumption, and it excludes feed and parts of products that are not edible”. Thus, food losses or waste are the masses of food lost or wasted in the part of food chains leading to loss of edible products meant for human consumption. Therefore, food that was originally meant for human consumption, but which gets out of the human food chain is considered as food loss or waste even if it is then directed to a non-food use (feed, bio energy) and so on. This approach distinguishes “planned” non-food uses to “unplanned” non-food uses, which are hereby accounted under losses.

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In an annual assessment of global hunger in 2013, the Food and Agriculture Organisation (FAO) of the United Nations reported that "the world produces enough food to feed everyone", yet at the same time an estimated one in eight people, or some 870 million people suffer from chronic undernourishment. At the centre of this gap between production and consumption are food loss and waste, which occur throughout the globe's countless food supply chains. Food loss poses tremendous problems for national food systems. At a minimum it represents the wastage of resources, including the land, water, labour and power used to generate food. It also reveals deficiencies within a country's food supply chain (FSC), which create areas that may be restricting access to food. Reduced access to food is one of the negative factors for food security. When food supply chains break down and food supplies become less physically or economically accessible, it is often the most vulnerable who are affected. Supply-chain wastage is a pernicious problem, and whether from insufficient storage for maize or lack of efficient transfer from field to market, food loss indicates structural problems in the agricultural infrastructure necessary for food security. The many consequences of food loss whether to food security, the economy or the environment and its causes vary significantly among countries, stages of the food supply chain and types of food products that are lost.

Methodological Approaches for Estimating Post Harvest Loss

Literature on post-harvest food loss has emphasized the need to first approximate the magnitude of the value of losses before time is spent on trying to reduce them. If this value proves to be low, expenditure of appreciable resources on reducing losses may not be justified (Greely & Harman, 1976). However, despite efforts over the years to develop acceptable techniques for measuring losses particularly for grains, this remains an imperfect science. A particular problem with measurement is that grain does not follow a uniform sequence from production to consumption. Harvested grain can be specially dried and treated for a family's consumption or for use as seed. Some of the harvest may be held for short-term storage, some more for long-term storage, and the rest may be sold either in one go or over a period, through a variety of different marketing channels (Kenton & Lindblad, 1976). This situation equally holds for other crops such as legumes and root and tubers. There are difficulties associated with accurately measuring on-farm storage losses over a long period when farmers are continually removing products from stores to meet their own consumption needs. Further, the surplus generated by a farmer at any harvest will dictate the quantity stored and the quantity sold, which, in turn, may influence loss levels. Given the lack of a consistent chain, care must be taken to avoid generalizing from measurements. Inordinately high- and low-loss situations must be put into perspective rather than giving them overemphasis as has been the case in some instances (Harris et al., 1976).

The origin and justification of loss estimates has thus never been particularly well-established and attempts to measure losses suffer from the fact that it is an extremely complex and costly exercise to do. To get round this problem, the African Postharvest Losses Information System (APHLIS) was established in 2009. APHLIS generates weight loss data using an algorithm that refers to a postharvest loss profile (PLP) that is specific to the cereal crop, climate, and scale of farming (smallholder or large scale) in question. The PLP is a set of loss figures, one for each link in the postharvest chain. Each PLP figure is the average of all those data available in the scientific literature for a particular crop (which include both quantitative weight loss figures and 'informed guesstimates'), under a particular climate, and at a particular scale of agriculture. Given data on production and certain other relevant seasonal data, APHLIS can provide weight loss estimates for the provinces of many countries in sub-Saharan Africa. The data are provided

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in tables and as interactive maps. A further important feature of APHLIS is that it provides a version of its loss calculator that can be downloaded from the website as an Excel file. Users can change default values in the spreadsheet and make calculations of losses at any desired geographical scale below the level of 'province'. With this calculator, users can go beyond estimation of losses at one link in the postharvest chain, e.g. just storage losses, which was the typical approach of the 1970s, and instead by substituting what figures they have for the default values in the PLP they can generate an estimate of cumulative losses from production. In other words, they can see the changes in cereal grain supply that result from improving or deteriorating losses across the postharvest value chain. APHLIS thus provides data that are transparent in the way they are calculated, adjustable year by year according to circumstances, and upgradeable as more (reliable) data become available.

POST HARVEST FOOD LOSS IN NIGERIA: AN EMPIRICAL REVIEW

Causes of Post-Harvest Food Loss

Literature is replete on several causes of post-harvest losses and some of which are identified by Food and Agricultural Organization (FAO) (1994) to include late harvest which can lead to attack by birds and other pests, inadequate drying of grain which can lead to development of mould and insects, traditional threshing methods which can lead to broken grains and cause development of insects, poor storage conditions which can lead to development of moulds and attacks from insects, rodents and other pests, poor transport conditions or defective packaging which can cause damages and lead to quantitative and qualitative losses and other factors like poor marketing prices, inappropriate or inadequate sectoral policies and other socio-economic aspects. Causes of post-harvest losses have also been traced to long distance to market, storage period, marketing experience, poor handling, vehicle breakdown and perishable nature of some agricultural produce (Adewumi et al., 2009).

The World Bank (2011) and Osunde (2008) categorized these causes of post-harvest food loss into technical and governance related causes. Technical causes include harvesting methods; handling procedures; drying techniques and moisture levels; types of storage or lack thereof; contamination; attacks by rats, birds, and other pests; insect damage; and invasion by food-borne pathogens. Governance-related causes include poor sales, procurement, storage, marketing and distribution policies or practices; absence of mechanisms for dealing with cash flow needs, such as warehouse receipts systems (WRS); mismanagement or poor management in handling grain stocks and associated financing; or difficulty in dealing with the ownership, control, and payment aspects of grain storage and price stabilization programs. In summary, food losses contribute to high food prices by creating food shortages in food supply to the market, thereby constituting economic loss or wastage. In a study by Kader (2005) and Bolarin and Bosa (2015), two major factors were identified accounting for post-harvest loss, and they are: biological and socio-economic factors. Biological causes of deterioration include respiration rate, ethylene production and action, rates of compositional changing (associated with colour, texture, flavor, and nutritive value) mechanical injuries, water stress, sprouting and rooting, physiological disorders, and pathological breakdown. The rate of biological deterioration depends on several environmental (external) factors such as temperature relative humidity, air velocity and atmospheric composition (concentration of oxygen, carbon dioxide and ethylene) and sanitation procedures and many technologies have been developed to reduce

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these types of losses (Kader, 2005). The socio-economic factors in the case of Nigeria as observed by Bolarin and Bosa (2015) include inadequate marketing system, inadequate transportation facilities, unavailability of needed tools and equipment, information asymmetry, poor maintenance of storage and handling facilities and inconsistent government policies. The Post- Harvest Education Foundation had also identified some other key factors accounting for food losses and the gap in knowledge to include:

- Poor understanding of harvest indices of plant foods and how maturity is related to quality and shelf life.
- Poor sorting and grading practices during preparation for market, allowing damaged/decaying foods to enter the supply chain and spread decay to other foods.
- Poor temperature management and lack of control of relative humidity, leading to shriveling, wilting and deterioration of perishable foods.
- Poor quality packages which provide little or no protection during handling, transport, and storage.
- Delays in marketing without proper storage (cool storage for perishables, drying of staple grains/beans/legumes before storage).
- General lack of education on appropriate post-harvest handling practices and technologies, leading to rough handling, mechanical damage, improperly handled mixed loads, and food safety dangers.
- Lack of the utilization of sustainable cost-effective post-harvest practice, leading to high levels of food losses on the farm, and in retail markets.

Extent of Post-Harvest Food Loss in Nigeria

The study on post-harvest losses of rice in Nigeria and their ecological footprint by FAO (2016) presents an analysis of food losses in the harvesting, processing, and marketing stages in Nigeria, and identifies their ecological footprint. According to the study, the main hotspots for post-harvest losses are harvesting and parboiling followed by losses occurring during milling. The results show an estimated post-harvest loss of 24.9 percent, resulting in a substantial loss of revenue to farmers. Considering the entire global warming potential along the complete rice value chain, a large environmental footprint can be seen: the losses in the rice value chain account for the emissions of around 0.65 million tons of CO_2 equivalent into the atmosphere. The industrial value chain shows 20 percent lower global warming potential than the traditional value chain, due to lower losses along the value chain. A reduction of food losses will therefore not only benefit farmers' income and improve food security, it will also lead to strong environmental benefits on various national levels and various impact areas. Also, investing in getting more of the final product in better quality to the consumer is vital to ensure a higher food and nutrition security. Earlier in a study by Mada et al. (2014), average grain losses and waste in Nigeria was found to range between 15 and 20 percent. In the case of Nigeria, the estimate of post-harvest food loss could be as high as between 20 and 40 percent of the total food production. Ajibola (2000) also estimated that the food wasted or lost in the 1990s could provide basic nutritional requirements for almost 200 million people. The extent of post-harvest food loss in Nigeria was highly demonstrated by the result of a survey on a study conducted on

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post-harvest food loss by NISER in 2014. The study was carried out in all the six geo-political zones and the Federal Capital Territory following a value chain approach and the highlights of the findings is presented here.

The proportion and quantity of losses for farmers, processors and marketers as indicated in Table 1 showed that average loss at farm level was about 25 percent and the highest was recorded for cowpea (30.7%) and lowest for rice (21.6%). At the level of processing, rice processors had the highest share of loss (8.0%). The same trend was observed for rice marketers where the share of losses was estimated to be 7.3 percent. The proportions of losses reported arose from various causes as well as from other contributory factors. In terms of quantity, cassava farmers and rice farmers recorded the highest magnitude of losses (2,388kg and 1,774kg respectively).

Table 1: Quantity and Proportion Post-Harvest Losses by Crops

	Average Quantity Harvested/Purchased (kg)			Average Quantity of Loss(Kg)			Average Loss (%)		
Crop	Farmers	Processors	Marketers	Farmers	Processors	Marketers	Farmers	Processors	Marketers
Yam	3,826.6	3,320.6	13,218.4	1,175	694	1,150	24.8	0.2	6.4
Cassava	9,632.7	187,056	579,200	2,388	50,131	49,232	22.6	1.8	5.1
Maize	3,255.4	30,659.9	99.988.6	745	6,040	8,799	23.1	3.7	5.7
Rice	7,851.9	109,016.9	62,544.8	1,774	25,837	8,381	21.6	8.0	7.3
Cowpea	840.4	2,070.1	65,397.1	182	797	4,447	30.7	1.5	4.2
All Crops Average	5,081.4	66424.7	164,069.8	1,245	2,019	9,680	24.5	3.1	5.7

Source: NISER Post Harvest Food Loss Survey, 2013/2014

At processing level, rice recorded the highest proportion of losses with an average loss of 8.0 percent followed by maize with 3.7 percent. The average loss for all crops at processing level is 3.1 percent. A major issue is the fact that processing equipment currently in use in some cases are inadequate and processing technologies employed are sometimes inefficient, a fact further corroborated by the respondent from the processing and infrastructure division of the Federal Department of Agriculture (FDA). In addition to this is the fact that there are delays at processing points as most processing outlets are situated off-farm. At marketing level, the average loss for all crops is 5.7 percent. Rice and yam recorded loss above all crop average with 7.3 and 6.4 percent respectively. Some activities at farm and marketing level are found to be critical factors accounting for the degree of loss experienced by the various crops. Table 2 and 3 presented some of these activities and their contribution to the post-harvest loss for the various crops. Activities considered at farm level include harvesting, on-farm storage, transportation, drying, threshing, and winnowing.

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Table 2: Proportion of Food Crop Losses Due to Farm Level Activities

Farm Activities	Proportion of Loss					
	Yam	Cassava	Maize	Rice	Cowpea	All crops average
Harvesting	11.4	7.9	5.7	6.9	5.9	7.6
On-Farm Storage	7.4	7.1	6.9	3.4	7.2	6.4
Transportation	6.0	3.5	1.8	1.6	2.7	3.1
Drying	-	4.1	3.1	3.1	4.5	3.0
Threshing	-	-	3.3	3.8	4.2	2.3
Winnowing	-	-	2.3	2.8	6.2	2.3
Total	24.8	22.6	23.1	21.6	30.7	24.5

Source: NISER Post Harvest Food Loss Survey, 2013/2014

Yam, cassava, and rice suffered the highest proportion of loss during harvesting; while yam, cassava and cowpea incurred more loss at the point of on-farm storage. Losses at the point of harvesting can be explained using traditional harvesting methods. This study revealed that about 95 percent of farmers used traditional hand tools such as hoes, knives, cutlasses, sickles, hand forks, and small diggers. Only about 4.5 percent of farmers used mechanized or combined methods of harvest. Most farmers (55%) equally utilized open fields as their on-farm storage facility underscoring the susceptibility of crops to further losses during on-farm storage. Farm level transportation also represented a crucial node where losses were recorded especially for yam farmers. Transport as an activity accounted for about 6 percent of losses incurred by yam farmers. Other technical activities sequel to harvesting- drying, threshing, and winnowing together accounted for a total of 8.7, 9.7 and 14.9 percent in maize, rice, and cowpea respectively.

Activities at the marketing stage that usually accounted for loss include farm to market transportation, packaging, and re-packaging as well as storage and warehousing. Rice still suffered the highest degree of loss due to transportation at this point followed by maize with 3.0 and 2.0 percent respectively. Packaging and repackaging activities led to the highest degree of loss of 1.2 percent in cowpea while yam sustained the highest proportion of loss of about 3.0 per cent in storage. The breakdown of losses arising from the various marketing activities is as shown in Table 3

Table 3: Proportion of Food Crop Losses Due to Marketing Activities

Activities	Average Loss (%)					
	Yam	Cassava	Maize	Rice	Cowpea	Average for All Crops
Transportation	1.7	1.4	2.0	3.0	1.2	2.0
Packaging/Re-packaging	1.4	1.5	1.5	1.4	1.6	1.5
Storage/warehousing	3.3	2.2	2.2	2.9	1.4	2.4
Total	6.4	5.1	5.7	7.3	4.2	5.7

Source: NISER Post Harvest Food Loss Survey, 2013/14

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Attempts at Reducing Post Harvest Loss and Country Level Efforts

There have been numerous attempts by donors, governments, and technical assistance agencies over the years to reduce post-harvest losses in developing countries. Despite these efforts, losses are generally considered to remain high although, as noted earlier, there are significant measurement difficulties. One problem is that while engineers have been successful in developing innovations in drying and storage, these innovations are often not adopted by small farmers. This may be because farmers are not convinced of the benefits of using the technology. The costs may outweigh the perceived benefits and even if the benefits are significant the investment required from farmers may present them with a risk they are not prepared to take. Alternatively, the marketing chains may not reward farmers for introducing improvements. While good on-farm drying will lead to higher milling yields or reduced mycotoxin levels, this means nothing to farmers unless they receive a premium for selling dry grains to traders and mills. This is often not the case.

Thus, part of the problem with uptake may have been an overemphasize on technology, to the exclusion of socio-economic considerations. In the case of drying, it may be a more appropriate solution to strengthen the capacity of mills and traders to dry than attempt village-level improvements (Shepherd, 1993). There is thus a continual need to balance and blend technically ideal procedures and approaches with social, cultural, and political realities (Reining, 1976; Shepherd, 2012). Past on-farm storage interventions that have proved less than successful have included the promotion of costly driers in West Africa that fell victim to termite when made with local wood or bamboo and were too expensive when constructed with sawn wood. In the 1980s, there was considerable enthusiasm for the introduction of ferro-cement and brick bins throughout Africa, but these were often found to be too complicated for farmers to construct, and too costly. Small breeze block silos also experienced construction difficulties and were found not to be economically feasible. Storage cribs made of wood and chicken-wire were introduced by donors but rejected by farmers because sides made of chicken wire showed others the size of each farmer's harvest.

Nevertheless, more positive achievements have been recorded in the Central African Republic, using a simple one-tonne capacity structure that was found by farmers to be easy to construct and proved popular even without donor subsidies. Considerable success has been reportedly achieved with metal bins over the last 20 years in Central America (Shepherd, 1993; FAO, 2008) and metal bins have been widely used for grain storage in Swaziland for half a century, drawing on the availability of local entrepreneurs who had been supplying metal water tanks. Replication of this success in other parts of Africa is very much in the pilot stage. Difficulties include the lack of local craftsmen to fabricate the bins; the need for grain stored in such bins to be dried to 14 °C, and problems with carrying out the necessary fumigation. Small-scale bins for use inside the home appear to be having more success than larger bins for outside use. A relatively new development is hermetically sealed bags, which appear to offer good possibilities to store a variety of quantities, although further socio-economic evaluation is still required. The Purdue Improved Cowpea Storage (PICS) bags are hermetically sealed bags that allow small-scale farmers/users to store cowpea without any use of chemicals (Purdue website). Similarly, the International Rice Research Institute (IRRI) and US-based GrainPro Inc. have collaborated to develop hermetic storage bags referred to as IRRI bags but widely known today as GrainPro Super Grain bag that offers the lowest water vapor transmission rate and oxygen transmission rate of any hermetic bags available in the market (GrainPro website)

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At the country level, there are a variety of programmes that indirectly addressed post-harvest loss management and these include the introduction of Cooperatives from 1935 to date; Commodity Boards from 1974 to 1986; PHL related Agricultural Research Institutes from 1964 to date; National Accelerated Food Production Project (NAFPP) in the 1970s; Agricultural Development Projects (ADPs) from 1975 to date; River Basin Development Authorities (RBDAs) from 1977 to date; Operation Feed the Nation (OFN) from 1976 to 1979; Green Revolution from 1979 to 1983; Directorate for Food Roads and Rural Infrastructure (DFRRI) from 1986 to 1993; Presidential Initiatives from 1999 to 2007. Agricultural transformation Agenda (ATA) of 2011-2014 and the Growth Enhancement Scheme (GES) of 2014 to date. Also noted are such research institutes that their mandates are related to PHL such as the Nigerian Stored Products Research Institute (NSPRI); National Center for Agricultural Mechanisation (NCAM) and National Root Crops Research Institute (NRCRI). In the last decade, there is the Fadama project, which attained the third phase as at 2013 and has since been extended till date.

The ATA adopted the value chain with emphasis on developing staple crop processing zones (SCPZ) which will attract private sector agribusiness to set up processing plants in zones of high food production to process commodities into food products. However, little is known about the characteristics, structural dimensions of food crop losses, extent of the losses, characteristics, and roles of various agents along the value chain as well as the effectiveness of post-harvest technologies in the country. These constitute the major gaps of the programme of which the current agricultural promotion policy planned to solve.

EMERGING ISSUES AND OPTIONS FOR REDUCING POST HARVEST LOSSES

Challenges in Reducing Post Harvest Loss

In developing countries like Nigeria, the root causes of food loss are interlinked and complex, but the primary drivers include lack of extension services to build skills in handling, packaging, and storage; insufficient postharvest storage facilities or on-farm storage technologies; and poor market access. Research and interventions in developing countries have largely focused on technology-based approaches that look for solutions to specific food loss problems at single points in the value chain—for example, on-farm storage in hermetically sealed bags, fruit and vegetable refrigeration through solar powered coolers, and mobile drying systems for grain. More recently, however, donors have taken a wider market-based approach to improving the efficiency of the value chain, rather than focusing on single points. However, there are emerging issues and challenges which serve as major barriers to reducing food loss and these include:

• Limited knowledge of the issue and of prevention and reduction techniques

• Broken distribution channels for loss-reducing technology

• Limited technical know-how of smallholder farmers

• Limited access to credit and financing

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• Difficulties in efficiently and cost-effectively linking adequate smallholder supply to buyer demand

Options for Reducing Post Harvest Loss and Meeting SDGs in Nigeria

Capacity development is required in achieving lasting and sustainable change in post-harvest food loss in Nigeria. The extent of post-harvest loss as demonstrated in this paper indicated that there is evidence that one-third of the current food production in the country does not reach the intended final consumer. As such, providing a long-lasting solution to the challenge of post-harvest loss requires stemming up technologies and understanding the complexity of food production systems (Agro-Nigeria, 2016). In addition to the provided technology, the farmers need education, training, and support. There is the need for improvements in technology, but that should not be a stumbling block to initiate actions that will benefit small holder farmers and the society, as appropriate technologies exist that farmers can adopt and when they do this, there will be drastic reduction in post-harvest loss. Therefore, an indispensable component of reducing food losses involves farmer education on ways of improving post-harvest management. As recommended and implemented by WFP between 2012-2014 in Uganda and Burkina Faso, such capacity development training and skill acquisition should concentrate on increasing farmer awareness of key biological and environmental factors during four major procedural stages of harvesting, drying and solarization, threshing and on-farm storage. Efforts at facilitating on-lending programmes by government and other financing agencies to promote aggregation and appropriate packaging and storage as well as linkage with buyers will no doubt mitigate some of the challenges.

CONCLUSION

Post-harvest food loss can be reduced to the barest minimum in Nigeria but pragmatic policy and highly dedicated and determined leadership is required. It is, however, important to ensure that post-harvest loss is reduced to achieve the food security goal of the future. Everyone, whether in the public or private sector, or in civil society, needs to appreciate the key role that can be played in fostering and maintaining the vibrant support system that will facilitate decision making and adoption of post-harvest loss reducing technology in Nigeria.

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