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1. Acknowledgments

This report presents the progression and outcomes of the AfricitiesFood project in Lusaka, Zambia. The processes and outcomes contained in this report are because of combined efforts involving researchers, stakeholders such as farmers, marketers, transporters, municipal governments, civil society organizations, private sector actors, and government ministries over a period of two years. The success of the AfricitiesFood project in Lusaka is a product of several stakeholders and partners as outlined below in this section. These stakeholders made the outcomes and success of this project possible through a series of activities including one-one-one meetings, group meetings, Focus Group Discussions (FGD), follow-up meetings to check on trials and several other innovative stakeholder and partner engagement activities throughout the research.

The Farmers that willingly took part in the survey provided insights on their daily experiences with food losses at the farm during harvest, post-harvest, transportation and lastly at market stages. Equally, food marketers, transporters and other stakeholders were able to provide insights into their daily experiences thus providing a rich data, information and engagement platforms that were used to ensure sustained engagements with several actors in the food chains in the study areas. The contributions from these actors provided opportunities for generating important data, information and insights into processes undertaken, challenges faced and possible interventions to reduce food loss in Lusaka city region.

Additionally, the support of the government institutions and officials such as the Mayor of Lusaka city, Local Authorities in Chongwe, Kafue, Chibombo, Chisamba, Chilanga and District Agricultural officials from the Ministry of Agriculture made it possible to interact freely with various groups of farmers who opened up and together co-produced possible interventions. Their invaluable and collective support was cardinal in making the project objectives acceptable to the stakeholders as it was acknowledged that the issue of food loss in urban agrifood chains in Lusaka is complex, challenging and of absolute importance and that solution to it needed a multi-stakeholder approach.

The input of and on-going engagement with civil society organizations such as Hivos International in Lusaka, Programme Against Malnutrition (PAM), Food, Agriculture and Natural Resources Policy Analysis Network (FARNPARN), Indaba Agricultural Policy Research Institute (IAPRI) among others provided critical reflections, capacity development trainings and insights throughout the process, thereby influencing the processes, procedures and finally outcomes of the research.

Our deepest appreciation also goes to the ACIAR team in Kenya and Australia that constantly provided support and insights on project activities and outreach efforts. In particular, our thanks go to Dr Howard Hall, Leah Ndungu, Kennedy Osano and Emmie Wachira for their open engagements, well-grounded insights and strong support to the AfricitiesFood project team in Zambia.

2. Executive summary

This report presents the research processes, activities, outcomes and impact of the AfricitiesFood project in Lusaka, Zambia. The report presents activities, outcomes and analysis of the gathered materials based on combined efforts of researchers, stakeholders, and several partners. Key contributors include among others: smallholder farmers, food marketers and distributors, transporters, local government officials, central governments officials, and civil society organizations over a period of two years from August 2021 and August 2023. The AfricitiesFood project report focuses on the extent, drivers and solutions to rampant and high food loss in urban food chains in the study area.. Fresh food losses are a global concern with far-reaching economic, social, and environmental implications. This project aims to comprehensively analyze the drivers of fresh food losses, and trial effective strategies for mitigation and prevention of the losses. It was implemented using transdisciplinary methods and has undertaken several initiatives to co-produce several research processes, co-create lessons and potential solutions to urban-agri-food loss challenges in Lusaka city region in Zambia.

The findings clearly indicate that there are significant fresh food and nutrition losses occurring at all the critical between harvest and marketing stages: r - harvest, post-harvest, transportation, and informal food markets- of the urban agrifood chains in Lusaka city region. The findings indicate that food loss in the urban agrifood chains in Lusaka is very high and a major contributor to low profitability for smallholder farmers, high loss of quality in the food supplied to the consumers in the cities and low nutrition value of the food available on the market. Thereby, food loss directly affects all actors in urban food chains in Lusaka. Green leafy vegetables record the highest losses at 35% of the food produced while Tomatoes stand at 30% of the total production. Meat and Milk experienced losses of 22% and 7% respectively. The study indicates that the highest proportion of the losses are incurred at harvest stage.

The major drivers of the food losses in the studied food categories uncovered by the study are varied, but key among them include inter alia,

1. Inappropriate food harvesting methods
2. Suboptimal harvesting and handling practices by workers
3. High incidences of theft and low levels of security
4. Lack of (food) shelter for harvested fresh produce
5. High levels of manipulation and gender inequality across the agrifood chains,
6. Lack of adequate food storage facilities at both farms and markets,
7. Lack of packaging and food preservation practices at the farm level.
8. Long distances to the market and inappropriate transport equipment
9. Poor road networks between food producing areas and markets.
10. Climate uncertainty and lack of access to climate information to support preparedness.

The study further established that most farmers in the city region of Lusaka take and sell their fresh food to Soweto market in Lusaka's Central Business District with a smaller portion selling right at the farm and others to smaller markets within the region. However, since the food comes from the outer parts of Lusaka district and beyond as demonstrated on the farm distribution map in the appendix, it is evident that the distances covered by fresh food

produce from the farm to the main open markets are quite long, with very limited support infrastructure such as refrigeration equipment, shelter and water services at different nodes in the chains. This therefore exposes the produce to heat for long hours. This coupled with the lack of refrigeration, leads to food spoilage and loss of physical appeal and quality. By the time the produce reaches the market, there are further losses that are incurred by the farmer and there is a price reduction due to the loss of food quality or food aesthetics. There is no known service to collate the food and achieve scale that warrants investments in food bulking and shared transportation costs among the sampled farms.

The project has established that to reduce the losses, several interventions need to take place at different stages in the agri-food chain in the Lusaka city region.

1. Implement activities targeting capacity building for all food handlers on appropriate food handling methods, available and affordable technologies, and tools. The efforts need to be applied across all levels of management, for workers, farm owners at the farm and across all stages of the food value chain including food agents.
2. Cooperative farms such as Kasisi need to invest in shelter at the farms so that harvested food can be sheltered from the sun, rain, and wind.
3. Lusaka City Council with support from several stakeholders need to review and realign the role of food agents at open air markets and make them accountable to the farmer and consumers while ensuring gender and social inclusion at all nodes in the chains.
4. Diversify the market and decongest Soweto market by building other several food markets in neighborhoods and locations so that farmers can have a choice on where to sell their food and consumers can have a diversified food market.
5. Introduce and increase investment in food bulking to reduce food transportation costs and increase the negotiating power of smallholder farmers. This can take the form of cooperative working in food aggregation sector. The food aggregators need to bridge farmers, food dealers and consumers.
6. Livestock and fish farmers need to increase their capacity on own feed making to lower the cost of production, reduce risk of animal and fish stunted growth.
7. Support and build capacity on adoption of low-cost, low demand and low technologies on food preservation, value addition such as sun drying of vegetables, tomatoes, and packaging using local materials.
8. Build capacity for gender diversity equity and social inclusion at all the nodes in the chain. This can be particularly transformative at open-air markets where women and other vulnerable groups and individuals find it hard to fairly engage in. The trainings should focus on gender equity, social inclusion and agent re-organisation and integration the activities of the market.

3. Background

Zambia is among the “hungriest countries” in Southern Africa. Secondly, the UN Population, UNData argue that Zambia is among the fastest urbanizing countries, with Lusaka projected to become a major urban centre in Southern Africa. The African Food Security Urban Network (AFSUN) established that Zambian cities and towns are among the most food and nutrition insecure in Sub-Saharan Africa.

The current international food security agenda focuses almost exclusively on the food insecurity of rural populations and ways to increase smallholder productivity. The plight of the urban poor is marginalized in this agenda leading to neglect of the ‘invisible crisis’ of urban food insecurity (Crush and Frayne, 2010; Crush et al, 2012; Crush et al, 2011b). Rapid urbanization and increasing urban poverty in the burgeoning slums and peri-urban areas of Sub-Saharan Africa are “shifting the historical focus of food and nutritional insecurity from the rural areas to the cities of Africa” (Crush et al, 2010:271).

With the demographic shift to cities and towns, food value chains now involve many actors that influence how food is produced, processed, distributed, marketed, and consumed and how food loss is dealt with. This situation has resulted in an increased number of actors, raised questions of actor responsibility and inefficiency, resulting in an increased food loss, increased cost of food and reduced nutrition security, especially for the urban poor in Southern African cities and towns.

To understand the complexities of the urban food and nutrition insecurity situations, research and policies need to go beyond analyzing production and productivity issues, but expand the analysis to include food governance, market oriented bottlenecks and climate and gender justice in the urban food chains in Africa. Thus, there is a need to critically interrogate and address the interplay of factors involving market forces and institutions, the power of the actors, in them and between them, and the interests and choices that the various participants in the urban food systems make at particular times and at different nodes in the chains.

The interrogation needs to involve a critical analysis of the informal sector and its role in influencing the performance of urban food systems. In Zambia, the role of the informal sector in food handling at post-harvest level (at farm), transportation and marketing are very dominant (Siame et al., 2020). The role of the informal sector in the food sector in Zambian cities, town and Southern Africa in general is very prominent. Smith (2016:83) states that “rural-urban and intra-urban food distribution networks, including informal taxi drivers, are important in African cities.” This means, actors at harvest, post-harvest, transportation, and open-air markets of fresh food value chains often operate outside of formal food handling regulations and responsibilities and that food agents increase in number exponentially between harvest and consumption stages. Thus, this study has been done to analyze actor and power relationships and how these impact on food loss levels in urban agrifood chains in Lusaka city region.

4. Objectives

The aim of the project is to Identify and characterize the nature and scale of food and nutrition loss in urban agrifood chains in Lusaka City and define its drivers and implications.

Specific objectives of the project are to:

1. To collect data and map chain actors, processes, communications, power dynamics in the chains, social and gender relationships in the chains, and the roles of each of the actors in the chains; develop, for project use and for wider dissemination, a clear and concise report and data sets on food losses and the urban food chain operations in Lusaka city.
2. To analyse chain operations in Lusaka city using the information assembled, information gap identification and determine further data collection; to identify potential ways of reducing food loss, improving food handling, storage and timely logistics, thereby improving food accessibility and nutrition security for the urban poor in Lusaka city.
3. To explore and test contextually relevant food innovations and interventions in food handling, preservation and storage, transportation, information use and exchange and other aspects of chain operations to reduce food loss, improve food quality and safety and enhance product flow through the chains.

5. Methodology

The methodology for executing the AfricitiesFood project was designed as mixed methods, involving both quantitative and qualitative data collection and analysis processes and implementing trialing activities. To accomplish the project objectives, the project first established a network of actors in the food systems sector and along the different stages of the food value chain in the study area. The research activities were done in the Lusaka city region covering areas as follows: Lusaka districts/Lusaka city, several areas in Chisamba district; Kanakantapa, Palabana, Kasisi and several other areas of Chongwe district, several areas in Chilanga district, several areas in Chibombo, Kafue, Siavonga district, Shibuyunji and Rufunsa Districts. These areas constituted what the United Nations Food and Agriculture Organisation (UN-FAO 2019) have defined as the Lusaka City Region Food Systems. The mixed methods approach enabled researchers to develop a qualitative understanding of losses and to calculate estimated quantities of the losses (Diei-Ouadi & Mgawe, 2011). The mixed methods allowed researchers to generate data that describes the types, causes, timing, impacts, and trends of post-harvest losses, as well as assess impact of the losses on actors in the chains (Torell et al., 2020) between harvest and marketing. Loss assessment was based on a participatory approach, focusing on the active involvement of relevant actors who are knowledgeable about PHL at different stages of the value chain between the harvest and the market.

The researchers undertook food analysis by doing load tracking to generate indicative quantitative data on losses to supplement the loss estimations identified by actor self-reports during interviews and focus group discussion. Load tracking is a quantitative loss assessment methodology used to measure specific losses along the value chain or losses related to specific activities, such as post-harvest handling, processing, transportation, and marketing (Diei-Ouadi & Mgawe, 2011). In this project, load analysis relied on both measurable and observable physical and quality losses at each node of the value chain by capturing the data in form of weights and food quality at all nodes in the chain between harvest and marketing.

At harvest nodes, farm-based reports were given about losses based on weighted or counted amounts of food while data capturing after the food left the farm depended on self-reported amounts that farmers or other actors were recording or had sold. Thus, the tracking of food used questionnaires, interviews, and observations at all study nodes in the chain, while observing food quality. Field observations provided insights into the magnitude of losses and the socio-economic and infrastructural context in the study areas. A checklist was used to guide observations on topics including hygiene standards, storage facilities, measures taken to protect foods from rain, sun, and other contaminants and spoilers, handling practices, equipment and methods, general market dynamics and practices, quality of services, food preservation practices, and loss reduction measures and levels of awareness about consumer expectations about food quality. For each of the criteria, observation was used to assess the quality of practices or equipment as good or poor. A questionnaire with over one hundred questions was used to capture quantitative data from 2000 farmers in the Lusaka region while qualitative data was collected using thirty expert interviews, three Focus Group Discussions, three research dissemination workshops, and several field observations. Data dissemination was done to ensure final sign off the data and findings by stakeholders at all nodes in the chain. To visualize the data, we used flow

diagrams to illustrate interconnections between the stages in Post Harvest Losses (PHL). The flow diagrams in appendix 1 present (all the four flow maps) the losses along the chain stages and highlight the food loss hotspots between the farm and the market.

5.1 Rationale for study areas

The project purposively identified the following factors for selecting study area sites:

- i. **Proximity to sources major open-air markets and urban food markets:** The locations are near major urban food markets, produce several fresh foods, have strong food rural-urban food relationship. There is a strong inter-dependency between urban high food consuming areas and the peri-urban and rural food producing areas. This ensured that the study accurately represented the availability and accessibility of fresh food options in the different areas. These areas were purposely selected for this study because they form a major source of fresh produce for Lusaka city.
- ii. **Geospatial representation:** The regional characteristic of urban, suburban and rural were also selected because they incorporate a range of small-scale farmers in these settings. urban and semi-rural settings with different agricultural practices and terrain. This was in order to help identify any disparities in fresh food supply and loss between the different regions and helped provide a more comprehensive understanding of the factors influencing fresh food supply and loss. The geo-spatial analysis focused on major nodes along the rural-urban continuum.
- iii. **Centrality and functionality of food markets in Lusaka city region:** Lusaka has several open air markets located in various areas but the biggest food market is Soweto which is located in Lusaka's Central Business District. It is also Zambia's largest semi-formal and partially council-managed open-air market that serves as both wholesale and retail space for various food products farmed and manufactured from within and outside Lusaka. The Soweto market is a hub of food business in the Lusaka City region. The market receives food from farmers from several food producing areas in the city region. It also supplies several neighborhood-level markets where food is retailed to the consumers. Soweto market acts a converging space for various actors along the food value chain and is a site of intense socio-political and gender relationships dynamics. The market is an appropriate site for in-depth analysis of social relationships and gender equity issues in the food chains.
- iv.
As the data collection processes sought to capture data on food flows from the farm to the open-air markets in the city region, respondents were tracked with their produce from their farms to the open-air markets. These fresh food products studied were Tomatoes, leafy vegetables, meat, and poultry, milk and milk products.
- v. **Stakeholder recommendation:** The selection process of study sites was informed by advice and interest from various project stakeholders and the potential for collaborative intervention to address the food loss challenge. Specifically, Hivos was very keen to have the project compliment on their data and projects in Chongwe, Soweto market, and Lusaka city. Other stakeholder such as farmers, food transporters, traders, food agents, farmer cooperative leadership, local government, ministry of agriculture among several others

recommended that AfricitiesFood project needed to focus on sites that occur along the rural- peri-urban-urban food flow continuum in Lusaka. The approach would enable collection of comprehensive data that can assist stakeholders understand the drivers of food and nutrition loss at different stages in the chain.

The project main objectives and associated activities were executed using the project grant chart which guided the sequencing process of activity implementation and the outputs to be produced. Although this was the case, the project methodology was also flexible allowing for changes where needed or requested by stakeholders. The first activity was inception workshop in which several actors were engaged to agree on major activities, methodologies, and formulation of research instruments. During the inception workshop, stakeholders identified key areas of focus, and this informed the formulation of data collection instruments, identification of possible areas for quick impacts through intervention trials. The comprehensive qualitative and quantitative data collection tools were then shared with stakeholders for further input and validation- Later, the tools were piloted twice before the actual collection of data. This was done in close collaboration with the relevant stakeholders from the identified institutions in the chains. One-on-one engagements with several stakeholders were constantly ongoing both virtually and physically. This continuous engagement of stakeholders from start to the end of the project allowed for strong buy-in and strong sense of project ownership by the target stakeholders, including farmers, agents, farmer associations and international organisations.

5.2 Data Collection Methods

The following data collection methods were used:

This project used a transdisciplinary approach mixed methods approach. Both qualitative and quantitative methods were used to collect and analyse the data. Research instruments were developed with the input of various stakeholder groups. Government departments, NGOs and cooperatives were included in interactions with regards to methodological development and applications.

Major stakeholders

The major stakeholders in the Lusaka project include Local Authority officials such as the mayor and Lusaka City council officials, Kasisi training institute, Hivos International, Soweto admin managers, traders, farmers, transporters, and agents, Palabana milk center and cooperative members, several smallholder farmers, IAPRI, FarmFeed, Harvest Fund and PAM Zambzi, District Agricultural officers from the different districts. There has been strong and sustained collaboration between researchers and the stakeholders, including consumers and individual smallholder farmers. The following methods were used to collect the data:

1. **Surveys:** Quantitative data was conducted using surveys. The surveys were conducted digitally using google forms as the survey tool was placed online. The online survey tool was designed to enable the project team to track the responses in real time and on a daily basis. In addition, the method enabled the capture of individual farm locations which was vital for the formulation of a food production areas and track the flow of the food to the markets. Paper based (hard copy) questionnaires were also printed out for data collection in farming areas that did not have stable internet connectivity. Structured

questions were asked to the respondents. A total of 2000 respondents were reached with the first 1527 collected in the initial survey and the other over 500 sample during the gap filling exercise. Respondents included farmers, food agents, farmer groups, municipal officials, central government officials, national nutrition commission, marketers and key respondents from relevant food institutions and officials in charge of open-air markets such as Soweto market.

2. **Interviews:** Qualitative data was collected using many methods. These include interviews. One on one conversations with stakeholders were conducted to generate ideas and qualitative data needed for generating in depth narratives on food and nutrition loss. The interviews were vital for determining the major food products being produced and consumed in the study area, and how actors engage with each other and with the chains. The respondents were people directly involved at one or more stages of the food value chain and were considered to have a good understanding of their role in the chains. The respondents were people directly involved at one or more stages of the food value chain and were considered to have a good understanding of Lusaka city region food systems and the studied chains.

Overall, the interviews and surveys were embarked on by a team of 15 university graduate research assistants who were recruited, trained and equipped with tools to ensure smooth data. This was to ensure adequate understanding adequate technical capacity, appreciation of the integrity of data collection in research and ensuring high quality of the data collected. The gender composition of the graduate research assistants was 6 females and 9 males. The field supervisor was done by the AfricitiesFood project manager and a PhD student who was enrolled in a PhD program at the University of Zambia.

3. **Observations:** During the data collection, data collectors observed specific issues that were not captured in the survey tool and interviews but were essential in comprehensive understanding of the context of food loss in the study area. The observation offered insights into some of the responses and dynamics along the food chains. To enable this, a checklist was used to guide observations on topics including hygiene standards, storage facilities, measures taken to protect foods from rain, sun, and other contaminants and spoilers, handling practices, equipment and methods, general market dynamics and practices, food preservation practices, and loss reduction measures and levels of awareness about consumer expectations about food quality. For each of the criteria, observation was used to assess the quality of practices or equipment as good or poor.
4. **Focus Group Discussions (FGD):** These FGDs conducted brought about the different stakeholders from institutions as well as the actual farmers. The data was shared, and discussions centered around the emerging issues in the survey and interviews as the data was collected. During the FDGS opinions of individual practices and diverse experiences that were shared giving more insight to the data that was shared. Specifically, FGD were undertaken at all trial sites with all key stakeholders. Focus group discussions were organised with key stakeholders including framers, traders, municipal officials, district agricultural coordinators, agents to refine priority loss points / causes and then low demand, low cost, and high impact trial interventions. Three FGD were held in Zambia for stakeholders to dissect and refine priority issues at trial sites. The FGDs were essential in achieving consensus on trial choices and methodologies.

5. **Document review:** As part of the methodology, a systematic review of existing literature was also conducted. A review of key concepts and processes from literature offered nuanced understanding of the fresh food value chain and losses thereby shaping the formulation of not only the data collection tools but also the interactions with the different actors along the food value chain. Documents reviewed covered journals, institutional reports, and social media content publications, agricultural policies, local and international reports on food systems on Lusaka.
6. **Participatory workshops and stakeholder engagements and exchange visits:** Workshops brought together different stakeholders including farmers, farmer group institutions, markets and market agents, municipal officials, ministry of agriculture official at district level, civil society organizations among others. During these workshops, data was continuously interrogated and refined bringing out areas of further data collection, more nuanced data analysis, data gap identification, and data quality improvement. Exchange visits involving farmers from both Lusaka and Mzuzu were also undertaken to ensure knowledge and identification of innovations to address specific challenges and areas for policy improvement. Farmers from Kamuzu Cooperative Fish farm exchanged with several fish farmers in Lusaka region. The exchange visit resulted in Mzuzu acquiring knowledge, skills and experiences about making floating fish feed. The project has had the support of various actors who have been profoundly involved from the launch date to closing event.

Data analysis and validity

Qualitative data generated through interviews, FGD, workshops and other qualitative methods was analyzed qualitatively and presented in the form of themes and narratives. Survey data was analyzed using excel to generate quantitative information on quantitative losses. The data was presented in the form of descriptive statistics including bar graphs, pie charts, table among other forms of descriptive statistics. Gender roles and the identification of social equity issues related to gender at different nodes in the nodes were clearly identified and analyzed. Further, the data was mapped to produce food flow charts that demonstrated the extent of losses at different nodes and how transport is a major factor driving losses between food producing areas and the markets. Further, climate and climate change as a driver of food loss was analyzed as a cross-cutting issue driving food loss in the study area. The data was thoroughly checked by key stakeholders to ensure validity, completeness and high levels of integrity and acceptability. Achievements against activities and outputs/milestones

Objective 1: To collect data and map chain actors, processes, communications, power dynamics in the chains, social and gender relationships in the chains, and the roles of each of the actors in the chains; develop, for project use and for wider dissemination, a clear and concise report and data sets on food losses and the urban food chain operations in Lusaka city.

no.	Activity	outputs/ milestones	completion date	Comments

1.1	Stakeholder engagement	Firm and sustained contacts and communication with key stakeholders	August 2021	<p>Prior to the inception workshop, a list of partners from previous projects and from prior engagements with stakeholders was drawn to be part of this project meeting as relationships had already been established. This was vital for the success of the project.</p> <p>Effective engagement was achieved with key stakeholders across key areas including farmers and farmer organisations / collectives, local government in the subject cities, ministries of agriculture, local NGOs, international organisations such as Hivos, service providers and city market committees and authorities</p>
1.2	Inception workshop-WS1	Familiarization of project objectives activities and timelines with stakeholders from relevant institutions and stages of the food value chain	6-9 th October 2021	<p>The project inception workshop was held in October 2021 and provided an opportunity for various project stakeholders to come together and achieve common understanding of the project. (Report in Appendix 1).</p>
1.3	Formulation of research instruments	Collaboratively formulated qualitative and quantitative research instruments with stakeholders	December 2021	<p>The first drafts of the instruments were formulated during the third day of the inception workshop with the partners present. Partners identified very important issues in line with the project objectives that were then framed into the survey, interview instruments and notes for the FGD and one on one stakeholder engagements. The instruments were further refined and shared with the partners who gave feedback and the process of refining the tools continued till a time when there was consensus.</p> <p>Research instruments available in Appendix.</p>

1.4	Complete data collection along the food value chain in the Lusaka City region	Field surveys of 2000 food actors and 60 in-depth Interviews of key informants and stakeholders collected in the Lusaka City region	December 2022	Data collection was carried out over a period of one year in the Lusaka City region. A team of interviewers conducted the surveys targeting stakeholders drawn from the four stages of the food value chains. Key informant interviews were also conducted within this period. Survey Data was collected online using google forms for better tracking and recording of data. Key findings of initial and final data collection in Appendix 1
1.5	Mapping of food flows along the four stages of the food value chain	Map showing the food flows from the farms to the market generated	March 2022	The location data that was collected was used to generate a map showing the food flows from the point of production in the Lusaka city region study site. See Appendix 1
1.6	Data analysis	Established the key drivers and dynamics of food loss in the Lusaka City Region and gender relations and roles of each of the actors along the food value chain	June 2023	From the data analysis, key findings such as dominant fresh produce, major drivers of food loss and implications of this on actors along the food value chain. Preliminary gaps in data and information were also identified for discussion and filling. It was also established that there was a need to streamline the fresh food loss categories so as to have more focused interventions. The selected fresh food produce was: Tomatoes, leafy vegetables, poultry, milk and meat. Reflection: The team would have benefitted from a full-time young researcher (statistician to assist in ensuring more coherence in survey data collection, analysis and presentation. Both teams appear to have struggled to retain their part-time statisticians.

1.7	Project information dissemination	Continued stakeholder engagements, Focus Group Discussion Presentation of findings to stakeholders, conferences, workshops, one-on-one meetings, meetings and social meeting platforms.	September 2021- On-going	Videos (2), Blog Posts – gender, climate change impacts (2), Regular UNZA Newsletter articles, Twitter feed, Specific short papers specific to the two chains studied in detail (Kasisi and Palabana), Paper – Food and Nutrient Loss (still in process), Meeting with Australian Ambassador and flyer provided, Conference Presentations: CultiAf Conference Nairobi, Livingstone Urban Planners Conference (attended by the President and Minister for Agriculture, Ministry for Local Government and Rural Development, Minister of Finance and National Planning, World Congress of Sociology Melbourne Aust. A workshop was held to train food actors in Soweto on gender inclusion at the market stage and strategies for food agent regulation. Trainings and capacity development on food handling to reduce food were co-implemented with Private sector actors including Farm Feed Limited and local and international NGOS including Hivos International, Self Help Africa, Indaba Agricultural Policy Research Institute (IAPRI) and government agencies including Lusaka City Council, Chongwe City Council among others.
1.8	Database of key actors and stakeholders	We have built a reliable and accessible database for all relevant stakeholders in the AfricitiesFood project in Lusaka.	January 2023	A database of partners of the project partners. A data set containing over 2000 survey respondents has been established.

1.9	Identification of chain actors	Major chain actors and their roles have been identified at all four stages of the food value chain.	June 2023	The chain actors range from laborers, farmers, market agents, cooperatives, market food agents, government and church institutions, councils, transporters and off takers. Local government officials such as the Mayor of Lusaka, district agricultural coordinators, Market Committees in the target districts have been particularly interested in this project. We anticipate by-laws and inclusion of more women in the Market Executives committee to be achieved in the next few years.
2.0	Food loss data set	Full data set on food long the value chain.	June 2023	Analysed data set showing the food loss quantities at every stage in the food value chain. A survey data set of over 2000 has been developed covering all major actors at different nodes in the chains.

Table 1: Objective 1: Achievements against activities and outputs/milestones

Objective 2: To analyse chain operations in Lusaka city using the information assembled, information gap identification and determine further data collection; to identify potential ways of reducing food loss, improving food handling, storage, and timely logistics, thereby improving food accessibility and nutrition security for the urban poor in Lusaka city.

no	Activity	outputs/ milestones	completion date	Comments
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2.1	Focus Group Discussion	Three FGD were held in Zambia for stakeholders to dissect and refine priority issues at trial sites. Report on stakeholder deliberations. Shared understanding of actor relationships and how these relationships influence the performance of the fresh food sector in Lusaka. The questions were drafted with input from stakeholders and from Mzuzu.	April 2022	The FGDs were key in establishing a shared sense of ownership, shared understanding and high levels of acceptability of the project outcomes. Summary report in Appendix 1
2.2	Gap identification	Gap identification in primary data collection by partners	June and early 2022	Gaps for further data collection were identified and agreed upon by all stakeholders. Summary report
2.3		identification of potential food loss solutions	late July 2022	The solutions and innovations have been identified for stakeholders to undertake trial processes to test the efficacy of the innovations.

2.4	Identification of trial sites and development of innovations for trials	The data was presented to all key stakeholders with a focus on spatial coverage, inclusivity, gender gaps in the data, calculation and general data quality. Actors identified sites indeed for trialing: The sites included Soweto market, Kasisi cooperative farm, various farms, and with relevant stakeholders.	July 2022	Sites were identified, and the project team and relevant stakeholders reached out to plan for the trial phase of the innovations. During gap identification process, stakeholders identified Important gaps including limited geographical coverage in initial data collection, important actors missing in the initial data, and more involvement of private sector inclusion in the project.
2.5	documentation of baseline data	Food loss and fresh food performance at trial sites was documented to form a baseline.	August 2022	Instruments are developed to capture data at each of the identified trial sites. This tool forms part of the second data collection process and contributes to gap filling. A non-trial participant was selected to collect data after the trials. The data collector was trained about the process and the procedures for data integrity.

Table 2: Objective 2: Achievements against activities and outputs/milestones

Objective 3: To explore and test contextually relevant food innovations and interventions in food handling, preservation and storage, transportation, information use and exchange and other aspects of chain operations to reduce food loss, improve food quality and safety and enhance product flow through the chains.

no.	Activity	outputs/ milestones	completion date	Comments
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3.1	Site selection	<p>The data was presented to all key stakeholders with a focus on spatial coverage, inclusivity, gender gaps in the data, calculation and general data quality. Actors identified sites indeed for trialing: The sites included Soweto market, Kasisi cooperative farm, various farms, and with relevant stakeholders</p>	April 2022	<p>The focus was on capacity building through training. This focused on food handling, gender and agent integration and inclusion and on food packaging. A long list of possible interventions included:</p> <ol style="list-style-type: none"> 1. Capacity building in food handling 2. Capacity building in food packaging and value addition and preservation 3. Provision of market shelter at food producing sites 4. Supply of storage facilities at markets and farms. 5. Supply of usable climate information for decision-making by farmers and other actors. 6. Protection of farmland through food centred urban planning and land use decisions. 7. Food agent recognition/formalization and gender inclusion at the market stage 8. Improvement of transport system between markets and food producing areas 9. Decongestion of the Soweto market through construction other food markets 10. Strengthening of policy on food loss and food waste 11. Decentralizing the food sector and making local councils have a bigger role in food and nutrition security. 12. Provide improved food systems infrastructure (all elements). 13. More research to better understand climate change and food loss and waste issues and policy directions. <p>Drung FGDs, stakeholders selected low-demand, low cost and high impact trial</p>
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				<p>recommendations. Further site selection was based on level of food loss and potential for impact in a specific chain as well as willingness of the site actors to lead try the interventions. Three sites were collaboratively selected and these included Palabana milk cooperative, Kasisi Farming block and Soweto Market in Lusaka.</p>
3.2	Engagement of sites for trialing	<p>Sites and their management staff engaged to co-design and co-create the innovations. Co-designed innovations. The site actors agreed to try the interventions.</p>	From April 2022 to 30th August 2022	<p>The engagements on the site were robust and were iterative, allowing for on-going learning and improvement. The co-management of the trials was very impactful and allowed for strong sense of ownership of the interventions and durability.</p>

3.3	<p>Focus Group Discussions and stakeholder engagements to critic the data, reports, identify solutions to the losses and come up with feasible trials.</p>	<p>Key areas of intervention</p> <p>Capacity development on food handling and management practices at Kasisi cooperative farm</p> <p>Gender and agent regulation at New Soweto Market</p> <p>Capacity development on milk chain management and disease control</p> <p>Capacity development on value addition on milk and milk products at Drogba Milk Cooperative in Mzuzu</p> <p>Gender inclusion at Mzuzu Main Market and capacity on tomato paste making at Mzuzu Main market.</p> <p>Capacity and introduction of low-cost technology on local fish feed formulation, capacity on fishpond management and introduction of floating fish feed at Kamuzu Fish Cooperative Farming</p>	April 2022	<p>Partners identified and agreed about the choice and location of several interventions as follows: The focus was on capacity building through training. This focused on food handling, gender and agent integration and inclusion and on food packaging. A long list of possible interventions included:</p> <ol style="list-style-type: none"> 14. Capacity building in food handling 15. Capacity building in food packaging and value addition and preservation 16. Provision of market shelter at food producing sites 17. Supply of storage facilities at markets and farms. 18. Supply of usable climate information for decision-making by farmers and other actors. 19. Protection of farmland through food centred urban planning and land use decisions. 20. Food agent recognition/formalization and gender inclusion at the market stage 21. Improvement of transport system between markets and food producing areas 22. Decongestion of the Soweto market through construction other food markets 23. Strengthening of policy on food loss and food waste 24. Decentralizing the food sector and making local councils have a bigger role in food and nutrition security. 25. Provide improved food systems infrastructure (all elements). 26. More research to better understand climate change and food loss and waste issues and policy directions.
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				Drung FGDs, stakeholders selected low-demand, low cost and high impact trial recommendations. Further site selection was based on level of food loss and potential for impact in a specific chain as well as willingness of the site actors to lead try the interventions.
3.4	Exchange visits	Solutions and interventions discussed and adopted by fish farmers in Lusaka and Mzuzu. Focus was on how to reduce the cost of fish feed and how to introduce floating fish feed for small holder farmers	June 2022	Visit between Mzuzu and Lusaka fish cooperatives to explore issues around food loss in the fishing sector and how to reduce cost of feed for fish. Stakeholders explored the ways of introducing and sustaining on-farm feed making by farm cooperatives and individual fish farmers. Uptake of lessons was very high by both Lusaka and Mzuzu stakeholders
3.4	Discussion to reduce food going to the dumpsite from farms and markets and re-channel it to feed the most vulnerable.	Decision to establish a Food Bank in George informal settlement in collaboration with Hivos and LCC	June 2022	During stakeholder meetings, stakeholders agreed to establish a food bank in one of the most food insecure settlements in Lusaka. The idea is to rescue food bound for the dumpsite and give it to the most vulnerable groups and individuals in the city. LCC and Hivos are very keen to sponsor the establishment of the foodbank. This is still at discussion stage. The team and stakeholders agree and recognize its importance. However, there is a need to work out the structure, sustainability, and management process of the same. This will be taken further in future projects. The aim at this stage will be to develop a full concept and achieve proof of proof of concept. We want to make it ready for upscaling. We will add more information in the final report.

3.5	Formulate a manual on integration of food agenda as key and formal actors in the fresh food chain	This is being advocated for in the formulation of two byelaws to recognize unregulated and unregistered food and market agents in Soweto and at Mzuzu Main Market. We expect impact to be realized in the medium term. The teams plan to continue to work on this after the project is formerly closed. This will be further supported by the planned formulation of a manual based on the working already prepared working paper for Lusaka. The team will continue to work on this task to ensure more stakeholder buy in is achieved and the issue if formally adopted by the city council in Lusaka.	On-going, end of 2022	It has been established through this project that while informal food agents are criticized for many reasons (justified), they still play a key role in mediating between smallholder farmers and consumers. The key issue then is, how can we reduce the manipulation and imbalance of power relationships to ensure fair participation of farmers, agents and consumers in the chain? One solution is to formalize, regulate and manage the role of food against and middlemen in the food chain. This is being advocated for in the formulation of bylaws to recognize, integrate and regulate food agents at open air-markets in Lusaka.
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3.6	Gender and youth mainstreaming in food market governance.	Women and youth business and entry into market committees promoted and training undertaken on gender and social inclusion at markets	This is still at discussion stage. The team and stakeholders agree and recognize its importance. However, there is a need to work out the structure, sustainability, and management process of the same. This will be taken further in future projects. The aim at this stage will be to develop a full concept and achieve proof of proof of concept. We want to make it ready for upscaling. We will add more information in the final report.	<p>Presentations from the Mayor of Lusaka at project launch and at the end of project event clearly shows commitment from the local council to introduce new by-laws in governance of the municipality owned markets in Lusaka to:</p> <ol style="list-style-type: none"> 1. improve access and facilities for women traders and representation of women on Market committees 2. specific improvements to infrastructure to improve produce handling, storage and logistics. 3. Recognise, semi-formalise and regulate food and market agents to improve transparency between food agents and smallholder farmers upgraded processes and structures of facilitation and interaction between market committees and local authorities
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3.7	Trialing innovations	Trial plan, trial implementation, trial monitoring and results	March	<p>The three trial sites were selected as follows:</p> <p>Fresh leaf vegetables are widely consumed by all classes of society in the study area. However, losses were the highest among the food studied. A FGD was held at Kasisi to co-define possible interventions to address the high losses. After several one-on-one engagements with smallholder farmers, the team in Lusaka arrived a conclusion to undertake a training to build capacity in food handling. The training was done at Kasisi cooperative farm and Farm Feed and Self-Help Africa were co-implementers of the training. Pre-trial and post-trial data sets were produced. Following analysis of water challenges and their impact on food loss, the management of the cooperative did invest in irrigation infrastructure. This has significant addressed water related challenges at the centre.</p> <p>The lack of adequate and equitable participation of women at the market stage was established as a major issue driving the losses. Further, market dynamics around manipulation, gender inequalities, provision of gender sensitive public services were found to have cascading major drivers of high losses at all stages. High occurrences of manipulation at the open-air markets (the hub of most of the fresh produce) contributed to high food losses. After a Focus</p>
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			<p>Group Discussion (FGD) targeting gender and food agents at Soweto, it was collaboratively agreed that training on gender inclusion and food agent regulation was a priority. The selection of trials in form of training with major actors at the market would enhance integration amongst various actors and stem anticipated reduction in food losses. Support of the Local authority also played a significant role in getting the participants to have a buy in and openly share experiences towards a common goal.</p> <p>The third trial was done in the milk value chain. After an FGD, stakeholders prioritized low-technology and low-cost but impactful interventions to address drivers of milk losses at Palabana Milk Cooperative. Farmers were trained in control of Mastitis, hygiene, appropriate feeding, and milk handling as ways of reducing the losses. This training was coordinated by IAPRI and Zambia Daily Development Association. The site management office offered to collect data on milk deliveries for a period of one month and this data was analysed to compare with the milk deliveries before the training.</p> <p>It is important to note that all trials were done to ensure that those trained train others. During project closure meetings, it was learnt that the trained farmers have continued to train others to build capacity and</p>
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				reduce losses at the selected sites.
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Table 3: Objective 3: Achievements against activities and outputs/milestones

6. Key results and discussion

7.1 Introduction

The project aims to identify and characterize the nature and scale of food loss in urban agri food chains in Lusaka City and define its drivers and implications. The project targeted smallholder farmers, transporters and marketers in the agri food value chain in Lusaka city region and other stakeholders who are actively involved in the process of food flows along the food value chain from harvest to the market. The following is a summary of key results.

7.2 Gender mainstreaming and relations at open air markets

The entire study captured more men than women, with the percentage of men to women standing at 60.1% to 39.9% respectively. Additionally, with regards to farm ownership, the study indicates that the majority (56.1%) of farms are owned by men while 26.9 % are owned by women. A total of 17% of the surveyed farms are co-owned by men and women. This is an indication of some possible constraints or inequalities faced by women as more men than women are involved in activities along the urban agri-food chain in the city region. This may consequently affect the agri-food business due to unequal treatment or unfair representation and participation of the female gender. This on the other hand offers opportunities to mainstream the female gender into more active roles in the urban agri-food business chain. The dominating role of food agents, men-skewed ownership of farm assets, lack of adequate water and sanitation services at open air-markets, and lack of equitable structural and legal support towards women are major drivers of unequal participation in the agri-food chains in Lusaka. However, it was established in this study that women tend to be laborers rather than owners of the food business and smallholder farms. The findings reveal that women are a huge workforce on the farms, with an average ratio of 1-20 female workers. In terms of the harvesting process, data collected shows that both men and women are actively involved in the harvesting process and are aided by youths and children. This entails that harvesting of produce at the farms is not a gender-specific activity but one where both males and females play a role.

Similarly, findings reveal that both males and females participate during post-harvest at the farm in activities that include grading, packaging, storage, and loading of produce on the transport equipment. Furthermore, results show that all workers and family members are involved in the packaging process for efficiency.

On the contrary, there are a lot of gender dynamics involved during transportation and at open air markets, with gender related challenges being experienced particularly by women traders. During the transportation stage of the urban food value chain, women are reported to have no role in the transportation of produce from the farm to the market as drivers, a scenario which is viewed as a preserve of the male folk. Therefore, men do the transportation while women help them load the produce on the van. For some farms men are the only ones involved in both loading and unloading of the van because the sacks are heavy and need manpower. The preference for males is based on the perception that they are strong and can load trucks quicker and that women are mostly supervisors as they cannot do much of physically taxing duties. On the contrary, this is an assertion that is highly contested by gender activists, who argue that women have equal abilities as men.

Despite this, women are given a chance to travel with the produce to the market by bus, small truck as passengers often in the company of the male folk. However, it is worth noting that not all women are able to freely sale the farm produce at open air markets due to gender related challenges that include: women getting harassed, disrespected and disadvantaged, being taken advantage of by customers who think women can take cheaper prices, vulnerability to theft and lack of security, manipulation by market agents who make women sell on their behalf and pay them very little, bullying from men who end up selling more produce than women among other challenges. Other challenges include lack of reliable and accessible water and sanitation services at surveyed open-air markets. During the FGD, women reported having difficulties to access public services and hence, some would rather depend on agents to sell the food at these markets.

7.2.1 Gender relations in open air markets

The study explored gender dynamics and gender relations in the market stage as a cross-cutting issue in urban food value chains. Data collected on social and gender relationships in the urban agrifood chains in Lusaka's open-air markets reveals gendered differences in how men and women interact daily in the food market space. The findings show that although men and women engage in food marketing of various products, women are more affected by unequal power relations and high levels of manipulation especially on pricing in open-air markets than men. This unequal power and gender relationship has profound impacts on food losses, leading to major costs incurred by smallholder farmers and consumers. We noted notable differences in the nature and type of involvement of men and women traders in open-air markets. Also, the impact of gender relations on food and nutrition loss was very evident, particularly on the issues of delays in food trading due to failure to secure transport and market space, resulting in food spoilage and reduced nutrition. Women traders were mainly affected by such occurrences as compared to men. Therefore, our study emphasized the importance of contextualizing gender dynamics and social relations for transparent and inclusive urban food chains in Lusaka. Our study establishes significant gender inequalities in the management of major urban food markets in Lusaka. One thing that stands out in these markets is the lack of representation of women in stages of the value chain where it's lucrative. This underrepresentation has resulted in the hindrance of women's full involvement and the untapped potential of the markets. We found that social, economic, and cultural factors contribute to this disparity. By participating less on the markets, women smallholder farmers tend to lose out on prices through manipulation, theft, and food spoilage due to poor handling of food and lack of care.

Concerning the issue of manipulation and extortion vis-à-vis social and gender relationships in open air markets, one female interviewee gave the following response...

“Yes, some people want to take advantage of me just because I am a lady. They want to collect levies more than normally required and they push me to sell my goods at a much lower price than average.”

(Female trader at Soweto Market, March, 2023).

The above comment and challenges experienced by female traders is a signal that gender related constraints are very rife in urban open-air markets. In order to avert these challenges, respondents indicated that this could be addressed by offering equal opportunities for all, empowering women food traders with information to help them report abuse and manipulation to local authorities and Zambia Police, employing more women as security staff (in police), and ensuring equitable allocation of stands in the market between men and women.

For instance, the study unraveled the social barriers restricting women's involvement, economic challenges women face, and cultural norms that perpetuate these gender inequalities. Similar with prior studies (Manda, 2022) we note that unbalanced access to opportunities is largely caused by pre-existing conditions of pervasive gender inequalities that start from households, in local communities and in widespread inaction on gender diversity inequality and social exclusion in the chains. The gender and social exclusion challenges are more pronounced in urban markets. Therefore, incorporating gender perspectives into the production and marketing processes can help to bridge the divide. Our findings show that women's participation in the market is minimal and their engagement in the market is adversely affected by their huge care responsibilities in the home, a situation which makes them leave earlier than men to go and attend to caregiving and other household chores. However, despite the various constraints faced by women in food marketing, interventions to reduce gender inequality have opened a window of opportunities for many women participating in urban food value chains. For instance, the study shows participants' recommendations on the stage where women's participation should be encouraged. Results show an increased preference for increased women's involvement in open-air markets, as shown below. Predominantly, most actors argue that there is a need to foster women participation at the market stage. This will require several radical changes including better service provision, raising awareness and capacity building for gender integration at market space.

Project

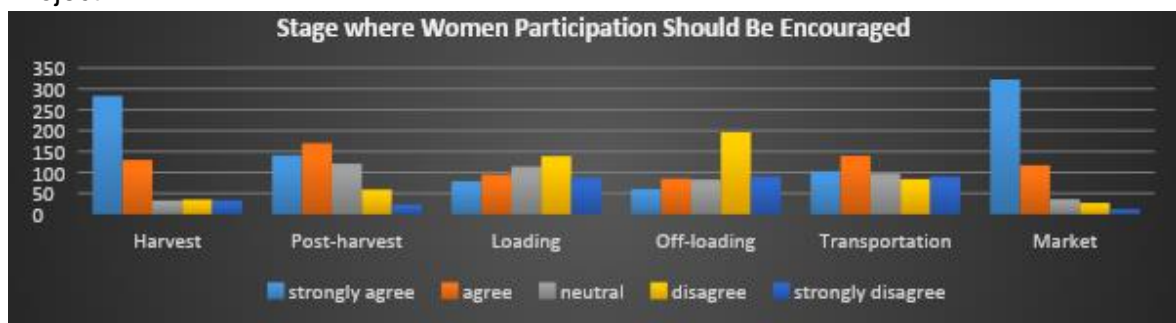


Figure 1: Data source: 2022 Field Data Collection, AfricitiesFood Project, 2022

When asked which stages (from harvest to the market) women's participation should be encouraged, 62.6% of the respondents strongly agreed with the market stage. This nature of response confirms the inequalities between men and women in open-air markets and participants' desire to encourage more women to participate in food marketing. Few respondents strongly disagreed with women's participation in food marketing, which signifies women's critical and indispensable role in urban food security. We also note that the traditional gendered roles of women as harvesters of produce are exceptionally

preferred, as depicted in the figure above. It should be noted that women highly participate in both the harvest and market stages as laborers and that the harvest stage is financially low rewarding for them. Our findings reveal the urgent need to encourage women to participate in an economically beneficial way because from the farm to the market stage, their level of influence, control, and benefit is often lower than their male counterparts. For instance, our survey shows men had 56% farm ownership compared to 26% of female farm owners.

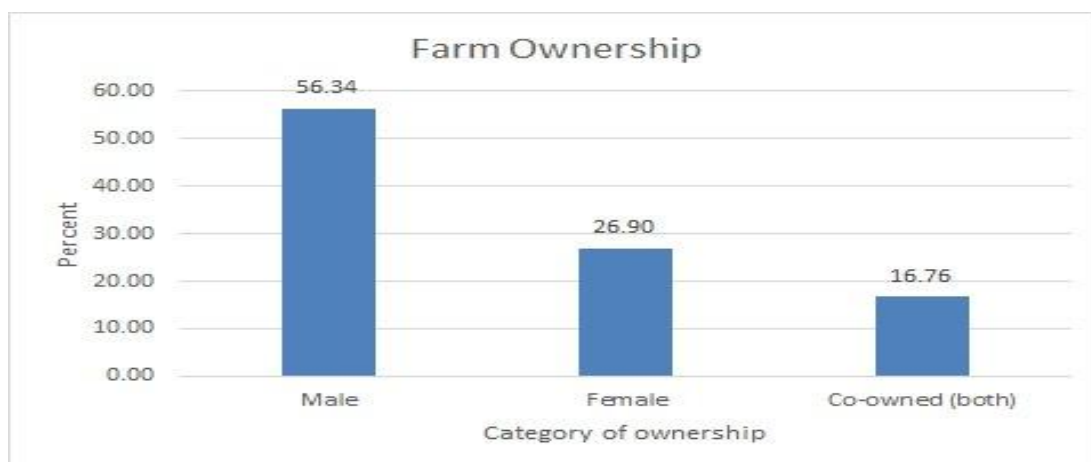


Figure 2: Data source: 2022 Field Data Collection, AfricitiesFood

Considering the above findings, reducing gender inequalities in the food value chain will improve efficiency and reduce food and nutrition losses when others unequally participate in food markets. Further, the findings of this study help us to leverage the lessons learnt to improve gender relations in food markets for well-functioning and efficient urban agrifood chains, particularly at the market stage where different farmers actors interact with each other and their customers in a market exchange aimed at earning a livelihood and reducing household poverty. There is need to ensure more women participate in the market as this will increase trust between farmers and food handlers at markets, consumers will access food at fair prices and urban poverty will reduce.

7.2.2 Gendered differences in food marketing and market governance

It is also worth noting that gender relations, beliefs, and perceptions over appropriate types of work and the division of responsibility shape the functioning of individuals involved in open-air food businesses and, consequently, the benefits that accrue to them in open-air food markets. For instance, our study revealed that some women experienced verbal abuse because they could not do certain things well, like offloading the boxes of tomatoes and other heavy produce from the trucks. Women had challenges carrying their produce to far off storage facilities and always had to pay someone (usually men and young boys acting as either food or market agents) to take them. While some traders believed that women received preferential treatment in the markets, others explained that customers preferred to buy products such as vegetables from women because they were better at taking care of them in terms of hygiene. On the other hand, others felt that some prefer to buy from men because men are not harsh. With all these beliefs and interpersonal relations, men and women were affected differently regarding privileges and competitiveness in the food market space.



Figure 3: A female trader giving a male trader a heavy box of tomatoes to carry for her at Soweto market. / AfricitiesFood 2022

In addition, certain perceptions and beliefs further disadvantaged women as opposed to men. For instance, perceptions that women can take lower prices, the idea that women should sell specific products and vice versa, and the belief that women cannot hold certain positions in market structures limited them from taking on leadership roles in the market. These findings show the gendered differences/gender-differentiated roles and power relationships in market governance. Positioning women at the margins of open-market leadership signals the entrenched power differentials between men and women from households to the informal labor market. The implication is that the unique interests of women will continue to receive minimal attention because they will not add their voices to the decisions made.

However, others noted that some women participate in market leadership and collect market levies. Our study also shows that women often organize contributions and mobilize funds whenever funerals occur in the markets. Women do this to help support bereaved families. Men also participate in such activities despite women being at the forefront. These women's role shows how traditional gender roles of women as carers and sympathizers are played out even in market spaces. It is important to note that such gestures enhance fruitful gender relations in food marketing due to the emotional and financial support that both men and women render to each other in times of crisis.

We also found that both genders preferred to trade with the opposite gender compared to fellow women or men. For example, we discovered that women marketers preferred to trade with men because they believe they are easy to negotiate with. Also, most male marketers liked dealing with female traders because they thought they sold better. Such kinds of gender relations are among the exciting dynamics in open-air markets that can empower or marginalize some food marketers when opportunities are given or denied based on one's gender.

7.2.3 Gender-based constraints in open-air marketing

Although gender-based constraints were not widespread, both genders acknowledged that they existed in food markets and food marketing. The narratives of those who said yes to the existence of gender-related challenges show that women were the most affected. As Westholm and Ostwald (2019) note, "Markets are gendered institutions, shaped by social

relations” (Westholm & Ostwald, 2019, p.361). These relations existed in control over food pricing, access to market space and customers, extortion, and manipulation, adversely affecting women and dwindling their opportunities to effectively participate in food marketing and reap the economic benefits thereof.

7.2.4 Respondents’ views on challenges faced by women and men in open air markets

Challenges faced by women at the market	Count	Percent
Too much competition	52	25.74257
Exploitation by middlemen and buyers	34	16.83168
Theft	10	4.950495
Harrasment from fellow traders	9	4.455446
Inadequate trading space	81	40.09901
Too many fees to pay	3	1.485149
Lack of storage facility	7	3.465347
Lack of leadership role	6	2.970297
Total	202	100

Challenges faced by men at the Market	Count	Percent
Too much competition	28	18.79
Exploitation by middlemen	16	10.74
Inadequate selling space	25	16.78
Lack of access to water	3	2.01
Lack of storage facilities	7	4.70
Lack of toilets	3	2.01
Poor negotiation skills (pricing)	28	18.79
Poor sanitation	16	10.74
Stigmatization	16	10.74
Theft	3	2.01
Too much fees to pay	4	2.68
Total	149	100

Figure4: Data source: 2022 Field Data Collection, AfricitiesFood

The above table shows that women were more vulnerable to inadequate trading space (40%), unfair competition (25%), exploitation by middlemen and buyers (16%), theft (4.9%), harassment (4.4%) among other challenges. While both men and women reported similar challenges but to varying degrees, men also reported unique challenges with regards lack of access to water, lack of toilets, poor sanitation, poor negotiation skills in terms of pricing, and stigmatization. The challenges faced by men demonstrate the gendered differences in access to water and sanitation. Often, women play similar roles in the home and at the market. Duties such as fetching water and accessing sanitation facilities are part of the cultural expectations of women. The stigmatization reported by men in the market may be due to the positive discrimination shown to women who are considered as more disadvantaged than the men. For instance, one male trader said that “Sometimes women are favored in the markets”.

7.2.5 Inadequate trading space

While open-air markets have the potential to be drivers of inclusive economic growth, issues such as inadequate trading space experienced by women pushes them out of a lucrative

market stage and affects their ability to generate income and participate effectively in the market. Several studies have identified a gender bias in the allocation of space in public markets. For instance, Loo (2015) found that the allocation of market space was male dominated with men occupying larger spaces. Women were often relegated to less desirable locations within the market, limiting their potential for growth and expansion. Similarly, prior studies demonstrated how gendered power dynamics often played a role in determining the allocation of space in informal markets, restricting women's access to resources (Roever, 2014; Siame et al., 2020). All these shows how a male-dominated market leadership and gender-based discrimination are among the factors contributing to inadequate trading space for women.

In an extreme case, one female trader explained:

“Some council members allocate market space only if you are in a relationship with him.”
(Female trader).

This excerpt illustrates how some women experience unequal relationships and constrained opportunities for self-determination when proposals to an undesirable emotional attachment deny their right to equal use of market space.

7.2.6 Manipulation and extortion of prices

While Soweto market has been predominant in fostering the local economy, it has also become an arena for manipulation and extortion by some individuals with profit maximization, monopolistic, and market domination tendencies. As a result, the manipulation and extortion of prices was a significant concern for most respondents in our survey. Male traders were reported as frequently manipulating female traders and extorting prices, perpetuating an environment of gender inequality and exploitation.

Gendered constraints emanating from the manipulation of women at markets are very rife in open air-markets in Lusaka, a situation that male traders outrightly acknowledged. According to the findings, perpetrators of manipulation and extortion are male market agents. This scenario further aggravates the already existing income inequalities experienced by women traders. Findings are that extortion of prices results in food loss for farmers because a lot of produce remains unsold when the buyers are unable to purchase it due to the high price tag. While the aim of some market agents is to maximize profits from selling at exorbitant prices, the extortion of prices potentially leads to more food losses at the market. For instance, the study shows that food losses at the market was mainly through the loss of fresh vegetables and tomatoes as shown in the figure below:



Figure 5: Data source: 2022 Field Data Collection AfricitiesFood

7.2.7 Theft and lack of security in open-air markets

The very nature of open-air markets makes them vulnerable to theft. Moreover, the fluid nature of these markets means that many people move in and out of the market space on a daily basis as they engage in the trade of various products. This dynamic and informal nature of open-air markets creates a sense of anonymity, and for those vendors without permanent trading spaces, their produce is not well secured and vulnerable to theft. Respondents in our study reported that insufficient security measures and a lack of proper storage as key drivers of theft in the overcrowded Soweto market. With a male dominated security system and better security for men, most female traders who often left the market early to attend to household obligations were highly vulnerable to having their goods stolen.

This situation highlights the need for security cameras, alarms, and other technology-based measures to help curb the alarming levels of theft in open-air markets. Although women were more affected by theft, the limited surveillance and security infrastructure in this set-up affects both male and female traders and customers.

7.2.8 Harassment and disrespect

Another gendered driver to food loss in open-air markets was attributed to harassment. Both males and females reported bullying from men who grab customers from women and end up selling more produce. In addition, disrespect and the use of offensive language were reported, as noted by another male trader: “Too many insults, bad place for women and children” (Male trader). For him, the open-air market was not conducive for women and children because of the insults hurled at women. The uncourteous and intimidating behaviour of forcefully getting one’s customer and using offensive language may result in adverse economic and psychosocial outcomes for those affected. For instance, most women who lost customers experienced lower sales and had a bulk of unsold produce, which resulted in increased food loss as seen in the statistics above.

It is noteworthy that security concerns for women encompassed both the security of their produce and that of themselves as individuals. One female trader who moved in the company of male traders remarked:

“That is why we always move with men” (Female trader).

The above indicates that women, particularly those who stay in the market until late evenings need more physical protection by their male colleagues as a preventive measure from harassment, physical attacks, and other forms of gender-based violence perpetrated by some male hawkers.

Similar to the sentiments expressed by the female trader, several male traders acknowledged that the open market is not safe for women. While one male trader indicated that “The open space is not very safe for women because we find a lot of criminals out there”; another one noted that “The open space is not very safe. Mostly women are not able to defend themselves from cadres who are found there.”

Also, most women experienced victimization when they failed to pay market levies charged by cadres, causing them mental harm due to a trading environment fraught with intimidation.

7.2.9 Control of produce and access to profitable income

Significant disparities also existed in the management and marketing of different products. While men were primarily involved in selling and marketing high-income-generating agrifood products like fish, milk, and meat, women mainly engaged in low-earning products like green vegetables and tomatoes, which were prone to damage when exposed to the sun and when poorly packaged. This situation resulted in enormous food, nutrition, and financial losses for women. When this happens, women feel outcompeted by their male counterparts and find themselves in unequal bargaining dispositions in food retailing. The figure below shows the involvement of men and women in selling different agrifood products. Men often sold high-market value products.



Figure 6: Tomato 2022 Field Data Collection Women selling tomatoes at Soweto open-air market, AfricitiesFood

7.2.10 Opportunity for action to reduce food losses through gender mainstreaming at open air-markets

Based on the findings on the gender-food loss nexus in open air-markets and in the chains generally, it is urgent that action is taken to mainstream gender. The AfricitiesFood project sought to mainstream gender at Soweto Market in Lusaka. This involved critical interrogation of gender inclusion issues in the analysis of the chains. The analysis included collaborative research with key stakeholders in urban food value chains such as the government departments, cooperatives, market committees, municipal officials and elected officials, individual farmers, civil society organisations, and traders, in interrogating gender dynamics to reduce both the short-term and long-term negative impacts of gender-related constraints experienced in open-air markets.

As earlier noted, markets are gendered institutions and spaces where social relations play a cardinal role and can either empower or marginalize women, the vulnerable, the youth, hence the urgent need for outcome-oriented approaches to equal market participation, reduction of food loss, and realization of economic benefits for all. In summary, research results reveal that both men and women participate favorably during the harvesting and post-harvest processes in grading, packaging, preservation, and storage, whereas disparities exist in gender specific roles during transportation of produce and marketing of the produce. More so, gender related challenges are more pronounced, disempowering, and gracious in open-air markets, with women being placed in a disadvantaged position due to unequal power relations and other vulnerabilities such as lack of security, theft, manipulation, lack of gender sensitive public services, and extortion among others. The unequal access to the market works against women in greater proportion. Smallholder farmers lose out on their produce as men food agents tend to take charge of the produce as most women fear to defend their food business interest. The findings show that gender diversity equity awareness is key in transforming the role of women at market spaces and that this needs to take interdisciplinary approach. The changes need to happen at various levels including market, policy, leadership associations and at market board selection levels.

7.3 Spatial distribution of food producing areas

The map Appendix 1 on the findings illustrates the sampled spatial distribution of farms which supply the fresh produce to open air markets in the Lusaka City region. The data indicates that most of the food in Lusaka city region comes from within Lusaka district boundaries and surrounding districts such as Chisamba, Chongwe, Kafue, and Shibuyunji. Results show that while most of the food sold to open air markets either directly by the farmer or through agents, some produce is also sold on the far, less produce is sold to individual traders that buy directly from the farm. The preliminary findings of the study further indicate the presence of urban agriculture in the Lusaka City region although the sizes of the farms were primarily relatively small, and the produce is relatively small. It should be noted that the second data collection for gap filling was designed to capture smallholders in areas outside of the city of Lusaka. Analysis of productivity and quantities will show the importance of inner city and outer city food producing areas in feeding Lusaka.

7.3.1 Key findings and discussion- Food losses

In line with the objectives of the study, the project has uncovered the drivers of food loss in the fresh foods agri food chain in the city of Lusaka. While dominant produce at each farm varied from place to place and the initial collection had a wider set of fresh foods, the project prioritized four fresh foods namely milk, vegetables, tomatoes, and meat. Additionally, while most farmers had a specific and dominant produce, there was evidence of efforts to diversify the production on the farm on some smallholder farms. The most dominant fresh food produced in the areas studied were therefore fresh vegetables, Tomatoes, poultry, fruits,

meat and meat products. Less dominant fresh food products included fish, milk and milk products. Data from FGD shows that both fish and milk sectors are relatively recent in terms of adoption and subsequent among smallholder farmers in the Lusaka city region. Figures 7 and 8 depict the primary food items recorded during the initial data collection phase and the produce that received prioritization during phase 2, respectively.

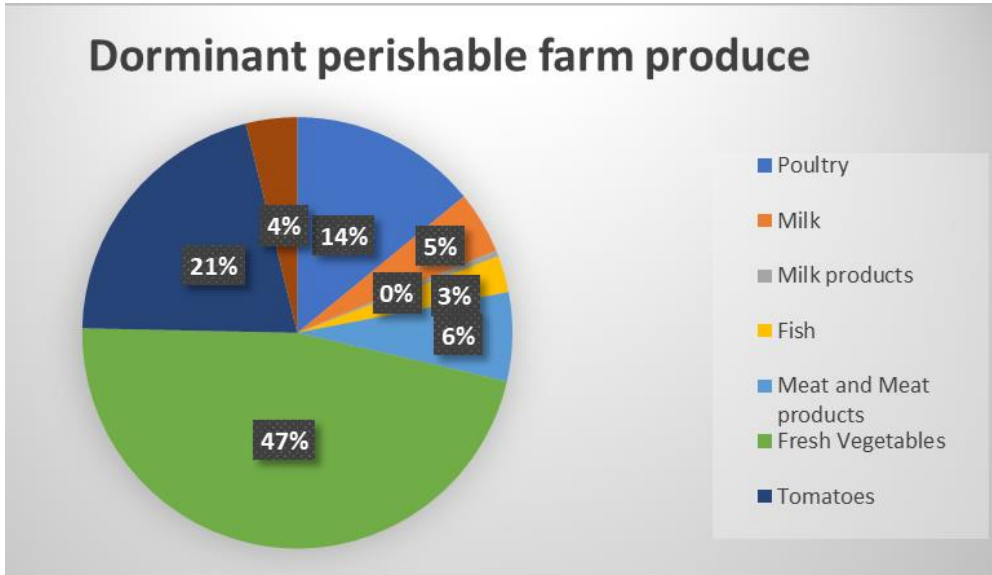


Figure 7: Dominant fresh foods in the Lusaka City Region

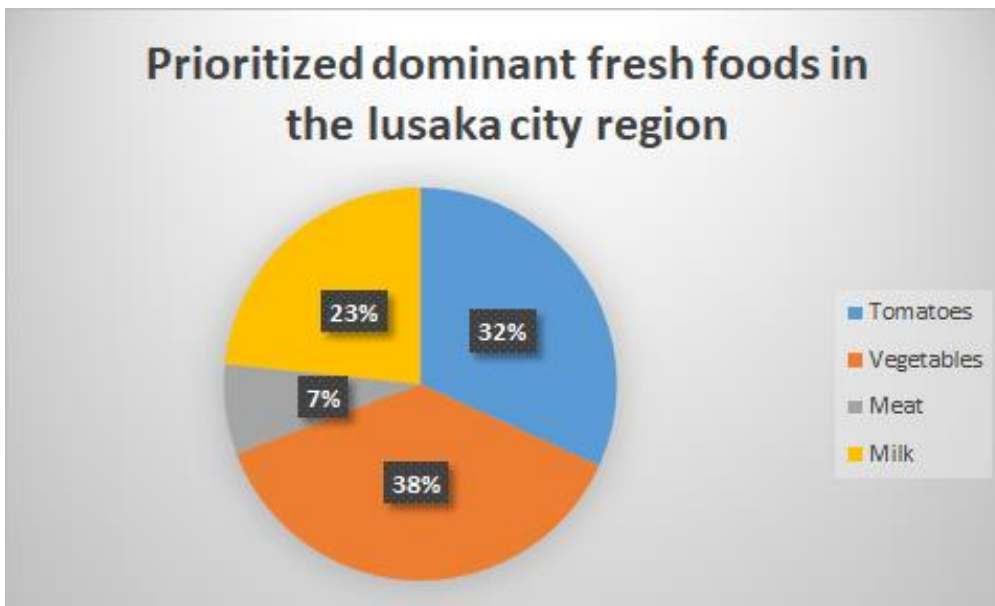


Figure 8: Prioritized fresh foods in the Lusaka City region

7.3.2 Individual product loss: Harvest to Transportation

i) Fresh Vegetables

The findings indicate that overall, there are losses that are incurred at each of the four stages in the fresh vegetables food value chain. At the harvest stage, analyzed data indicates that an overall sample average of 4, 621 Kg of fresh vegetables are harvested in the Lusaka city food region. The study indicated that although most of the fresh foods in the rural and urban areas within the city region is destined for the major market in Lusaka's

business district, a certain amount is sold to farmers that prefer to buy directly from the farms. One example of such a case this is Kasisi farming area where traders directly from the farmers in this study, an overall sample average of 2, 169 Kgs of the fresh vegetable produce was indicated as sold on the farm. The remainder of the produce is what is then packed and transported to the market. At post-harvest stage, findings indicate that an average total of 1, 429Kg of the fresh produce is packed for transportation to the market indicating a loss of 1,016Kg on the farm. This post-harvest loss represents a percentage loss of 22% of vegetables on the farm between the harvest and post-harvest stage.

This therefore indicates that from the average total of 4621.3 Kgs of vegetables, only 1429 kg are loaded onto vehicles for transportation. Furthermore, the findings are indicative that losses are incurred between packaging and loading for transportation after on farm sales. The findings also indicate that losses in vegetables occur between the stage when the produce is packed and loaded for transportation. An average total of 1,336 Kgs are loaded and transported indicating another average of 93 Kgs representing a percentage loss of 2.3%. Total post-harvest losses before transportation therefore stood at 24.3%. During transportation, the study found that an average of 404 Kgs of leafy vegetables are lost translating to 8.8% losses incurred. An additional average of 87.3Kgs are lost at the market stage translation to percentages losses of 1.9%. Hence, post-harvest losses of 614.4Kg (33.1%) before the market are incurred. At the market, the study indicates a percentage loss of 1.9% thereby giving a total percentage loss in the vegetable value chain of 34.9%. Figure 4 gives an infographic picture of the losses in the vegetable value chain from districts in the Lusaka city region.

The food losses according to the study, are attributed to factors such as; lack of suitable harvesting methods, poor food handling techniques such as exposure of vegetables to the sun during transportation, lack of storage at farms, pilferage, lack of suitable roads and readily available transporting vessels. The study reveals that food losses are further worsened by limited capacity among smallholder farmers to invest in appropriate equipment, human resources, and storage infrastructure to properly handle fresh food from harvest to market stages in the chain. Figures 9 and 10 provide a summary of the losses in the fresh vegetable chain.

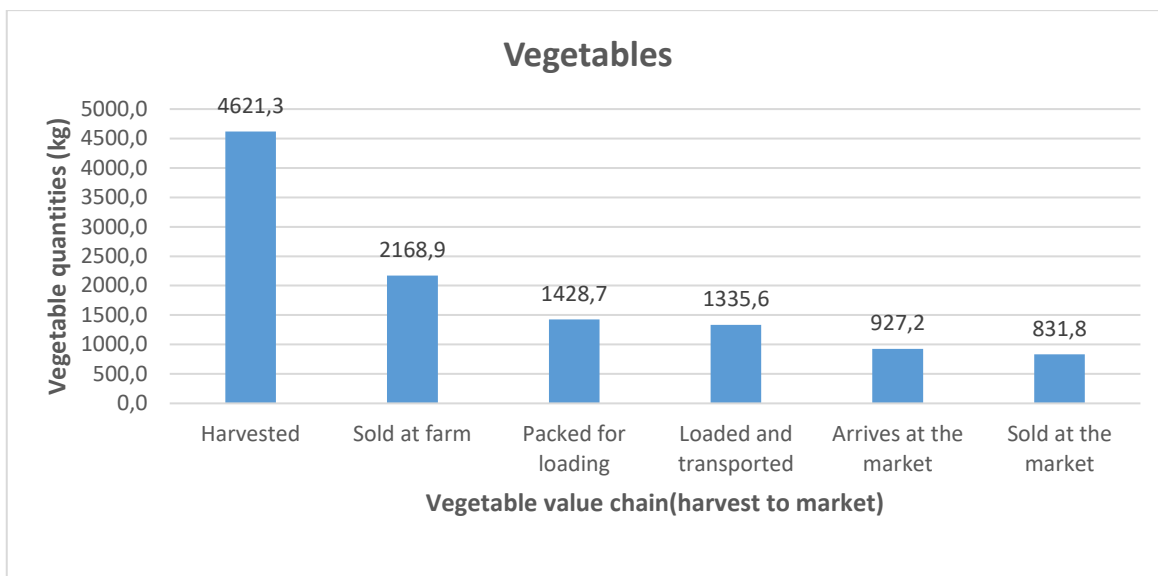


Figure 9: Fresh vegetable losses along the food value chain

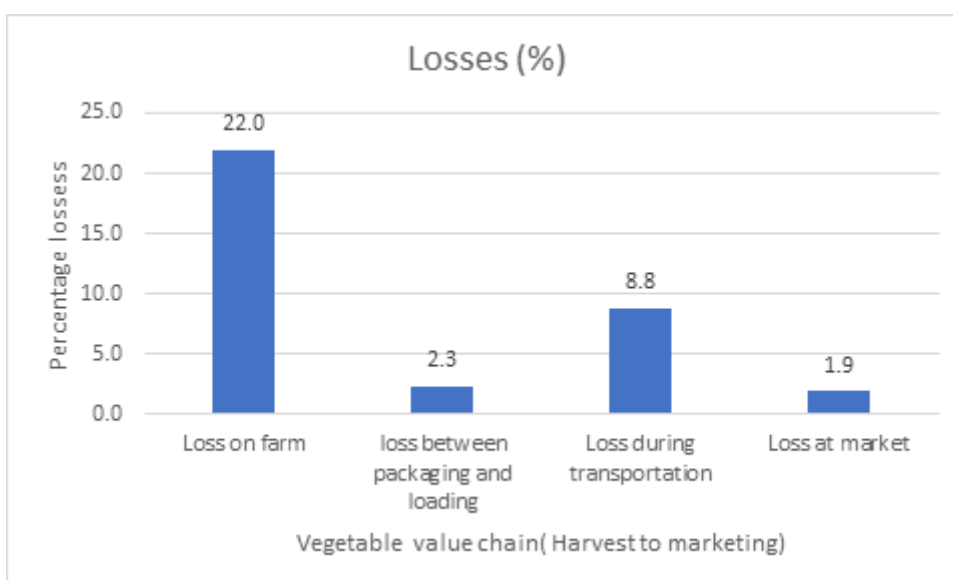


Figure 10 : Percentage losses in the vegetable value chain

Source: AfricitiesFood project, 2023

The study's findings show that although food is lost during each of the four stages of the food value chain, the harvest stage experiences the greatest losses. This indicates the need for more creative approaches at this point to ensure that food losses are kept to a minimum, resulting in a larger intake of nutrient-dense foods and greater financial rewards for all parties involved, particularly smallholder farmers. The farmers expressed concern over how bad weather contributes to higher losses, particularly for goods like tomatoes that spoil immediately on the field if they are wet or exposed to more sunlight. If there is no shelter to protect the product from the rain on the farm, the losses for green vegetables can easily quadruple.

ii) Tomatoes

Tomatoes are one of the widely utilized horticultural products in households and food businesses and hence extensively cultivated in Lusaka's city region. According to the study's findings, tomatoes are the second most dominant produce among Lusaka city region's small scale farmers. This indicates the potential profitability of the crop. However, they too incur losses at all stages of the food value chain. The study findings indicate that an overall sample average of 10, 186 Kgs of Tomatoes are harvested across the city region. As the fruit is harvested and taken to the market, the trend shows that losses are incurred along the four stages of the value chain under investigation. In the case of tomatoes, some of the crop is sold right at the farm and the findings are indicative that an average of 2, 168.9Kgs are sold at the farm. However, losses are incurred between the points of harvest, packaging and loading for transportation. An average total of 2,590.9 Kgs are lost on the farm due to a myriad of factors. This translates to 25.4% of the produce that is lost on the farm from the harvest. An additional loss of 177 Kgs (1.7%) is lost during packaging for loading of the produce for transportation. The study further indicates that from the average of 3,173 Kgs that are loaded and transported, there is a drop in the amount of produce that arrives at the market. A loss of 81 Kgs is incurred translating to a percentage of 0.8% loss during transportation leaving 3084 Kgs of tomatoes that arrive at the market. At the market findings show that the average amount of tomatoes that is finally sold for the fork are 2,633.7 Kgs. This therefore indicates that the tomatoes incur losses of 1.7% at the market bringing the total cumulative losses in the tomatoes value chain to 30%. The highest losses as indicated by the study occur on the farm and at the market. The losses are attributed to theft, low market demand, poor handling techniques especially at farm and loading stages and long hours of heat exposure. Figures 11 and 12 show an infographic representation of the findings in terms on average and percentage losses respectively.

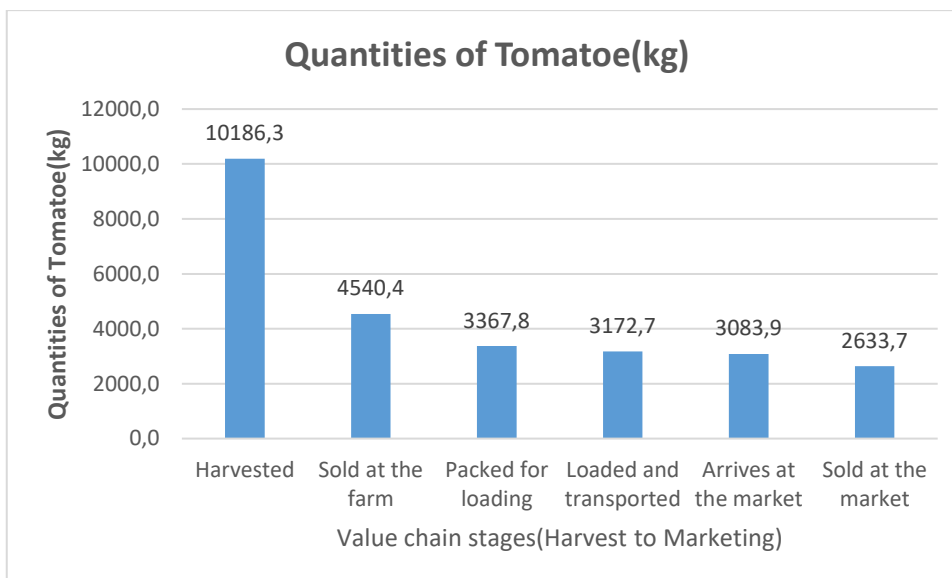


Figure 11: Losses along the tomato food value chain Source: AfricitiesFood project, 2023

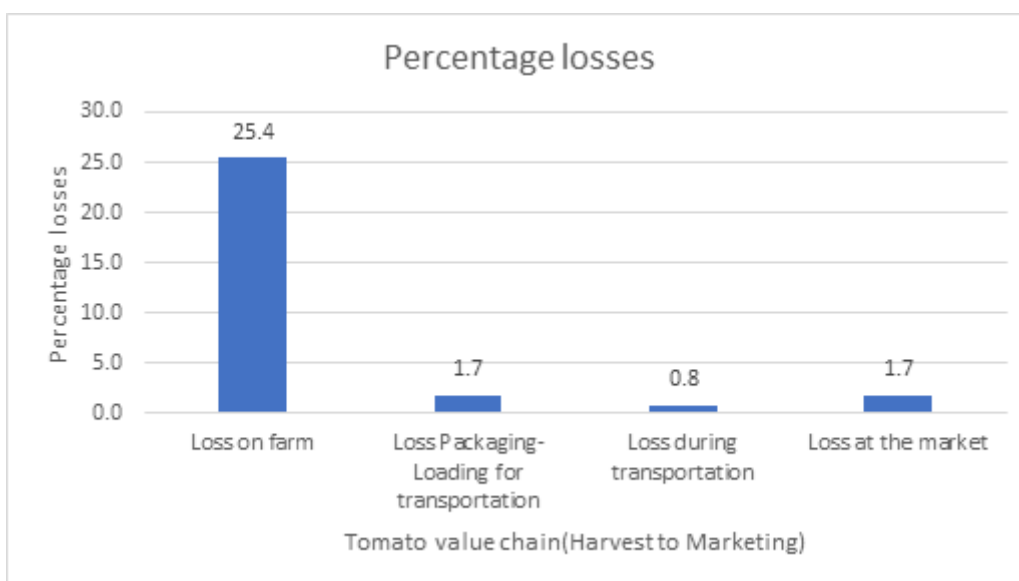


Figure 12: Percentage losses in the tomatoe value chain Source: AfricitiesFood project, 2023

iii) Meat

Findings indicate that with meat, losses are incurred at all stages of the food value chain. While an average of 5,412 Kgs are harvested, a portion of this, 2,663 Kgs are sold at the farm to off takers and individual buyers. However, there is a loss on farm of 269 Kgs (5%) that is recorded. Between harvest, packaging and loading points, an average of 45 Kgs of meat are lost representing a percentage loss of 1%. Findings further indicate that on average, a loss of 4Kgs (0.07%) of meat is lost during transportation. A percentage loss of 1.1% is further incurred at the market representing an average of 59Kgs. Therefore, losses are similarly incurred throughout the value chain with most of these happening at harvest and market stages respectively. In total, findings show that in the meat value chain, from the average weight of 5,472 Kgs of meat that are harvested, only 2,432Kgs make it to the

market due the losses incurred along the value chain. This then represents a total percentage loss of 7% in the meat value chain. Interventions therefore are oriented towards the farm and the market where losses are highest. Figures 13 and 14 show the trends in losses in average figures and percentages. The drivers of the food losses are driven by high incidents of theft, poor supervision, lack of packaging and adequate storage facilities.

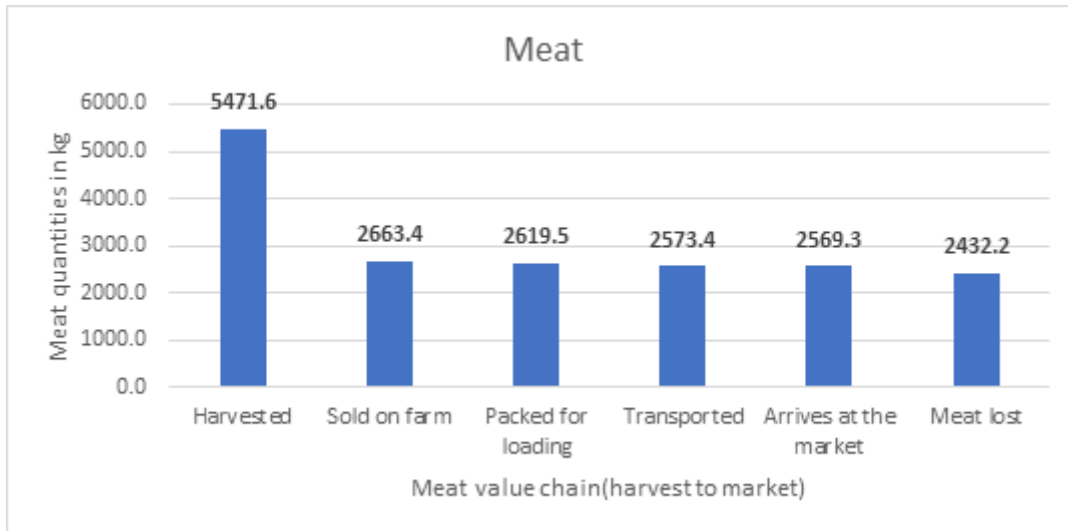


Figure 13 : Average Meat losses along the food value chain. Source: AfricitiesFood project, 2023

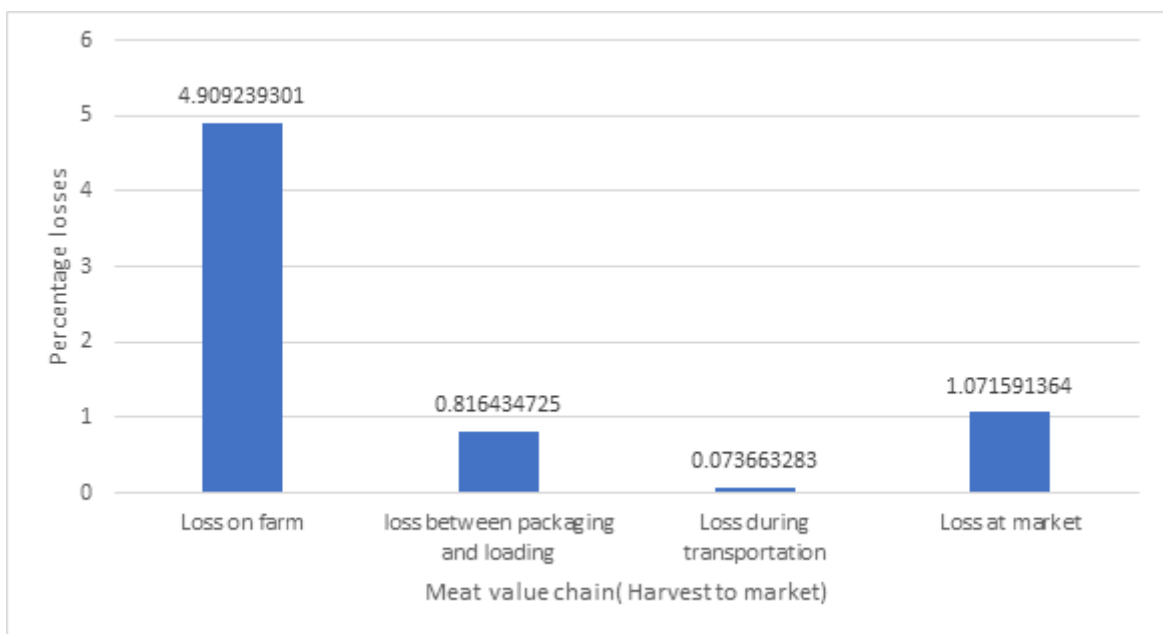


Figure 14: Percentage losses in the meat value chain Source: AfricitiesFood project, 2023

iv) Milk

Data on milk indicated that there are losses along the food value chain culminating to a total percentage loss of 22% in the Lusaka city region. From an average harvested amount of 1,809.0 Litres of milk harvested, 1,625 litres are sold at the farm. However, dairy farmers still incur losses of 233 litres representing an percentage loss of 13% on the farm. An additional loss of 0.12 % is incurred between packaging and loading. This represents an

average of 2.2 liters. Losses are further incurred during transportation. The study findings show that an average of 68litres is lost during transportation representing a percentage loss of 3.8%. At the market, 92 litres of milk are lost representing 5% percentage losses. The picture that is shown by the research finding therefore is that at all nodes of investigation in the milk value chain, food is lost with most of the losses occurring on the farm at harvest stage. Graphical representation of this is given in Figure 15. Losses in milk products are attributed to insufficient storage, spillage, and diseases such as mastitis on the cows which drastically reduces milk volumes, theft and improper handling of the milk product. In the milk value chain, findings indicate that the major drivers of food loss are disease burden in the dairy cows, spillage during the post-harvest processes as well as transportation and a lack of suitable infrastructure to provide a conducive environment for the fresh milk. In addition, poor or little knowledge on food preservation techniques has been identified as a driver. Figures 15 and 16 show summary losses in the milk value chain.

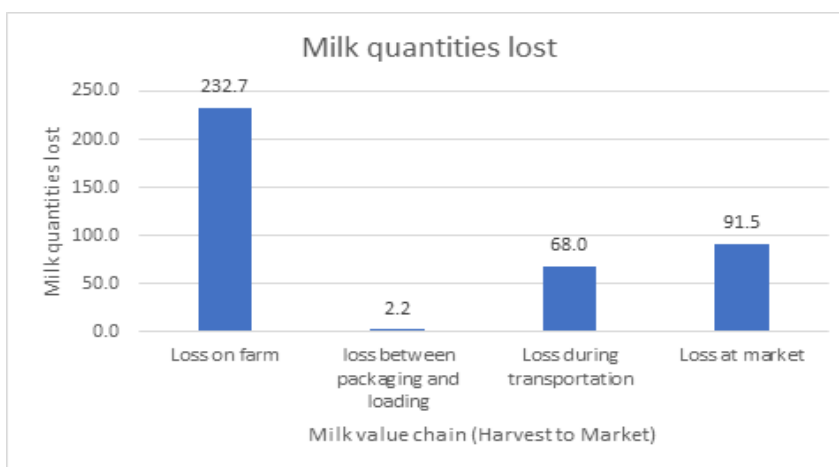


Figure 15: Graphical representation of average findings along the milk value chain



Figure 16: Percentage losses along the milk value chain

7.4 Comparative views on fresh food losses in Lusaka city region

Drivers of food loss categorized by stage of the food value chain and type of fresh food product

In line with the first objectives, the study is indicative that the food loss is driven by various factors at different stages of the food value chain. While some factors are product specific, others are clearly cross cutting.

Tomatoes

Tomatoes are a by nature very fragile especially when fully ripened. The drivers of losses in the study are identified as early as the harvest stage and are attributed to mainly poor handling of the crop at harvest which caused the tomatoes to either be bruised, cracked or split. At farm level from the harvest to the bulking or transport point, the study indicates that laborers that are hired mishandle the tomatoes partly by throwing them roughly as they bulk because some laborers would like to achieve a certain target that is closely tied to the wages that are very given. Poor handling reduces both the aesthetic value and durability of the crop making it less marketable for the market or simply damaged and unfit for the market. The poor handling techniques are attributed to lack of supervision and necessary skill as most of the harvesters are engaged on a temporal, cheap labor basis as casual workers. This practice is not only common but also low-priced. Two other drivers of loss that were found to be unique to tomatoes are poor packaging methods and materials and the practice of harvesting overripe tomatoes. The ideal and recommended packaging mode is either wooden boxes or plastic crates. Tomatoes are often loaded onto an open van which makes tomatoes prone to damage. 18.4 % of respondents linked some tomatoes losses to poor packaging methodology during transportation. Furthermore, packaging overripe tomatoes at the bottom and the least ripe and firm tomatoes at the top is another cause of losses as the firm tomatoes exert pressure on the ripe tomatoes thereby damaging them.

The study also indicates that theft and pilferage of produce on farm, during transportation is a common driver of fresh food losses in the tomatoes value chain. Food loss was also attributed to weather and climatic conditions such as very hot temperatures. This coupled with long hours of exposure in the sun ripens the tomatoes easily and causes them to break. During the transportation stage, bad road infrastructure was identified as a driver of food loss in some regions as this mainly affects the time taken to transport the food produce to the market as the vehicle needs to move slowly. This however coupled with long hours of exposure of the produce to the sun which quickens the ripening and rotting process.

At the market, the major driver of losses in tomatoes is credited to oversupply. Due to its high profitability, the farming of tomatoes is highly engaged in. The study shows that due to this, there is often oversupply on the market as many tomatoes farmers bring their produce for sale. The oversupply and low demand at the market without storage for the tomatoes lead to the spoilage and therefore loss of tomatoes for farmers. While there is economic loss on the part of the farmer, nutrition is also lost on the part of the consumer at the market. There is evidence of the huge heaps of tomatoes discarded at the market. A lack of cold storage facilities at the market to preserve and prolong the shelf life of tomatoes therefore partially contributes to food losses in the tomatoes value chain.

Fresh vegetables – mishandling

Green leafy Vegetables are highly perishable. Being fragile, they are lost in many ways that include and mainly attributed to poor handling practices throughout the stages of the value chain. The study indicates that vegetables are lost by way of breakage, withering, crushing and bruising. Losses in vegetables begin right at the point of harvest. At the time of harvest, 35% indicate that losses on vegetables are a result of mishandling of the produce because of the harvesting methods used by the laborers who are the main actors making up the largest proportion of 78%. Lack of appropriate training and skills contributes to the large losses that are incurred. Inadequate storage contributes to the losses that are incurred. In the absence of adequate storage facilities, farmers make use of tree or bush shades to protect the harvest from the scorching sun that makes vegetables wither. 16.9% of respondents attributed losses to inadequate storage facilities. In some cases, respondents attributed losses to pilferage throughout the value chain constituting a total of 10% of the drivers at harvest. Subsequently, lead time from harvest to market is a major driver of losses and this aspect is attributed to by 6.9% of the respondents.

During transportation, losses were attributed to an unreliable mode of transportation. Most small-scale farmers do not own a transportation vehicle and rely on hired transportation or shared transportation modes. Due to this hired transportation, animals and crops are packed together with people and so this damages the produce. In the study, 26.7% of the respondents attributed the losses to unreliable transportation modes such as canters, bicycles and trucks and a very poor road networks between farms and markets. In most agrarian regions, transportation is not available on a daily basis and is scheduled to be available on some days. As a result of this, produce begins to spoil and gets lost by the time it gets transported or to the market. Bad weather was the second highest driver of losses at the transportation stage constituted 26.3% of the responses. Respondents claimed that during bad weather events such as floods in some areas, are impassable and this leads to delays in delivering the produce to the market. The produce will either not be fresh, withered or dried up hence the loss in food. Additionally, too much rainwater, it was said, causes vegetables to rot as they are in transit to the market.

18.4% of the respondents attributed the losses to poor packaging. Vegetables are poorly packaged in sacks before being transported to the markets. In an effort to increase the quantity packaged in one bag, vegetables are often pushed into the sack thereby creating breakages that are further rejected by customers at the markets and thrown at the dumpsite. 6.9% of the drivers are attributed to theft throughout the stages of the value chain.

Milk

While a myriad of drivers are responsible for food losses, the study indicates that the largest driver of milk losses is attributed to poor food handling techniques. Most respondents (35%) cited mishandling of the food produce as the major driver for milk losses. The mishandling ranges from preparation for harvest to actual harvest techniques and finally to packaging. This was largely attributed to a lack in skills among the hands on workers. This coupled with a lack of knowledge on milking techniques and handling of the animal, contributed to losses. The study revealed that some workers were not properly mentored on how best to prepare the animal for milking which may lead to the cow producing less milk. Furthermore, the lack of knowledge on best practices during harvesting such as cleaning of the cow's udders

before milking and the use of proper equipment often lead to the physical contamination of the milk which would later be rejected and recorded as a loss. In order to avert this physical contamination (fur and other solid particles in milk), it was imperative that workers make use of sieves and appropriate milking buckets specifically stainless steel buckets).

Another driver of milk losses identified by the study was the improper infrastructure, specifically the milking parlors. While some dairy farms had well-constructed shelters, the study found that some small-scale dairy farmers lacked the appropriate infrastructure in which to milk their cows. Milking cows in the open was responsible for the accumulation of dust particles in the milk. Milk was therefore found to be contaminated at several points during the harvesting. This coupled with poor hygiene standards of both the animal, environment and milking equipment led to the eventual loss in milk. The study recorded 0.3% of respondents who attributed milk losses to poor hygiene standards at harvest stage which also contaminated the milk and rendered it a loss. The aspect of hygiene was therefore closely related to mastitis, the largest driver in the milk value chain. Mastitis is a common and economically significant disease affecting dairy cattle. Mastitis was in areas like Palabana largely responsible for milk loss as there would be changes in the milk's appearance, such as clots, pus, or blood.

In addition, wrong milking time was responsible for some of the losses at harvest stage. While the recommended time of milking is in the early hours or late evenings, some farmers tended to milk their cows at a time when temperatures were high. This was responsible for some of the losses as some milk quantities would go bad before being transported to the market. In some cases milk loss was attributed to wrong cleaning materials such as strong detergents that would give the milk a particular distinct and undesirable smell. This milk would be rejected and accounted for as a loss. Inadequate labor on the farm was also cited as a driver. In the case of a lot of animals, fewer workers translates to slower milking time especially when manual milking is employed. By the time all the cows are milked, there are high chances of the first milk spoiling. Between the points of harvest and transportation, the lack of cold storage infrastructure for most small-scale dairy farmers is responsible for milk losses.

At post-harvest the study indicates that 24.1% of losses are attributed to poor hygiene practices. These practices include poor personal hygiene of the milk handlers and the lack of protective gear to wear during milking, inadequate cleaning and sanitization of the milk equipment, and inadequate quality and safety testing of the milk at post-harvest level. Transporting milk using unreliable transport services such as bicycles often leads to the spillages of milk and temperature fluctuations and contamination during transit. This is coupled with the bad road infrastructure and long distances to the markets that is characteristic of some farming areas such as Kanakantapa and Palabana. This is often exacerbated by harsh weather conditions in which roads get flooded and farmers are unable to take their produce to the farm in good time. The study also found that food preservation methods and knowledge are generally lacking and uncommon among the small scale dairy farmers therefore, milk that is not deemed fresh for the market is either discarded or consumed at farm level. 3.4 % of respondents further indicated poor management as a driver of losses at the arm level. To reduce losses, it is important to maintain the quality and safety of milk at the post-harvest stage, follow strict hygiene practices, invest in proper equipment, and adhere to food safety regulations and guidelines. Regular monitoring and quality control checks can help identify and rectify any issues in milk handling practices.

At the market stage, one of the major drivers is rejection of the milk due to the presence of antibiotics in the milk. Upon conducting tests on the milk, the study indicates that some quantities of milk are rejected and discarded because of contamination with antibiotics as well as low quality of milk in terms of fat content. In a few cases, the study revealed that some small-scale farmers mixed their milk with water to increase the milk content leading to the discarding of milk and its loss thereof. A lack of cold storage facilities at the market stage is also responsible for some of the losses that are incurred.

Meat

Meat protein constitutes a large part of an average Zambian's diet. In the meat value chain, losses at the farm level are attributed to spoilage to an inadequate and in some cases lack of cold storage facilities. Farm-level meat theft is a severe problem that can cause farmers to lose money and disrupt the food supply chain. Coupled with the lack of physical security, this contributes to losses in the meat value chain, high levels of theft and pilferage at harvest. At Post harvest, the study indicates that poor hygiene and handling practices are also a driver of food loss. The hygiene aspects cross cuts across the harvest and post-harvest stages. This may often lead to cross contamination, physical damage as well as rotting of the meat produced. The study further indicates that at post-harvest, 7% of the drivers are related to spoilage of the fresh produce. This is closely related to the humid weather conditions and a lack of proper cold storage units such as cold rooms or refrigeration units in the absence of which there are temperature fluctuations and spoilage. Meat produce is also prone to loss by biotic factors such as pests and rodents. At the transportation stage, loss of food is attributed to poor road conditions, bad weather, and long distances to the market as well as high transportation costs.

7.5 Summary of Factors with Percentage Breakdown by Stage.

The study is indicative that at each stage and for each produce, losses are incurred due to various reasons. While some drivers are case specific, some drivers are cross cutting and therefore would indicate the interventions need to be more focused on those. The major drivers of food loss are storage, both a lack of cold storage facilities at farm and the market as well as insufficient storage and lack of food shelters. This driver is prominent in all fresh food produce and cold storage in milk, meat, poultry, and fish produce. Theft and Pilferage of produce are another common factor that was widely connected to food loss in products such as fresh vegetables and tomatoes. It was also widely noted that in all fresh food produce, the aspect of food spoilage due to poor handling techniques was common. Most damages to food produce were to the fresh green leafy vegetables. This coupled with long hours of exposure to heat is a major driver of food loss. Other drivers of food loss are long distances to the markets. In the findings of the study, it was noted that most farmers take their food to Soweto market in Lusaka's Central Business District. However, since the food comes from the outer parts of Lusaka district and beyond as demonstrated on the farm distribution map, it is clear that the distances that have to be covered from the farm to the main open markets are quite long hence the long hours of exposure to the heat that eventually causes spoilage to the transported foods. By the time the produce reaches the market, there are further losses that are incurred by the farmer and there is a price reduction due to the loss of food quality or food aesthetics. There is no known service to collage the

food and achieve scale that warrants investments in food bulking and shared transportation costs.

7.6 Food loss drivers at various nodes across the food value chain

7.6.1 Harvest stage

At harvest stage, the study indicates that 29% of the food losses are as a result of food spoilage or damage mainly due to poor handling methods. This is the major driver of food losses recorded. The second largest driver that the study indicates at harvest stage is the inadequate and lack of storage facilities (13.1%). These include cold rooms for mainly the meat, milk and tomatoes and shelter for fresh vegetables. 12.4% of the drivers at harvest stage are attributed to inadequate human resources for harvesting the produce. As highlighted in the earlier sections, inadequate human resource at harvest can result in delays in harvesting produce and vegetables. Not harvesting crops like vegetables and tomatoes at the optimal time, may lead to over ripening or damaging of the produce. This may further cause produce to be susceptible to pests and diseases, leading to reduced quality and quantity hence loss. Workers may also damage the produce as they seek to reach their daily targets. Ultimately, this affects the quality of the harvest which is often rejected by buyers or consumers along the value chain. 11.3% of the food losses at harvest are attributed to lack of access to affordable equipment and tools that can be used in harvesting and ensure proper food handling. Unreliable transport services account for 10.1% of losses that are incurred at harvest stage. The study indicates that unreliable transportation services lead to delays in getting food products from the farm or production facility to the market or distribution center resulting in food items reaching their destination in less-than-optimal conditions, leading to spoilage, deterioration, or reduced shelf life. A lack of physical security is another driver of food loss uncovered by the study. This includes fences, security personnel, electric barriers and emergency response services. Most small scale farmers are unable to provide such forms of security for their farms and therefore are prone to issues such as theft or pilferage from intruders. The study indicates that 10% of the drivers are attributed to this. The study further points out theft and pilferage as a driver of food loss accounting for 8% of the drivers. Lastly, indicates that 7% of the drivers are attributed to lack of relevant knowledge and skill which are largely responsible for the improper handling methods that lead to food spoilage and loss.

7.6.2 Drivers of food loss at the post-harvest stage

The largest driver of food loss at post-harvest as indicated by the study is poor handling, hygiene and stacking practices. This driver cuts across all food produced under investigation. The study is indicative that meat, milk, green leafy vegetables and tomatoes are largely due to poor handling methods by casual laborer or farm workers. This driver is responsible for cross contamination of milk and meat, damaging and breakage of green leafy vegetables and breakage and damage of tomatoes. The poor handling also encompasses improper packaging, and grading of the fresh food produce. This accounts for 24% of the drivers of losses in the fresh food value chain. Theft at post-harvest is another driver accounting for 11.3%. Coupled with a lack of physical security, most farmers incur losses in their fresh produce. Food spoilage accounts for 7% of the losses that are incurred.

Lack of shelter for harvested produce accounts for 6.7% of the drivers of food loss. The adverse conditions such as rain and heat lead to accelerated deterioration of food quality. This tends to wilt harvested vegetables therefore reducing the lifespan and physical appeal of the vegetables hence loss. 6.3% of the drivers are attributed to improper cold storage facilities and 5% rodents, pests and insects attacks that lead to eventual losses. At post-harvest inadequate sorting and grading also lead to losses in food. The study finds that 5% of the losses are attributed to this factor. Packaging foods of different quality and physiological maturity produce often leads to rot spreading and reducing the appeal of the produce. Poor management accounts for 3% of the drivers at the post-harvest stage such as ineffective storage practices, improper food safety measures, poor communication and coordination of stakeholders at this stage. Other drivers are lack of knowledge on preservation and prolonging of fresh food shelf life. This driver accounts for 1% of the drivers at the post-harvest stage.

At the transportation stage, the largest driver of food loss that the study uncovered was the high cost of transportation at 27%. High transportation costs were found to discourage farmers from transporting the perishable fresh foods such as leafy vegetables, and dairy products over longer distances. This disinclination often results in limited market access for these products and eventual loss. Although uncommon, the study highlighted that as transportation costs increase, farmers opted to increase the price of the produce and onto consumers in the form of higher food prices. However, this often leads to reduced consumer purchases at the market leading to lower demand and eventual loss of produce. In addition, high transport costs lead to a lot of losses because farmers opted to go for cheaper yet inappropriate transportation vessels in which fresh produce would be trampled on by animals or humans leading to breakages, wilting and losses by the time the produce arrives at the market. Unnecessary roadblocks which represent 13% of the drivers mentioned in the study cause delays in getting to the market. This causes prolonged exposure of the fresh produce to the sun and harsh weather conditions eventually causing losses. Other related factors include delays in reaching the market due to traffic congestion (1.4%) long distances to the market (2.4%), lack of readily available transport (1.4%) vehicle breakdowns and corruption by traffic officers (0.5%) The third largest driver of losses at 11% at the transportation stage is linked to poor or bad roads which often cause transportation vehicles to get stuck during the rainy season and occasionally over turn tip dropping the food. This driver is closely coupled with bad weather conditions which were cited as taking up 7%. Inadequate transport vehicles to transport produce (4%) also compounds the aforementioned drivers. Lastly, theft of produce (0.9%) during transit was also uncovered as a factor in food loss.

At the market stage, the study is indicative that the major driver of food loss is over supply of the produce representing 37% of the drivers of food loss. Every year tonnes of fresh food produce such as tomatoes and fresh vegetables and fruits are lost due to this factor. When there is oversupply of a produce to the market, there is less demand and farmers therefore often do not manage to sell their produce in good time. Therefore, losses are incurred during this period. Bad weather was also cited in the study as the driver of food loss at the market. The heat and rain cause losses in that food like vegetables are withered, meat spoil especially with the lack of cold storage facilities at the market (6%). The study indicates that spoilage of food at the market is a driver of food loss representing 3.1% of the drivers. Spoilage in terms of damaged, bruised and wilted and broken produce as well as discolored produce. The study further indicted that similarly at the market state there are a number and

the study indicates that of inappropriate food handling methods that range from improper packaging, mishandling by customers and off loaders, low quality fresh foods which all led to eventual food losses. Theft is similar present at the market stage and the study indicates that at least 3% of the drivers of food lost the market stage are attributed to theft. Lack of storage facilities at 0.2% were also cited as a driver of food loss. The study indicates that 17% use vehicles as a form of storage. This is more common in tomatoes section where the tomatoes or sacks of vegetables are stored in the transportation vehicle until the produce has been sold. Only 9% indicated strong their produce in refrigerated vans or cold rooms. 4% stated that fresh food produce is stored in a shelter or shade at the market. 3% indicated that wooden boxes are utilized as storage while 2.4 stated that food is stored in the open area. 1% stated that they utilized cooler boxes, 1% stated that they used Deep freezers as storage. Other storage facilities indicated by the study are sacks (1.7%) cages (0.86%) and containers (0.86%). Figure 17 provides major drivers of food losses at each of the major nodes in the chain.

7.6.3 Major activities and actors along the food value chain

- a. **Harvest stage:** Findings further indicate that the harvesting process is dependent on maturity of produce and market demand as well as climatic conditions such as heat and rain. On days of extreme climatic conditions such as intense heat and heavy rains, 26% of respondents stated that they harvest their produce to avoid damage by the sun or rainfall. The majority (71%) of the respondents stated that the harvesting depends on maturity of produce. This is so because mature produce provides optimal yield and best quality. On the other hand, 47% harvest in accordance with the market demand for a particular produce. Findings further indicate that at this stage, farm labor is hired in a variety of modes of tenure, from short term harvest, to long term daily staff and farm managers. The study indicates that 78% of the actors at harvest stage are laborers and of this category, the study indicates that 31% is hired labor such as casual workers. In most cases family members assumed many of the roles for farm labor as it was considered cheaper and ensured efficiency in reducing loss of produce. Children and women are equally involved during harvest family members therefore represented 57% of the actors at harvest stage. Other identified actors at the harvest stage include individual farmers who consist of 24% of the actors at this stage, transporters making up 21%, Market agents at 19%. The least in terms of percentage composition of actors were out grower schemes and cooperative societies at 2.4% and 1.9% respectively. Most of the respondents sampled indicated that they spent 5 or more hours working on the farm with most of the working beginning early morning and a break off by mid-day. Early evenings were spent irrigating or sorting and packing for the market in the shade, in sacks and boxes, cold rooms or refrigerators if available.

The common drivers of food loss indicated at harvest stage included, food spoilage from improper food handling, inadequate labor required in comparison to harvest amounts, theft of harvested produce or just before harvest, lack of proper storage facilities (which include physical storage facilities to protect from weather elements of heat, rain, wind and theft and lack of supervision) as well as lack of mechanized storage facilities such as refrigerators and cold rooms. Storage facilities were also sourced at the farm at a short distance of 100 meters and the furthest storage being up to 10 kilometers away from the farm. This is indicative that returns from harvest produced may not be adequate to invest in storage facilities or have not been prioritized as an investment in farming activities in the region. Other highlighted challenges include inadequate supervisors and sometimes inadequate

time to remove or harvest all the produce. Losses are therefore sustained during harvest due to damage from heat, exposure to weather conditions such as rain or the cold. The majority of farmers, 688 indicated that the food loss is handled by either burning give or throwing away while smaller fractions indicated that they either resell at a cheaper price or feed livestock. A few mentioned giving to workers or using as manure at the farm.

Post-harvest stage: At this stage, findings indicate that there are a number of activities that are undertaken that range from sorting and grading, packaging, assembly and cleaning and finally the aspect of storing the produce before it is finally transported. The produce is typically packed in sacks or crates or canes and put under the shade of trees before transportation to the market. The majority of the farmers however alluded to the fact that they lack storage facilities at the farm and where storage facilities exist, conditions are bad and do not guarantee the preservation of the product in good form. Therefore, farmers protect their produce by merely covering them. While a few have small cold storage facilities for animal produce such as poultry and meat, even fewer have makeshift shades at their farms to store their produce. Most farmers attributed to the available storage facilities being located within 100m – 2000m while a smaller percentage indicated that the distance to the storage facilities is over 3km away from the harvesting point. It is worth noting that farmers specified that at post-harvest, there is no role that any NGO plays in helping them with management of their harvest. The major challenges that come with this therefore are damages and consequently food loss due to faulty loading or generally poor handling techniques during packaging, sorting and loading activities and to a larger extent the lack of storage facilities, theft, inadequate manpower and pest control. Although farmers employ selected methods to manage post-harvest losses such as training laborers in handling methods, post-harvest losses are still incurred and remain very high. The major actors at this stage include the farm owners, farm managers and laborers and primary transporters. The study indicates that the major actors at post-harvest stage are out-grower schemes at 98% followed by food and market agents at 96%. Out grower schemes were found to be present in the fresh food category as they helped farmers with access to a ready market and often helped farmers with technology and means to better increase their productivity. At 90% the study indicates that the local authorities and environmental Agency are some of the major actors at post-harvest stage whose main role is to ensure that land use is in accordance with the city region plans. At this stage, cooperative society were present as actors to assist farmers to access markets and financial empowerment of the farmers.

b. Transportation stage: At this stage, findings indicate that the produce is typically loaded onto transportation vehicles for conveyancing to the market. Findings indicate that the majority of farmers do not own their own transportation vessels and therefore rely on hired transportation such as trucks, small trucks and in rare cases, ox-carts, bicycles. In the unique case of milk, small scale farmers make use of bicycles to transport the milk to the collection centers. However, food loss is incurred due to spillages and mishandling of the milk produce as it gets transported to the market. In the rainy season, food loss is incurred by long hours of exposure outside a temperature-controlled environment which causes milk to become sour and is therefore treated as loss as it cannot be taken by the off taker. Type of roads ranged from gravel roads to tarred roads from the loading point to the open-air markets. Not only do the type of roads determine how safely the produce gets to the market but also how long before the produce can get to the market. A few farmers referred to delays

in getting to the market due to unnecessary police roadblocks that in turn cause the easily perishable fresh produce to wither and spoil before it gets to the market. The major actors as identified by the

Market stage: At the market stage, findings indicate that there are still losses that are incurred by the farmer by the time the produce reaches the market and through the lifespan of the produce. Most of the farmers taking their produce to the market come from far off places such as Chongwe, Kafue, Mumbwa, Chibombo, Chisamba, and garden house areas in Lusaka West. Pricing of the food produced to the market is determined by farmers in collaboration with the marketers and agents, depending on the prevailing market prices. The farmer in the hierarchy of decision making about price has little control while the food agent is highly influential and powerful. Price setting from the farm to the cooperative is done collectively based on the joint marketing and selling of an agreed product, but this is easily fixed by agents and farmers have no direct control of what gets to be agreed. Price is determined by factors such as the quality of a product (size, appearance, taste and even smell), other factors include demand, high supply of the same products by farmers and cooperatives, hoarding by storage facilities, competition with the same type of products produced in another country. In turn the socio-economic hierarchy is that the farmer is the one with the least decision-making power when it comes to market supply and price setting. At the market stage, the price is set by agents and not by the farmers and the smallholder farmers have to follow what is decided at the market.

It was established at the time of the study that interference from political factions is now (December 2021- February 2022) highly minimized compared to recent years and farmers are trading almost freely at open air markets. Allocation of trading space disclaimed by respondents to be equally free from manipulation and extortion. However, findings still indicate that there are some losses at the market stage that are incurred by the farmers, whether he or she sells own produce, or the produce is sold by the agents. Findings indicate that at the open-air market, food loss is mainly due to lack of storage facilities, poor service delivery, poor handling and lack of packaging and lack of care as well as consistent exposure of produce to the heat which causes food to deteriorate consequently causing a low demand for the produce which is no longer fresh. This implies that the farmer loses revenue depending on how much losses they incur. Suffice to say, marketers and market agents do employ some preservation techniques that allow for products to stay fresh for longer periods of even up to 3 days such as sprinkling with water and covering with tents. To recover from damaged produce to cushion some of the financial losses that could potentially be incurred, farmers and food agents reported selling the damaged produce at a cheaper price. As an attempt to lower production costs, the damaged produce is sometimes used as animal feed, used for compost, processed into other products such as sour milk, given to farm help as an incentive or completely disposed of through burning or waste disposal methods such as burying.

At the market, market agents who are described as individuals that sell the produce on behalf of the farmers are widely utilized by the farmers and are therefore among the major actors. Other major actors at this stage include local authority officials, farmers, middlemen, food agents and marketers. At this stage, NGOs, and the Government were seen as distant actors who played the role of learning and advocacy, and the role of government as regulatory at the market point. Beyond this, NGOs and governments were seen to have little

role to play at the farm stage, and only for a limited time at the market in the form of inspection and collection of levies.

Gravity of the issue- what is the scale of urban food loss in Lusaka?

Table 1 provides summary losses in each of the analysed chains while figure 17 provides summary table of the losses. Post-harvest losses in Lusaka is very high. As shown in table 1, in the four studied food products, the losses are highest in fresh leafy vegetables standing at 34.9 percent while tomatoes value chain stands at 29.7 percent. The third highest loss is recorded in the milk chain at 21.8 percent while the lowest losses is recorded in the meat value chain at 6.9 percent. The losses in these four food products attributed to several factors including poor food handling methods, climate and weather uncertainty, inadequate infrastructure at all the nodes of the chains and lack of skills and knowledge in appropriate food handling and packaging activities at all nodes in the chain. The high losses are also attributed to high number of actors and very long chain for the fresh vegetables and tomatoes.

<i>Food product</i>	<i>Aggregate Losses (%)</i>
<i>Tomatoes</i>	29.7
<i>Fresh leafy Vegetables</i>	34.9
<i>Fresh Meat</i>	6.9
<i>Fresh Milk</i>	21.8

Table 4: Aggregate food losses in Lusaka city region, AfricitiesFood Project, 2023

The food loss in the above food products include physical losses which involve weight lost between harvest and open air-market. The other loss includes loss of quality and physical appeal which involve deterioration and food brockages. Both physical and quality losses lead to loss in consumables and monetary gain from the lost food (Ward and Jefries, 2000). It should be noted that a large part of food is sold at the farm, implying that both retailers and wholesale food dealers follow the food to the farm. This accounted for over 10% of the total leafy vegetables and tomatoes produced in the city region of Lusaka.

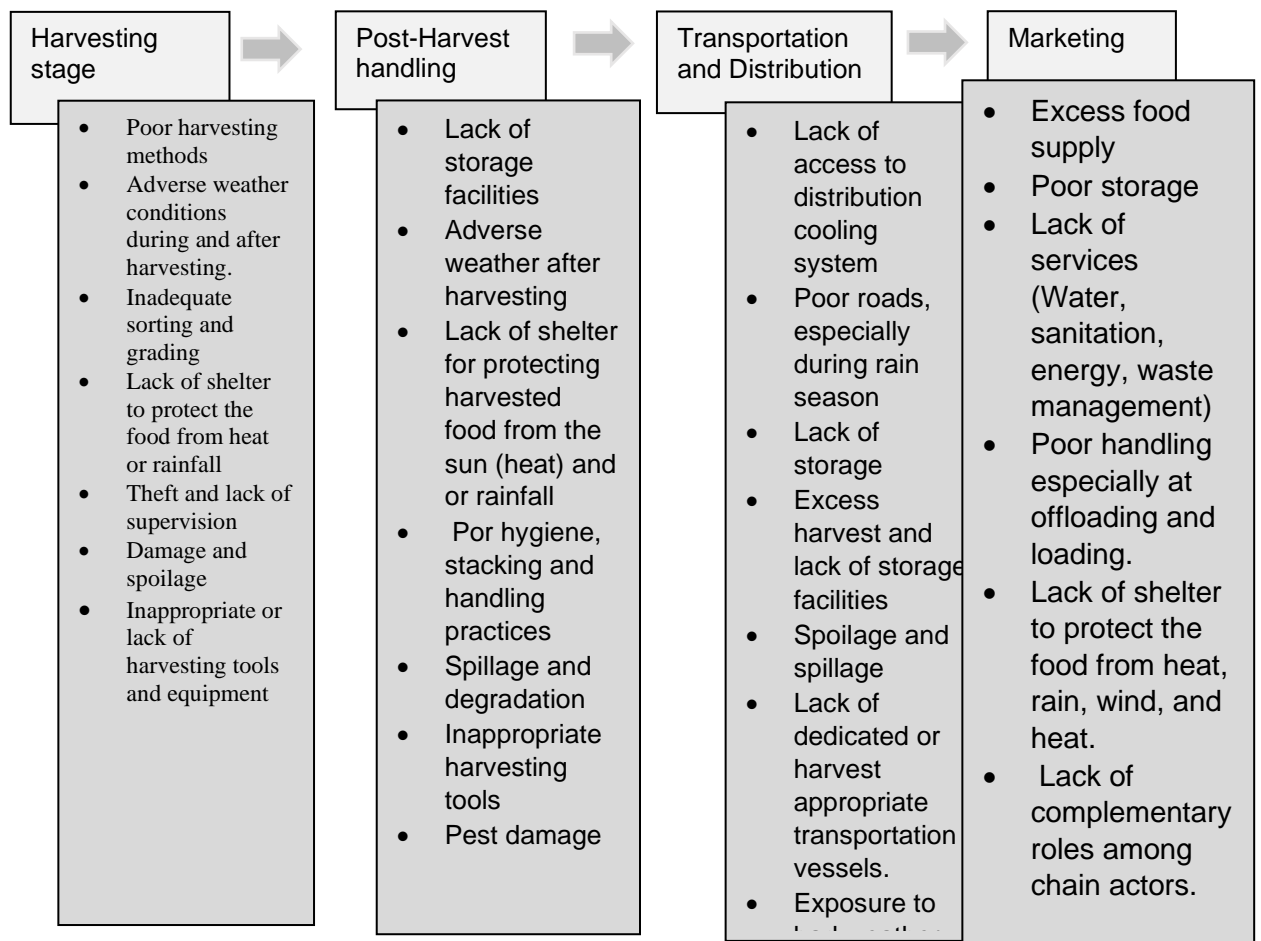


Figure 17: Food loss drivers along the chains in Lusaka city region food system, AfricitiesFood project, 2023

7.8. Impacts

8.1 Scientific impacts – now and in 5 years

- (i) During the entire life of the project, trans-disciplinary methods have been used in the generation, analysis and dissemination of data and information. The project documented the usefulness of such methods in analyzing the drivers of food loss in cities. The data shows that transdisciplinary methods are very useful in establishing nuanced analysed and understanding of the nature and drivers of food losses, build consensus on trial processes for innovation, and actual co-creation of solutions in urban food chains and in championing and centering the interest of farmers. The methods are useful in building just food chains, that include equitable participation of all genders and the other vulnerable groups. By centering all actors and actor relationships, the project has demonstrated the importance of moving beyond the sectoral approaches that tend to be biased Singular elements in food loss research.
- (ii) The study has contributed information and understanding on developing climate resilient food systems. So, far the data and analysis seem to indicate a direct link between climate uncertainty and food loss in urban food chains. This line of analysis has provided the links between climate change and food loss at farm, harvest, transport, and market stages, showing clearly how each stage is affected by lack of accessible and usable climate information for adaptation and resilience. More research is needed to draw strong conclusions about how climate change is driving increased food loss and waste in African urban food chains.
- (iii) The creation and expansion of new food loss prevention measures, innovations, and technologies. The project has used trials to develop innovations that could radically reduce food losses in urban agri food chains through low cost and low demand capacity developed focused solutions.
- (iv) The study has mapped food lows indicating losses and linking these losses to other aspects such as role of transport infrastructure, poor food governance arrangements and lack prioritization of food loss and waste in African urban food systems. We expect this study will form the basis for large scale studies on food loss and waste in the urban chains in Africa.
- (v) The Study has generated nuanced analysis of food loss and gender relationships in urban chains in Southern Africa. Gaps on gender diversity equity and social inclusion remains a major problem, especially at food market stage. This study has presented provoking data and information around gender and food loss linkages.
- (vi) The study used innovative methods to implement trial studies, gap filling and scenario building on multiple issues around the future of food loss in Southern African city regions. These methods were applied for the very first time by the research team. The resultant impact has been capacity development on these impact focused research processes. The team has developed skills on back-casting processes to build scenarios, do gap analysis in the initial project data and develop trial solution within the life of a two-year project.
- (vii) The study has attempted to analyze corruption and manipulation in food actor relationships at open-air markets. We centered this analysis on Soweto. Soweto is among the most difficult markets to be properly studied dues to political nature of the space, highly interweaved relationships between formal and informal

actors and highly ambiguous nature of socio-economic activities. We have developed methods of engaging deeply while creating value for all actors involved.

- (viii) The project has clearly demonstrated the importance of keeping all relevant actors fully informed during the entire research process. We maintained a sustained stakeholder engagements involving all key stakeholder and ensuring mutual gain and a shared sense of responsibility in the research processes. Thus, stakeholders gained a lot of confidence in the methodologies, research process and this made them develop a high sense of ownership, thus, making trialing feasible and sustainability of the trials possible beyond the lifetime of this project. We built the confidence of all key stakeholders, especially smallholder farmers.
- (ix) Further, Hivos International is expected to continue to include food loss and food waste in its new projects including in the HealthyFoodAfrica¹. Other aspects of the AfricitiesFood project will be incorporated in the Urban Futures² project and the AfriFOODlinks³ project. Hivos is continuing with some major elements in the AfricitiesFood project.

8.2 Capacity impacts – now and in 5 years

The trial activities conducted in the three trial areas have enhanced the understanding of key matters within the food value chain among stakeholders. For instance, among dairy farmers, there has been a noticeable increase in awareness regarding hygiene practices, including the cleanliness of the milking area, the milking process, quarantine protocols for mastitis cases, measures to control mastitis, packaging, transportation, and ensuring timely delivery to the milk center. The study has shown that individuals' abilities to manage animals during the milking process have also seen improvement. These newfound knowledge and skills have been put into practice by participating stakeholders and have proven to be beneficial.

The project involved two students. One was a PhD candidate who has written a doctoral thesis based on the project methodologies and data. The second is a masters student who has written a masters dissertation on tomato value chains by analysing tomato losses in Soweto food market. We expect that these two young scholars will emerge as future leaders in food systems and food loss research in urban food chains in Africa in next five years. Further, the project manager for this project has been awarded the ACIAR John Allwright Fellowship (JAF) for 2024. Her proposed research topic is on food loss and climate change nexus in urban agri-chains in Africa. This will be a significant capacity development issue. We expect the University of Zambia to develop significant capacity in food loss and climate change research in the next five to ten years.

¹HealthFoodAfrica is taking the food systems approach and food loss is a key aspect of it- <https://healthyfodafrica.eu/>

² Project is focused on youth, gender and urban food systems- <https://hivos.org/program/urban-futures/>

³ AfriFOODLinks project is seeking to generate learning and better policies on rural-urban food relationships in Africa - <https://afrifoodlinks.org/about/>

8.3 Community impacts – now and in 5 years

8.3.1 Economic impacts

During the project trials, there was a substantial decrease in vegetable losses. These losses were primarily attributed to improper handling from harvest to packaging. Farmers have improved their productivity and resilience by adopting new packing techniques, such as using plastic crates to prevent vegetable damage. This has translated into economic benefits, including higher income from their produce.

In the case of the milk value chain, the project trials demonstrated reduced losses and increased milk quantities available for sale. Farmers have embraced new hygiene practices and acquired simple equipment to boost milk productivity while minimizing losses. Average milk production has significantly risen, resulting in greater economic gains for the farmers. Moreover, farmers in the Palabana cooperative have improved milk quality and negotiated higher prices with milk buyers, underscoring the project's positive economic impact.

The project has also encouraged dairy cooperative farmers to explore value addition by producing dairy products like yogurt and cheese. Additionally, at the market stage, the project has initiated discussions for policy changes to promote gender mainstream.

The economic impacts have largely been based on smallholder farmers adopting trials that were able to reduce losses and increase revenue from their produce. The trials are highly likely to be adopted at a large scale and more farmers are likely to increase their revenue from their farming activities. Secondly, the Mzuzu team gained knowledge about own feed making, thus cutting down costs very significantly.

8.3.2 Social impacts

Social impacts refer to changes in equity, culture, health, gender roles, and the religious, political, ethnic, or demographic status of an individual or community gender equity in markets refer to Soweto training,

There has been an increased participation of community members and farmers alongside government and civil society actors in the chains. The involvement and willingness of various factors such as low-income food marketers and smallholder farmers and the high levels of cooperation by the people interviewed shows a positive reception of the project objectives and also shows the significance of food loss among stakeholders. There is a marked increase in the confidence levels among farmers, and they are able to clearly articulate issues, propose solutions and look for partners to address the issues. In addition, findings are deeply appreciated by stakeholders and more social relationships and bridges among actors have been built already through site specific trials and issue dissection. Stakeholders, especially farmers and marketer's views after presentation of initial project findings were instrumental in identifying the data gaps and formulating the second data collection tool. There has also been an increase in the participation of women in the project as some men opted to support their wives and take a back role. This was both during the data collection process as well as the call for upscaling of such innovations and willingness to participate. Further, the trials at Soweto generate initial steps on better relationships and more transparency between farmers and food agents. This has created a strong basis for municipal bylaws on gender inclusion and agent regulation at open air-markets in Zambia.

The project has impacted society in that gender has been agreed to be an important issue that can solve issues of food loss as woman at the core face of food in a home and are much more open to preservation for nutritional purposes. While this has always been at the

back of people minds the project has brought the urgency of prioritizing women in this agenda. Through the training, of trials, stakeholders agreed to come up with guidelines that will enable gender mainstreaming in the food loss agenda. Stakeholders attested to women being sidelines and the need to give them more leadership roles, although this did not fully happen during the life of the project, we envision this happening later as the local authority bought in to the idea of this at the open-air markets. There has further been consensus on equity, giving women opportunity to take up leadership roles and support them as such and also the need for mindset changes in the women towards taking up challenging and more leadership roles towards inclusivity along the food value chain.

While the introduction of bylaws is political and may take some time, it has been clearly demonstrated that there is political will on the part of the city through the mayor of Lusaka who has been supportive from the onset. This is an indicator that the project has had striking impact, and this is likely to be actualized. Further, the issues of gender, child labour are being highlighted and presented to authorities for intervention. Through the project there has been immense realization that food loss is also equal to waste and nutrition loss as much of the food that is destined for the market does not make it and therefore individuals are hindered from accessing the much-needed fresh food for their nutrition and good health. While the project and stakeholders hoped to establish a food bank in the life of the project in a slum, this has not been actualized but the pace has been set to have this actualized through the collaboration with other partners such as community organizations, specifically the Zambia Homeless and Poor People's Federation. This will provide food to people who struggle to afford it (Djan, 2023). A food bank is a non-profit facility that collects, stores, and distributes food to individuals and families in need thereby not only reducing losses but also reducing food insecurity and nutrition for the urban poor and vulnerable populations. The food bank it is hoped will thereby contribute to environmental management and finding solutions to high levels of malnutrition and hunger among vulnerable urban populations. The project is likely to generate increased appetite for large chain stores such as Shoprite, Pick and Pay to donate their expired foods to the vulnerable.

8.3.3 Environmental impacts

1. At the start of the project, the losses in terms of food at the largest open air market dumpsite was huge. The heap of food lost and dumped was a combination of mostly tomatoes that has been crushed, damaged during transportation and or discarded due to oversupply and low demand for the product. Other food products consisted of fresh leafy vegetables and fruits. By the end of the two-year project, there was evidently less food loss at the dumpsite. Through constant one on one engagements with the Soweto market stakeholders and local authority personnel, the project fostered dialogue and raised awareness among farmers, traders and agents on the topic of food loss. It was evident that the stakeholders were informally spreading lessons and the need to better manage food waste. In this way losses reduced at an individual level and consequently reducing the environmental burden of the food loss on the environment particularly the land and air through reduced methane emissions. The project has further directly through its engagements and information influenced the local authority in terms of waste management as there has been a constant clean up in order to save the environment. When our partners and stakeholders toured the market, the local authorities seemed to develop a habit of ensuring clean environments and this has continued. If sustained, this could be a major breakthrough to waste management at markets. Further, the idea of setting up food banks has been welcomed under the department of community development. Through the project dialogues, individuals have been encouraged to find alternative uses for lost food and waste, discussions have centered around recovering the food and using it to feed the vulnerable members of society, using lost food for making of compost manure and animal feed among others. These possibilities are

likely to be widely adopted at Kasisi Agricultural Training Centre. Through improved food handling training, the project has witnessed reduced food loss and its likely reduced contribution to climate change. There is improved understanding among the identified actors on the link between food loss and climate change.

8.4 Communication and dissemination activities

Information during the project has been disseminated through several stakeholder engagement activities and engagements. These have happened mainly through: FGD, workshops, groups meetings and one on one engagements. Over 40 dissemination activities through meetings, workshops, bilateral engagements, familiarization tours, trial meetings and survey feedback engagements, conferences and workshops have been undertaken. The following dissemination activities for the project were conducted:

Conference presentations at national and international levels.

The project was actively showcased at both national and international conferences. The initial conference was the cultiAf conference, with the theme focusing on productivity and resilience in food systems, held in Nairobi, Kenya. This conference brought together research teams from various African countries, including Kenya, Ethiopia, Uganda, Malawi, Mozambique, and Zimbabwe. At this event, the project introduced the AfricitiesFood Project and shared valuable insights derived from it. Representatives from organizations such as ACIAR, IDRC, Icipe, and academic institutions were also in attendance. The conference served as a platform to identify opportunities for collaboration and network with other participants. The project presentation raised questions about the high losses occurring during the harvest stage, leading to a refinement of the collected data. Additionally, the project leader framed a session on resilience and productivity.

The second international conference where the project received exposure was the 40th International Sociological Association World Congress in Australia. The theme of this conference was "Food and Nutrition Loss in Urban Agrifood Chains: Leveraging Lessons Learned from the AfricitiesFood Project to Address Food Loss in Lusaka, Zambia," within the session titled "Food System Shocks and Food Security Vulnerabilities: Moving Beyond Business as Usual." The project garnered interest for its insights originating from a region with limited contributions and for highlighting food loss as a significant issue. Attendees raised questions about how farmers cope with food losses and transportation challenges at the farm, as well as the challenges and measures in place for storage at the market to prevent food loss.

Moreover, the project was featured at the Zambia Institute of Planners conference, centered around the theme "Unlocking Barriers to Socio-Economic Development." In this context, the project delivered a presentation titled "Integrating Food in Urbanization Processes and Spatial planning," drawing upon insights from the AfricitiesFood Project in Zambia and Malawi. The conference was attended by the national President and Minister for Agriculture, Ministry for Local Government and Rural Development, Minister of Finance and National Planning, mayor of Livingstone city and several other very senior officials in Zambia and, officials from the Zimbabwe and Botswana Institutes of Planners.

The project progress report was presented to the Australian Higher Commissioner to Zimbabwe, Zambia, and Malawi. The High Commissioner was briefed about the project, and she gave warm remarks about the nature and impact of the project. In the end, the Project Leader was invited to join the Australian Alumni Network in Zambia and has been an active participant in the network's activities in Zambia. A brochure was published and shared with

the Australian ambassador to Zambia, highlighting the project's impact after its first year of implementation.

The final conference was a local closeout event, which brought together a wide range of stakeholders, including farmers, marketers, food agents, local authorities, government ministries, research institutions, and civil society organizations. This conference provided an opportunity to disseminate comprehensive information about the project's objectives, processes, and outcomes and recommendations. Participants raised questions about the sustainability of the trial outcomes beyond the project's funded phase and the potential for multi-actor collaborations. There was also a discussion about the need for a shift in the policies and practices of policymakers and farmers, with an emphasis on embracing improved food handling techniques during harvest. During this conference, the city government and individuals affirmed their commitment to continued engagement and the promotion of the project's positive impacts, as well as the adoption of beneficial innovations.

Face to face communication

Furthermore, the project conducted numerous in-person interactions with stakeholders, including district agricultural officers within the urban region, with a special emphasis on one-on-one engagements with DACO-CHONGWE, HIVOS, DACO Lusaka, and individual stakeholders. These meetings served the purpose of addressing inquiries, addressing concerns, and providing guidance on the next steps. It was through these face-to-face dialogues that the project not only gathered support from government line ministries in terms of establishing a structured farmer database but also received backing for advancing the project's objectives and trial results. Specifically, the District Agricultural Officer for Chongwe district committed to constructing a vegetable shelter for local farmers based on project data. Furthermore, the Mayor of the city of Lusaka made a resolute commitment to employ the project's findings to implement innovations aimed at reducing food loss and waste in the city. This dissemination approach proved highly effective in delving into the project's particulars and clarifying specific processes and outcomes. Additionally, a meeting was held with the Australian ambassador to Zambia to share the project progress and impact after a year of implementation with dialogue focusing on issues such as possible decentralization of markets, general reception of the project and future plans.

Digital communication

Utilizing digital channels, the project has been actively publicized through Twitter and the University's official website. This information has been disseminated to various entities, including ACIAR East and Southern Africa, IDRC, the University of Zambia, URAC Malawi, as well as certain individuals. Notable project milestones that have been spotlighted include the project's launch workshop. The noteworthy aspects shared encompass images from the status call, select dissemination events, and blog posts.

Print media

The project's introduction and promotion occurred through the utilization of the University of Zambia's newsletter at the project's outset, with the primary goal of engaging the academic community and affiliated institutions associated with the university. Additionally, a publication was established to publicize the project in an autonomous online newspaper known as the MAST newspaper.

Written communication

Blogs, articles, and a working paper have been created to ensure that information about the project is widely available and can be used as references. These materials are intended for

a broad audience, including but not limited to farmers, marketers, and various institutions. To keep stakeholders informed, reports from workshops have also been generated and shared regularly for ongoing project monitoring.

Through these dissemination efforts, it is evident that the project has had and continues to have a significant impact on both society at large and the various participants at different stages of the food value chain.

We have learnt that dissemination needed to expand to other platforms such as webinars, public discussions, mainstream media appearances and more conferences, among others. As part of the project's legacy, a PhD thesis and academic articles have been produced and will continue to be referenced and shared. Additionally, all datasets will be made publicly accessible on the UNZA and ACIAR websites.

Project videos

The project has created two distinct project videos: an animation video and a video documentary. The rationale behind utilizing animation for communicating project findings lies in its capacity for visual engagement, clarity, and simplicity. Through animation, the project has effectively conveyed the narrative surrounding food loss, its underlying causes, and potential solutions in a manner that is easily comprehensible and appealing, even to younger generations and individuals outside the academic sphere. This approach has the potential to enhance information retention and facilitate widespread sharing among various stakeholders. When published, these short videos will be made accessible on platforms such as YouTube and official institutional websites.

Furthermore, the project also produced a video documentary, which was presented at one of the conferences attended by stakeholders. The documentary proved to be an effective means of conveying the intricacies of the complex and extensive issue that the project was investigating. It offered a comprehensive perspective on the processes involved and the impact that the project had on the various stakeholders especially the farmers dealing with milk and vegetables as well as the market traders and agents.

Academic publications

Two papers have been drafted and will be submitted to peer reviewed journals by first quarter of 2024. We expect to publish a minimum of four papers and each paper is being led in authorship by different team members.

9. Conclusions and recommendations

9.1 Conclusions

Through the project, an increasing number of individuals, institutions both governmental and non-government began to really see food loss as a real issue and also an opportunity in terms of wasted resources and enhancing profitability, partnerships and collaborations in the urban-rural food chain.

The AfricitiesFood project has created and sustained a good momentum throughout its 2-year implementation period. The project facilitated a co-creation process for innovations to be trialed in three areas. The impact of the trials has been documented to be positive with increased knowledge, reduced losses and increased economic benefits.

The project has identified the impacts of gender imbalances and skewed social relationships on food losses. This needs to be communicated for action, especially at the markets.

Through farmer groups and cooperatives, individuals have demonstrated willingness to take up and implement the skills and knowledge acquired during the project trials to ensure sustainability. There has been an increased appetite for trainings such as the ones conducted during the project trials. This has also encouraged the strong collaborations among the stakeholders as a means to have change.

The project managed to a large extent to actively involve more government officials especially the District Agricultural Officers in the city region and food sections at the market associations for smallholder farmers and urban consumers, urban poor groups in telling the story about the findings.

The project has identified food banks as a key innovation in reducing the food losses and in promoting the social responsibilities by food handlers and dealers in the cities. Although this has not been actualized during the life of the project, the city government and local community organization have indicated willingness to pioneer this initiative in one of the informal settlements of Lusaka.

The project has pushed forward with strong recommendations on the need for recognition of market food agents, regularization and more transparency between farmers and the food and market agents. This is a very difficult issue to deal with and has been recognized as such by several actors in the food systems research in Lusaka region. The findings show that agents need to be better managed and farmers need to be more empowered to better participate in the food market space.

9.2 Recommendations

The project makes the following key recommendations:

- Scaling up capacity building and technological solutions to address food loss: Food handling, accessible and appropriate technologies such as yoghurt making, drying of tomatoes, vegetables and better packaging by cooperatives.
- Shifting minds and policies to address bias on productivity: Addressing food loss ensures productivity across the chains.

- Better infrastructure and markets: Decongest open air markets, improve hygiene at markets, and provide shelter for food bulking purposes.
- Improve market governance and gender mainstreaming across the chains: Review and realign the role of food agents, legislate, and enforce gender diversity equity and food agent regularization, strengthen farmer presence in the market and build systems for actors to deliver inclusive infrastructure and social systems for optimal performance of food systems in the study area, especially at open-air markets .
- Make climate information accessible to farmers – weather information and seasonal forecasts are critically important.

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List of reports and other publications produced by project

Food Loss Issue as an Area of Policy Need in Lusaka city region (working paper 1)

The Gender and Food Loss Nexus: A Case of the AfricitiesFood Project in Lusaka, Zambia

Short term impacts of Training in Reducing Milk Losses among members of Palabana Dairy Cooperative in Chongwe District of Zambia

Gender Relations in Open-Air Food Markets: Insights from the AfricitiesFood Project in Lusaka, Zambia (Blog)

Climate change and food losses in the Lusaka city region food system

Appendices

The project documents are found on the drive here:

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https://drive.google.com/drive/folders/1m26r0K45Gyo_nvOFeiUSpSB7PbqQ2NvH

Appendix 1:

Data base

Inception report

End of project report

Data collection tools

Focus Group Discussion minutes

Gap filling and foresighting minutes

Project Pictures

Summary analysis of results

Farm distribution maps

Food flow maps