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**Title: REALIZING A BLUE URBAN AGENDA FOR COASTAL CITIES IN KENYA
THROUGH SUSTAINABLE PRODUCTION AND CONSUMPTION POLICY AND
GOVERNANCE**

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LIST OF ABBREVIATIONS AND ACRONYMS

AI- Artificial intelligence

AFA- Agriculture and Food Authority

ARBE-Agriculture, Rural Development, Blue Economy and Sustainable Environment

ASDPD- Agricultural Sector...

AU- African Union

BAMX- Mexican Food Banking Network

BMUs-Beach Management Unit(s)

CAADP-Comprehensive Africa Agriculture Development Programme (CAADP)

CIDP- County integrated development plan

EU- European Union

EBRD- European Bank for Reconstruction and Development

FAO-Food and Agriculture Organization

FLW- Food loss and waste

FGDs- Focus group discussion(s)

GET- Green economy transition

GHG- Greenhouse gases

GoK- Government of Kenya

JKP- Jumuiya ya Kaunti za Pwani

KCEP- Kenya Crops Enhancement Programme

KEFRI-Kenya Forest Research Institute

KEPHIS- Kenya Plant Health Inspectorate Service

KEMFSED-Kenya Marine Fisheries and Socio-Economic Development MEAs- Multilateral Environment Agreements

MMF- Marginal Mixed Farming

NAGRIP-National Agricultural & Rural Inclusive Growth Project

NGOs-Non Governmental organizations

OECD- Organization for Economic Cooperation and Development

SCP- sustainable consumption and production

SDG- Sustainable development goal(s)

UK- United Kingdom

UNEP- United Nations Environment Programme

UNSD-United Nations Sustainable Development

USAID-United States Agency for International Development

USA-United States of America

WIO- Western Indian Ocean

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CHAPTER ONE

Introduction and Context

1.1 Introduction and context

The project on “*Realizing a Blue Urban Agenda for Coastal Cities in Kenya Through Sustainable Production and Consumption Policy and Governance*” addresses four (4) sectors in three project sites in Mombasa, Kwale and Kilifi counties. The sectors are agriculture and food processing, tourism and hospitality, construction and infrastructure, and environment and natural resources.

The **main aim** of this research project is to investigate how to integrate sustainable consumption and production (SCP) in Kenya’s coastal cities and urban areas, mainly through the coastal counties’ development plans, urban planning, legislation, regulatory frameworks, investments and policy decisions. In this regard, the research will analyze global, regional, and national and sub-national frameworks on SCP with a view to address policy, legal and institutional gaps and possible interventions. It will also seek to present good practices on how SCP policy and governance can support the development and implementation of the *Blue Urban Agenda* for Kenya’s coastal region, and also present possibilities for replication elsewhere in the Western Indian Ocean (WIO) region.

The goal of the project is to highlight the relevance of SCP policy and governance in developing and implementing a Blue Urban Agenda in Kenya coastal cities. The specific objectives are to:

- a) Identify the regulatory and governance gaps in the existing global, regional, national and sub-national policy framework on SCP in relation to the development and implementation of the Blue Urban Agenda;

- b) Investigate how to integrate SCP policies into coastal cities and urban areas' development plans, urban planning, legislation, regulatory frameworks, investments and policy decisions in the *Jumuia ya Kaunti za Pwani(JKP)* region;
- c) Present good practice examples of efforts and initiatives of coastal cities that are making tangible contributions towards implementing SCP; and
- d) Provide policy options and recommendations for developing and implementing the Blue Urban Agenda in the JKP region.

This report focuses on the Agriculture and Food Processing sector across the three project counties and sites, namely Mombasa, Kwale(Ukunda/Diani), and Kilifi(Malindi). It is therefore part of a larger study that covers the other three sectors of concern. It seeks to unpack sustainable agriculture in Kenya's coastal cities. Sustainable agriculture, in the context of SCP, ensures that the basic nutritional requirements of present and future generations are met, while providing a range of economic, social and environmental benefits. It provides durable employment, sufficient income, and decent living and working conditions for all those engaged in agricultural production. It maintains and, where possible, enhances the productive capacity of the natural resource base as a whole, and the regenerative capacity of renewable resources, without disrupting the functioning of basic ecological cycles and natural balances, destroying the socio-cultural attributes of rural communities, or causing contamination of the environment (UNEP, 2010)

CHAPTER TWO

Situation and Gap Analysis

2.1: Situational and Gap Analysis

2.1.2 Overview of Selected Project Sites

The project is focused on **three key locations: Mombasa City in Mombasa County, Ukunda/Diani municipality in Kwale County, and Malindi municipality in Kilifi County.** *Figure 1* presents the project sites.

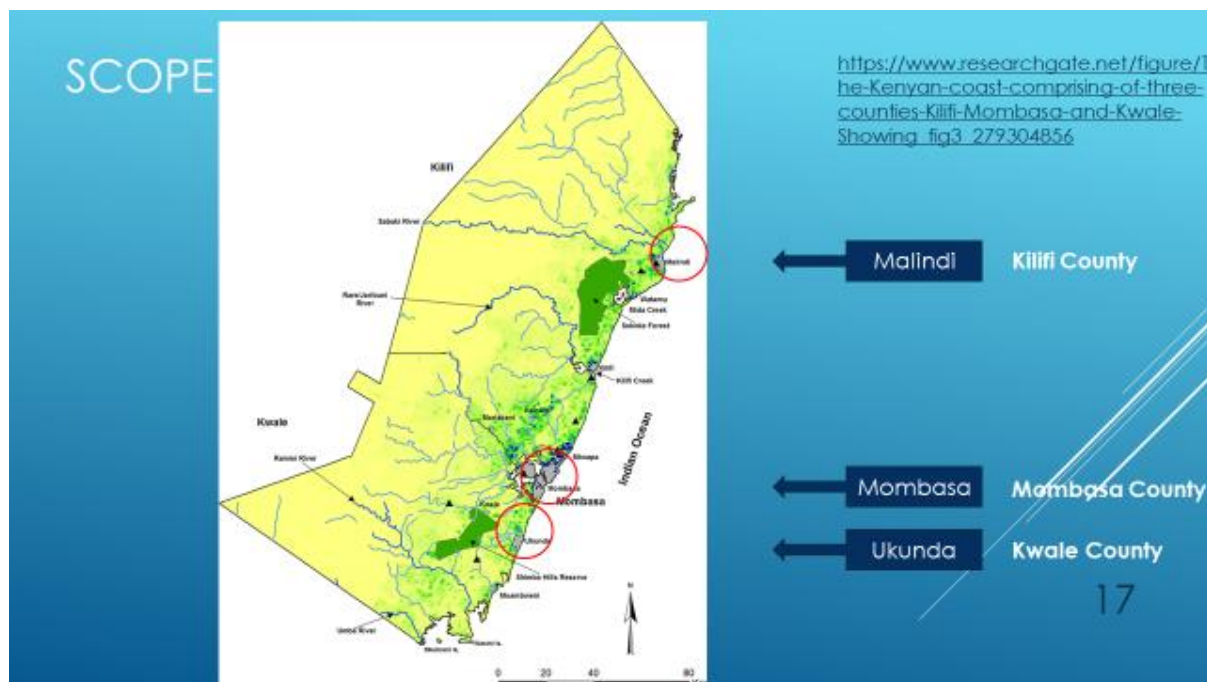


Figure 1.1: Project sites

As can be seen, the counties and sites of interest in this project are all within the *Jumuiya ya Kaunti za Pwani (JKP)*. Thus the choice of the project counties and sites was both strategic and pragmatic. However, of course the *JKP* has a national context, in which devolved units typically belong to regional economic blocks of proximate, geographical and sometimes cultural likeness.

Mombasa city has the highest urban population in the JKP region and significant levels of pressures from urbanization and economic activities. Although it is the smallest county in the country covering an area of just 294.7Km sq, 65 km long coastline and overall population of

1,208,000 as of 2019, it is also an economic hub for neighboring counties and mirrors the challenges of sustainable consumption and production in a rapidly urbanizing coastal city. The peri-urban areas of Mombasa present an opportunity for agriculture and food production, including vegetables, fruits, cereals, and animal production.

Ukunda/Diani Municipality in Kwale County is selected due to its increasing population and urbanization pressures against its pristine natural features that make it a major tourism hotspot. In this regard, the study aims to identify the conflicts between spatial expansion of town centers for tourism and other socio-economic activities, including peri-urban and hinterland agriculture and food production. It is a relatively small city/town compared to Mombasa and even Malindi. It has both scenic ocean and beach front and a rather pristine peri-urban hinterland with high agricultural potential including crop and animal product

Malindi Municipality in Kilifi County is selected due to its place as a major tourism hotspot, increasing commercial activities and urban sprawl and informal settlements. Malindi municipality has fine, long and expansive ocean front beaches that are pristine. However, it also has an expansive peri-urban area that has mixed uses including residential, crop farming and animal production, as well as eco-tourism potential. Of special interest in this report is crop farming including vegetables, fruits, cereals, and animal production primarily dairy, beef, mutton, and poultry

2.1.3 Overview of Agriculture and Food Production Across the Three Counties

The Agricultural Sector contributes over 31.3% of the country's Gross Domestic Product (GDP) and a further 27% through manufacturing, distribution and service sectors and accounted for 69.7% of the total export earnings. The Sector employs over 80% of Kenya's rural work force and provides more than 15.5% of formal employment (KNBS, 2018, GoK 2021: Agricultural Policy). . The sector also accounts for 65 per cent of Kenya's total exports and provides more than 18 per cent of formal employment. More than 70 per cent of informal employment is in the rural areas. The agricultural sector comprises six subsectors—industrial crops, food crops, horticulture, livestock, fisheries and forestry—and employs such factors of production as land, water and farmer

institutions (cooperatives, associations) (*GoK Agricultural Sector Development Strategy(ASDS) 2010-2020*). Food crops contribute 32 per cent of the AgGDP but only 0.5 per cent of exports, while the livestock subsector contributes 17 per cent of the AgGDP and 7 per cent of exports. Livestock and fisheries subsectors have huge potential for growth that has not been exploited (*GoK Agricultural Sector Development Strategy(ASDS) 2010-2020*). Overall marketed agricultural production increased from KES 413.2 billion in 2016 to KES 465.7 billion in 2019 with marketed crops accounting for 68.3% (GoK 2021: Agricultural Policy).

Moreover, land is the most important resource in agricultural production. Limited availability of productive land is a major constraint to increased agricultural production. Kenya has an area of about 587,000 km² out of which 11,000 km² is water. Of the remaining 576,000 km² landmass, only about 16 per cent is of high and medium agricultural potential with adequate and reliable rainfall. This potentially arable land is dominated by commercial agriculture with cropland occupying 31 per cent, grazing land 30 per cent, and forests 22 per cent. The rest of the land is used for game parks, urban centres, markets, homesteads and infrastructure. About 84 per cent of the country is arid or semi-arid and is not suitable for rain-fed farming due to low and erratic rainfall, though there is limited cultivation of some crops. The ASALs are used as rangelands by ranchers, agro pastoralists and pastoralists. Agricultural growth must be led by intensification and substitution towards more high value products, and expansion of the cultivated area through irrigation (*GoK Agricultural Sector Development Strategy(ASDS) 2010-2020*).

The JKP region, which is in the coastal lowland agro-ecological zone, is made up of 6 counties namely; Kwale, Mombasa, Kilifi, Tana River, Lamu and Taita Taveta altogether occupying approximately 79,968.1 km² area coverage and account collectively for 17% of the Kenyan population (KEFRI, 2016). An estimated 75% of the coastal areas of Kenya lies in the arid or semi-arid zone (Muli, 2013). Kenya's coastal land is 25% non-agricultural, 50% is suitable for ranching and 25% is suitable for crop farming (Waaijenberg,2000).

The main crops farmed in the agricultural areas are cashew nuts, sisal, cassava and millet, as well as coconut, mangoes and bixa among others. Overall, irrigation farming contributes a high percentage of the coastal agriculture, the main crops being sugarcane and rice. Majority of the

farming is rain-fed which means crop production is seasonal, where there is relative abundance of food during the rainy season and scarcity during the dry season. Moreover, many actors in agricultural value chains lack a “business mindset” and continue to engage in enterprises that offer little change in their levels of income. (GoK, Agricultural Policy 2021).



Figure 1.2 Coconut Trees in Kwale County (@ Mboce N, 2023)

Agricultural activities along the Kenyan coast produce both food and non-food products for subsistence and commerce, and traditional shifting cultivation and slash and burn farming practices are still common in some places. Livestock production contributes significantly to the Kenyan coastal economy, and there are at least 85 ranches within the coastal region, 25 of which are operational. Livestock production is mainly concentrated on the marginal land of the coastal region, which accounts for some 69 percent of the total coastal area. For example, the pastoral

communities in Tana River County graze large herds of cattle in the lower ridges of the Tana River basin, and often into the neighboring counties such as Kilifi. However, Kilifi and Kwale counties have significant livestock production.

The main food crops grown on the Kenyan coast include cassava, sweet potatoes, maize, coconut, cowpeas and rice, which are grown in irrigated areas, marshes and floodplains. Vegetables and tropical fruits such as citrus, mangoes, bananas, pineapples and watermelons are grown for both subsistence and export. Other crops, which are mainly grown for export, include cashews, bixa and sisal. The average farm size on the Kenyan coast is between 6 and 8 ha, and tree crops (cashews, coconuts, citrus and mangoes) occupy about 50 percent of the coastal arable land.(footnote/ reference)



Figure 1.3 Agro-forestry in Kwale County (@ Mboce N, 2021)

Coastal agriculture is usually undertaken in low-lying and saline-prone soils where spatial competition with urban growth is an increasing problem. This land is usually sandwiched between land and sea. Coastal agriculture is thus more susceptible to climate change and anthropogenic disturbance compared to inland farming systems, and this includes temperature changes, erratic rainfall, sea-level rise, salinity, tidal processes, water stresses, waterlogging and land use changes such as increased population and pollution. According to USAID (2018), a sea level rise of 30 cm

is estimated to threaten 17 percent (4,600 hectares) of Mombasa with inundation. This would greatly affect the limited available agricultural land for the coastal residents.

The coastal counties of Mombasa, Kwale and Kilifi have significant production and processing of agro products. These include food processing and distribution/retail, crop production and especially fruits and vegetables, horticulture, cereals, livestock and animal husbandry, meat products, fisheries, poultry, etc. Crop and animal production is especially found in Kilifi and Kwale counties, which also have a lot of agricultural space in urban, peri-urban and hinterland areas. Agro processing including milling, fruit processing, fish processing, water processing and packaging, among others, is most established in Mombasa city, with less such establishments in Malindi and Ukunda/Diani.

Just like in other ASAL areas of Kenya, irrigation plays a key role in agriculture in the coastal areas. The main sources of irrigation water are the rivers that pass through these areas. Irrigation of crops such as sugarcane and rice in the coastal areas have contributed to construction of a sugarcane factory in Kwale County and a rice miller in Tana Delta area. The main source of water for these irrigation activities are the surface water bodies such as rivers, shallow wells, springs, water pans, dams and boreholes.

In Kwale county, agriculture as a source of income accounts for 80.6% of all house household incomes. The sector employs about 62,681 in the county.¹

Kilifi county is classified as an arid and semi-arid area and 65% of Kilifi faces seasonal water shortage. Residents of those areas opt for rain water harvesting or depend on pans for regular supply of water for domestic and livestock use. The water pans however often dry up during the dry spells. The county has four main livelihood zones including 44% Marginal Mixed Farming (MMF) of the population, 22% cash cropping/dairy, 11% Mixed Farming and 2 % ranching. Other livelihood zones include 3% fishing and mangrove, 14% formal employment and 2% forest/tourism and casual labour. Main food crops grown in Kilifi include cassava, maize, cow

¹ Kwale County Government website
https://kwalecountygov.com/kwale/index.php?option=com_content&view=featured&Itemid=839

peas, rice, and green grams. Fruits such as mangoes and bananas are also grown, as are horticultural crops including cashew nuts and coconuts (Kilifi County, 2017).

The agricultural sector is a large consumer of the natural resource base, including land, forests and woodlands, water especially for irrigation, energy, and packaging material. It has high intake of inputs such as preservatives, fertilizers, and animal feeds. It has significant environmental impact including from agro chemical wastes from pesticides and herbicides, industrial discharges and fumes from food processing, food losses and wastes, throw away and food wastes, among others. As would be shown in subsequent sections post-harvest food losses both on farm and in the markets and other value chains are significant problems across the coastal counties of Mombasa, Kwale and Kilifi. It would be interesting to undertake a whole value chain analysis of agriculture and food production, and especially on food losses and wastes. It is noteworthy that there are major data gaps on Kenya's food loss and waste levels. In addition, most of the agricultural sector activities are regulated by law, policy and other governance frameworks.

2.1.4 Review of Relevant International and National SCP Relevant Legal, Policy and Other Governance Frameworks

2.1.4.1 International Instruments

Some of the international legal instruments relevant to SCP and agriculture and food production, including food loss and waste, are the FAO (2014) *Building a Common Vision for Sustainable Food and Agriculture*; FAO (2015) *Global Initiative on Food Loss and Waste*; and FAO 2019: *The State of Food and Agriculture*. FAO 2017: *Policy Measures for Managing Quality and Reducing Post Harvest Losses in Fresh Produce Supply Chains in South Asian Countries*, Rome. World Bank 2011: *Missing Food: The Case of post-harvest losses in Sub Saharan Africa*, World Bank. Other Operational Studies 2824, Washington DC; UNSD 2018: Goal 12, New York, USA, United Nations Statistics Division. In general, these frameworks are soft law in nature and do not have firm and binding commitments on agriculture and food production, as well as on food loss and waste. However, their policy orientation, especially on food loss and waste, are quite commendable.

Elsewhere, the African Union (AU) frameworks also address SCP in **agriculture** and food systems in general. The Department of Agriculture, Rural Development, Blue Economy and Sustainable Environment (ARBE) leads the efforts to promote sustainable environmental management and agricultural development by boosting member states' rural economy, development and agricultural transformation by supporting the adoption of measures, strategies, policies and programmes on agriculture. The Department promotes the implementation of Agenda 2063 continental frameworks such as , (CAADP); promoting agricultural and rural development, promoting policies and developing strategies and programmes to ensure food security and nutrition; helping member states to achieve sustainable growth and improved livelihoods through sound environmental and natural resources management, and promoting multilateral environmental agreements (MEAs), Land Policy Initiative, climate and disaster risk reduction, among others.

The African Union (AU) *Malabo Declaration*, adopted in June 2014 in Malabo, Equatorial Guinea, reaffirms previous commitments related to agriculture, food and nutrition. Among others, the AU Heads of State and Government recommitted to the principles and values of the CAADP process. They also committed to enhancing financial investments in agriculture, both public and private. In this regard they upheld the earlier commitment to allocate at least 10% of public expenditure to agriculture and to ensure its efficiency and effectiveness. On a commitment to end hunger, the *Declaration* states as follows:

“We commit to ending hunger in Africa by 2025, and to this end we resolve: a) to accelerate agricultural growth by at least doubling current agricultural productivity levels, by the year 2025. In doing so, we will create and enhance the necessary appropriate policy and institutional conditions and support systems to facilitate: • sustainable and reliable production and access to quality and affordable inputs (for crops, livestock, fisheries, amongst others) through, among other things, provision of ‘smart’ protection to smallholder agriculture; • supply of appropriate knowledge, information, and skills to users; • efficient and effective water management systems notably through irrigation; • suitable, reliable and affordable mechanization and energy supplies, amongst others.

b) to halve the current levels of Post-Harvest Losses, by the year 2025;

c) to integrate measures for increased agricultural productivity with social protection initiatives focusing on vulnerable social groups through committing targeted budget lines within our national budgets”.

The *Malabo Declaration* also committed African countries to ensure that by 2025 the agricultural growth and transformation process is inclusive and contributes at least 50% to the overall poverty reduction target; and to this end create and enhance the necessary appropriate policy, institutional and budgetary support and conditions: a) to sustain annual agricultural GDP growth of at least 6%; b) to establish and/or strengthen inclusive public-private partnerships for at least five (5) priority agricultural commodity value chains with strong linkage to smallholder agriculture; c) to create job opportunities for at least 30% of the youth in agricultural value chains; d) to support and facilitate preferential entry and participation for women and youth in gainful and attractive agri-business opportunities.

Therefore, the commitments by Africa to address sustainable agricultural production and food loss and waste were clearly made. The greater challenge is leaving up to the rather lofty commitments.

2.1.4.2 National frameworks

Kenya's *Poverty Reduction Strategy Paper* (PRSP) of 2001, *Economic Recovery Strategy (ERS) for Wealth and Employment Creation*, 2003-2007 and the *Kenya Vision 2030* ranked agriculture and rural development as the topmost Government priority, with food security listed as one of five key sub-sectors. The ERS was supported by the *Strategy for Revitalizing Agriculture (SRA)* 2004-2014 which evolved into the *Agriculture Sector Development Strategy ASDS* (2010-2020). The mission of the ASDS is to create an innovative, commercially-oriented and modern agriculture to ensure a food-secure and prosperous nation. The Vision 2030, under the economic

and social pillars emphasizes the enhancement of productivity of crops and livestock, incomes, and food security and nutrition. (*GoK: National Food and Nutrition Policy 2011, p 7*)

The Government's initiatives to revive the economy and the agricultural sector are fully in line with its international commitments and declarations to end hunger and extreme poverty, including at the World Food Summit of 1996, the United Nations Millennium Development Goals (MDGs), and the Comprehensive Africa Agriculture Development Programme (CAADP) 2002 (*GoK: National Food and Nutrition Policy 2011, p 7*)

Kenya Vision 2030 is the current long term development blueprint for the country. The *Kenya Vision 2030* is the country's development blue print covering 2008 to 2030 and whose primary goal is to transform the country to a newly industrializing "middle income country, providing a high quality of life for all its citizens by the year 2030." It aspires to foster achievement of the United Nation's Millennium Development Goals (MDGs) which have since transformed to the Sustainable Development Goals (SDGs). The Vision is based on three pillars: economic, social and political. Vision 2030 has identified agriculture as one of the key sectors to deliver the 10 per cent annual economic growth rate envisaged under the economic pillar, with the main emphasis being on transforming agricultural productivity and increasing value in agriculture. To achieve this growth, transforming smallholder agriculture from subsistence to an innovative, commercially oriented and modern agricultural sector is critical. This transformation will be accomplished through: Transforming key institutions in agriculture, livestock, forestry and wildlife to promote agricultural growth; Increasing productivity of crops, livestock and tree cover; Introducing land-use policies for better use of high- and medium-potential lands; Developing more irrigable areas in arid and semi-arid lands for both crops and livestock; Improving market access for smallholders through better supply chain management; Adding value to farm, livestock and forestry products before they reach local, regional and international markets. Vision 2030 has identified four major challenges that continue to face the agricultural sector:

Productivity. Productivity levels for many crops are below potential and for some agricultural produce yield and value over a 5-year period have either remained constant or are on the decline. Similarly, the production level for most fish and livestock products is below potential. Forest

cover and tree productivity have been on the decline while population growth has led to increased human–wildlife conflict.

Land use. Land in the high- and medium-potential areas as well as in arid and semiarid lands (ASALs) remains under-exploited for agricultural production. Much of the available cropland remains under-used with smallholders using only 60 per cent of their land for agricultural production.

Markets. The productivity of the agricultural sector is constrained by inefficiencies in the supply chain resulting from limited storage capacity, lack of post-harvest services and poor access to input markets. Vision 2030 calls for proactive efforts to maintain existing markets and create new ones to increase Kenya’s bargaining power in global agricultural markets.

Value addition. In agriculture, value addition determines the competitiveness of the country’s produce in world markets. However, Kenyan farmers export semi-processed, low-value produce, which accounts for 91 per cent of total agriculture-related exports. The limited ability to add value to agricultural produce coupled with high production costs make exports less competitive (*GoK Agricultural Sector Development Strategy(ASDS) 2010-2020*).

Other national policy frameworks include: National Agricultural Policy 2021; Agricultural Sector Development Strategy (ASDS, 2010-2020); National Food Safety Policy 2013, and its revised draft 2021; Veterinary Policy 2020; National Fisheries and Oceans Policy 2008; National Policy on Prevention of Anti-microbial Resistance; National Food and Nutrition Security Policy (2011); Kenya Health Policy 2014-2030 Agricultural Marketing Strategy (2023), and National Phytosanitary Policy 2022. These policy instruments deal generally with food production, food safety and nutrition security, but less directly with food waste and food losses.

The National Agricultural Policy 2021 provides an overview of key challenges constraining the development of agriculture across the country. These include: highly erratic and unpredictable rainfall in ASAL counties (84% of the country), a steady reduction of agricultural land; low agricultural production and productivity; poor marketing, low diversification in production, market uncertainties and low value addition to agricultural products; **high post-harvest losses** and unfavorable taxation and tax regimes. Other key challenges are ineffective and inefficient inter-sectoral linkages for development of agriculture; high cost of credit for investment in

agriculture; poor governance in farmer organizations and farmer cooperatives; fewer adherences to demand-driven research for agricultural development; ineffective research-extension-farmer linkages and inadequate insurance facilities to cushion farmers and fisher folk from production uncertainties. Moreover, the Agricultural Policy proposes interventions to address the challenges, including by providing guidelines to the National and County Governments regarding production and management of produce; specifying the different roles towards ensuring household and national food and nutrition security; food safety; **increasing agricultural production and productivity** through the use of appropriate good quality and affordable inputs; facilitating access to premium domestic, regional and international markets and while promoting agribusiness, value addition and product development.

Other measures outlined in the Policy include strengthening inter-governmental relations, agricultural institutions, developing institutional linkages and enhancing collaboration in order to create harmony and synergy in developing agricultural resources; harnessing resources for improved agricultural output in partnership with the private sector and introducing appropriate financing and insurance systems in the agricultural sector; promoting demand-driven research and timely dissemination of research findings in the agricultural sector and conserving biodiversity of different crops, livestock and fish.

The overall *Vision* of the Agricultural Policy is to achieve innovative, sustainable and commercially oriented crops, livestock and fisheries resources development and utilization, while the stated *Mission* is to facilitate the transformation of agriculture in Kenya from subsistence production to viable commercial enterprises. The goals of the Policy include: to transform crop, livestock and fisheries production into commercially oriented enterprises that ensures sustainable food and nutrition security, and to provide a framework for the support and intensification of cooperation and consultation between the National and County governments and among other stakeholders for enhanced development of crops, livestock and fisheries.

Nationally, and definitely also in the coastal region, high post-harvest food losses arise from inadequate technologies for product development and storage, poor infrastructure particularly rural access roads and high energy costs for cooling and processing facilities. (GoK Agricultural Policy 2021). Some of the stated objectives of the Policy is to reduce or minimize post-harvest

losses of agricultural produce and products, and to promote agribusiness, value addition and product development. The proposed policy interventions for both the national and county governments include to : increase investments in construction of post-harvest and transport infrastructure; promote Public-Private-Partnerships for post-harvest management; develop capacity of crops, livestock and fisheries value chain players in post-harvest management; promote the adoption of appropriate technologies that reduce post-harvest losses at community and household levels, and ensure reliable energy supply for post-harvest processing, handling and storage. In addition, national government is to enhance surveillance mechanisms to control introduction or spread of trans-boundary pests and diseases; and establish mechanisms for determining post-harvest losses along the crops, livestock and fisheries value chains. **County governments are to promote appropriate on farm storage and community commodity banking, as well as the evaluation and documentation of post- harvest losses.**

According to the Agricultural Policy 2021, production of crops, livestock and fisheries has been practiced by farmers and fisher-folk in the country for many years; however, productivity has remained low. The agricultural sector has suffered from production and productivity challenges, among them; variable weather due to effects of climate change, overreliance on rain-fed agriculture, declining soil fertility, poor inland transport and market infrastructure, poor food storage, pre-and post-harvest losses and use of inappropriate varieties, breeds, species and production technologies. Rapid degradation of land and water bodies, land sub- division and conversion of agricultural land to other uses, high cost of inputs, high incidences of pests and diseases, growth and spread of noxious and invasive weeds, inadequate extension services and frequent droughts and floods affect production and productivity. Inadequate resources for monitoring, control and surveillance of agricultural resources; low involvement of stakeholders in policy formulation, planning, implementation and management; poor resource use and trans-boundary conflicts are other diverse challenges that affect food production and productivity. The Policy also notes that soil is an important natural resource and maintenance of its fertility is a prerequisite for sustainable crop, livestock and fisheries production. Soil fertility depends on good agricultural practices. Extensive and intensive production of crops, poor soil and water management practices and rearing of livestock has over time led to low soil fertility and productivity. The situation has been worsened by minimal and inappropriate use of soil-health

restoration measures which has been attributed to the high cost of fertilizers and other soil amelioration products. In addition, there has been low adoption of other soil-health improvement practices such as use of farm yard manure and soil and water conservation measures.

Policy measures to improve production and productivity and thereby overcome the challenges highlighted above include for the national government and county governments to take measures to improve, intensify and diversify agricultural production and productivity to meet national food security and market requirements while promoting conservation, development and sustainable utilization of crop, livestock and fisheries resources; and to improve soil fertility for increased production and productivity based on good agricultural practices. Specific policy commitments include to: promote conservation, protection, development and sustainable management of agriculturally based biodiversity; support development of joint programs and foster cooperation within governments and regional partners in crops, livestock and fisheries research; develop strategies for joint early warning systems for disasters preparedness and control of weeds, diseases and pests; develop and harmonize policies and legislation for sustainable crop, livestock and fisheries resource management; promote the development of private sector led input supply including service provision production, processing, value addition and trade; promote adoption of conservation agriculture principles; promote use of efficient technologies to increase crop, livestock and fisheries production; promote sustainable soil management programmes to improve soil quality and increase productivity through appropriate integrated soil fertility management technologies; and provide mechanisms for utilization of all land irrespective of the agro-ecological zone in order to exploit the potential of the land resource throughout the country. The latter would invariably include coastal lands.

Moreover, the national government is committed to provide regulatory procedures for management of pests and diseases.; standards and legislation for soil health inputs, as well as targeted incentives to support production and productivity. The county governments will develop programmes to support targeted incentives to enhance production and productivity.

In 2010, the Agricultural Sector Development Strategy (ASDS 2010-2020) was developed and it provided a framework for progressive agricultural growth and development in the next 10 years

to 2020. It mainly aimed at transforming Agriculture into a modern and commercially viable Sector. The ASDS largely addresses agricultural and food production, and is aimed at developing and transforming the agricultural sector towards the achievement of Art 43 of the Constitution of Kenya 2010 especially as it regards right to food and nutrition.

The ASDS 2010-2020 acknowledges that one of the key governance frameworks in Kenya's agricultural sector is cooperatives. The cooperative movement has played an important role in agricultural development and in the economy. Agricultural cooperatives have helped in procurement of inputs, production, value addition and marketing. In the financial sector the cooperative movement through savings and credit cooperatives (SACCOs) has helped mobilize savings and provide credit to producers. Agricultural cooperatives form 46 per cent of all cooperative societies in the country. The cooperatives are member-owned and -operated organizations. The Ministry of Cooperative Development and Marketing provides the necessary legal and regulatory environment.

The *National Food and Nutrition Security Policy 2011* is largely focused on improving food and nutrition security in the country, helping realize the global "right to food". Food waste and losses directly undermine food and nutrition security and the universally accepted "right to food", which is a basic right for humankind, including children and women. The policy emphasis is on ensuring that all Kenyans throughout their lifecycle enjoy safe food in sufficient quality and quantity to satisfy their nutritional needs for optimal health. The Policy views food security as an issue of national security. It is noted that globally, food stock levels have been declining, thus underscoring the importance of supporting domestic production as well as diversification of food production and consumption (p.4). Moreover, the growing number of urban and peri-urban dwellers requires special focus to ensure adequate safe and nutritionally diverse diets for all. Also competing uses for agricultural land such as bio-fuel production, human settlement and leasing out of agricultural areas for export production are likely to affect food production, but interventions to ensure that food and nutrition security for all Kenyans remain the priority of the Government (p 5).

While the *Agricultural Sector Development Strategy (ASDS) 2010-2020* comprehensively addresses the many issues that determine domestic crop and animal production, the *National Food and Nutrition Security Policy 2011* helps to ensure that these efforts meaningfully address food availability and access concerns to improve the quantity and diversity of food to meet nutritional requirements. Amongst the key constraints that need to be addressed are: declining soil fertility and high input prices, losses due to pests and diseases, climate change, inappropriate land use and inadequate access to credit. Moreover, agricultural production systems in Kenya are largely rainfed, making them vulnerable to the threats of droughts and floods, despite great potential to increase the area under production. Expanded and purposefully linked agricultural and nutritional research and strengthened extension are needed to better develop and disseminate suitable technologies to sustainably address food security and nutrition (p 12).

Moreover, in view of the agro-ecological diversity of Kenya, different interventions are required to enhance production. In areas with relatively high production potential, where the highest absolute number of chronically food insecure live, continuous cultivation of soils, loss of forest cover and over-emphasis on maize production have led to a decline in soil fertility and yields. Production potential is often unexploited due to high input costs. Irrigation and water management techniques in these areas hold great potential for production. In Kenya's arid and semi-arid lands (ASALs), which comprise some 80% of the country and have the highest rate of food insecurity, natural resources are degraded by unsustainable land management practices. This has led to a significant loss of bio-diversity which has in turn adversely affected traditional sources of food, income and other basic needs of many rural communities (p 12).

Also, urban and peri-urban agriculture (crops and livestock) is increasingly being practiced and holds potential to improve food access and overall food security and nutrition conditions in these areas. However, to date, there has been inadequate support, guidance and concerted effort to develop this potential. Additionally, regulatory guidelines are required to ensure the safety and quality of food produced, sold and consumed in urban and peri-urban areas. inadequate support, guidance and concerted effort to develop this potential. Additionally, regulatory guidelines are required to ensure the safety and quality of food produced, sold and consumed in urban and peri-urban areas (p 12).

On the other hand, livestock productivity is affected by limited access to, or high cost of feed, veterinary services and other inputs. Poor infrastructure has increased transportation and storage costs for livestock inputs and many Kenyans cannot afford the price of milk, beef and other meat products. There is inadequate support for inland fisheries and aquaculture. Despite the vast potential for investment, the marine fishery has been low because of poor infrastructure and inadequate fishing technologies (p 12). Over the past few years, demand for land for various uses has been increasing. As a result, most of the urban areas have witnessed increased conversion of agricultural and livestock land into settlement areas (p 12).

Key policy interventions outlined to **improve domestic food production** include: i. Establish an Agricultural Development Fund that will focus on strategic issues and areas stipulated in vision 2030; ii. Increase funding to the food and agriculture sectors to 10% of the national budget; iii. Promote sustainable food production systems with particular attention to increasing soil fertility, agro-biodiversity, organic methods and proper range and livestock management practices; iv. Promote the production of nutrient-rich foods (crops, livestock, fisheries) by promoting diversification and exploring bio-fortification options; v. Promote and support sustainable irrigation and water management systems; vi. Support the role of markets and the private sector to provide agricultural inputs and financial services at affordable prices and favorable terms to farmers, pastoralists and fisherfolk; vii. Develop special programmes to support those experiencing food insecurity through targeted subsidization of critical production inputs using appropriate mechanisms; viii. Support and promote agro-forestry, afforestation and re-afforestation to enhance livelihood systems and Kenya's environmental resources; ix. Support investments in infrastructure, including roads, water, power, communications and markets, throughout Kenya to increase production; x. Promote integration of climate change adaptation in agricultural development programmes and policies; and xi. Improve forecasting of climatic change and support communities to respond to new opportunities and challenges. (p 13).

On storage and agro-processing, the key policy commitment is that the Government will initiate appropriate measures, including research, aimed at addressing post-harvest losses, food quality and safety including aflatoxin infestation (p14). In this regard, it is noted that a

significant proportion of the food produced is lost due to post-harvest spoilage and wastage, including in some cases from toxin causing micro-organisms. Losses are often substantial for grain and produce (fruits and vegetables) along with spoilage of animal products including milk, meat and fish. Losses of stored maize are estimated to be a staggering 30-40% per annum (p 14). There is little on-farm and off-farm processing of products in rural areas. Kenya lacks sufficient infrastructure for effective transport, storage, refinement, preservation, distribution and marketing of many foodstuffs (p 14). Specific policy interventions include: i. Promote and support safe and effective storage of foodstuffs by the private sector at national, county, community and household levels; ii. Put in place measures that facilitate renting of underutilized public storage facilities; iii. Enhance the capacity of the institutions involved in product development, standards establishment and monitoring of quality; and iv. Promote safe, small-scale rural and home processing and preservation of various foods, including livestock and fishery products, grains and produce (p 14).

On access to and quality of markets, poor physical infrastructure limits efficient food distribution and market access by farmers in areas with excess production. From the consumer perspective, many rural communities are cut off from food supplies and face high food prices. Emphasis should be on supplying local markets through local food production with a view to ensuring year-round availability of fresh and diversified foods, limit transactions costs and provide a reliable market to local farmers. Market space and facilities to handle food products in many markets in both urban and rural areas are insufficient, resulting in high levels of waste and spoilage. Many markets have insufficient management and maintenance, although county governments routinely collect fees or levies. Despite recent improvements, market information systems remain inadequate to serve the needs of various users of agricultural information. In this regard, key policy interventions include: i. Support investment in infrastructure to enable food to move quickly and at reasonable costs within local areas and from food surplus to deficit areas; ii. Enhance farmer access to timely market information services; iii. Support the establishment and strengthening of warehouse receipt systems and agricultural commodity exchange iv. Ensure that the urban development plans provide for additional and better functioning wholesale and retail markets; and v. Ensure that counties invest an appropriate proportion of the revenue collections on market infrastructure development. (p 15).

On food trade, it is acknowledged that trade in agricultural commodities is a major determinant of national food security. With rapid population increase, declining per capita production and self-sufficiency, urbanization and changing eating habits, food imports have become increasingly important in ensuring food and nutrition security in Kenya as consumers have benefited from inexpensive and a wide range of imported food and food products. Imports increased significantly after the introduction of market reforms in Kenya. There are fears that food imports from developed countries where producers are heavily subsidized may displace local production. This distortion may also occur in the case of regional food imports. Official and informal cross-border trade with the neighbouring countries is common. Enhanced trade in food products among the EAC and COMESA member States will ensure regional food self-sufficiency, provided food safety is ensured. Following Government actions to improve regional food trade, the major challenges for Kenyan farmers is to reduce the cost of their production and develop marketing arrangements to make farm products competitive. (p 15).

Specific policy interventions to address the challenges facing food trade and ensure a predictable supply of commercial food imports include: i. Facilitate the competitiveness of Kenya's agricultural sector; ii. Foster regional trade by adhering to East Africa Community (EAC) and Common Market for Eastern and Southern Africa (COMESA) trade policies; iii. Contribute towards harmonization of regional standards which will provide a level playing field and fair trade practices for Kenyan farmers, iv. Control dumping of subsidized foods; and v. Ensure predictable and transparent involvement of the state in markets to reduce uncertainty and ensure a predictable supply of food imports.

Unfortunately, low incomes and poverty characterise most smallholder food producers. Small farmers producing cash crops earn higher incomes but these incomes are threatened by loss of their market share in key areas. Livelihoods in the ASALs are under constant threat of natural and manmade disasters. (p 17). Other critical challenges include low accessibility to energy, and water; lack of capital and poor technology and skills. Participation of women and other vulnerable groups in off-farm activities is limited by access and control of resources. (p 17). Policy interventions include: i. Support measures that improve security and access to land and water resources by all Kenyans especially by taking all necessary measures to enable women, the

older persons, pastoralists and child-headed households, to have access to landuse and water, and the benefits that accrue; ii. Support cooperatives, out-grower schemes and fair-trade initiatives to increase the share of small producers in the production and export of high value crops and livestock; iii. Promote collective action to increase bargaining power of farmers; iv. Promote production of high value crops and value-addition to increase earnings; v. Support small rural business by developing value chains and agro processing zones by increasing access to technology (p 17). Some of the agricultural and food laws of relevance herein include: Crops Act 2013, which mandates the Agricultural Food Authority to regulate safety of crops and crop products, handling, transportation, processing, packaging, preservation, conservation and market standards of food crops and crop products.

Other SCP relevant laws reviewed include the Agriculture and Food Authority Act 2013; Agriculture, Drugs and Chemical Substances Act cap 254; Dairy Industry Act; Fisheries Management and Development Act 2016; Kenya Plant Health Inspectorate Service Act No 54 of 2012; Pest Control Products Act cap 346; Fertilizers and Animal Foodstuffs Act cap 345; Meat Control Act cap 356; and Animal Diseases Act (cap 364); Biosafety Act No 2 of 2009 and the Public Health Act cap 258, among others.

The **Crops Act, No. 16 of 2013**, is perhaps the primary legislation of concern herein. The Act was established to provide for the growth and development of agricultural crops, including those grown in the coastal areas such as coconut, bixa, cashew nuts, sisal and sugar cane. Undersection 3, the objective of this Act is to accelerate the growth and development of agriculture in general, **enhance productivity** and incomes of farmers and the rural population, improve investment climate and efficiency of agribusiness and develop agricultural crops as export crops that will augment the foreign exchange earnings of the country, through promotion of the **production**, processing, marketing, and distribution of crops in suitable areas of the country, including through regulation or overregulation of the crops subsector; and promotion of competitiveness in the crops subsector and to develop diversified crop products and market outlets. Among its key guiding principles is that land owners and lessees of agricultural land, being stewards, have the obligation to cultivate the lands they own or lease and make the land economically productive in a sustainable and environmentally friendly manner (Sec 4 (b)). The Act applies to all scheduled crops specified in

the First Schedule and to all agricultural land whether privately or communally held as well as to farmers, farmers' organizations, cooperatives and community associations. (Sec 5). The Agriculture and Food Authority, on behalf of the national government, shall be responsible for licensing and charging of levies and breeder royalties on all scheduled crops on condition that the total sum of the levies charged by the Authority shall not exceed ten per centum of the gate value of the produce. On the other hand, the county governments will implement the national government policies to the extent that the policies relate to the county and in particular shall be responsible for— (i) development of crops grown within the county; (ii) plant disease control; (iii) markets; (iv) cooperative societies within the county; and (v) soil and water conservation (Sec 6). Thus, the mandate for the implementation of national government policy, development of crops grown within the county and establishment of agricultural cooperatives at the county level devolves to the county governments.

Moreover, the national and county governments are duty bound to provide an enabling environment for the development of the crop subsector, and they shall determine and promote the implementation of agricultural policies and measures in a manner designed to promote, support and enhance productivity in the crop subsector. (sec 6(2) and (3)).

The Agriculture and Food Authority is mandated to promote the development of scheduled crops. In particular, the Authority shall— formulate general and specific policies for the development of scheduled crops specified in the First Schedule; facilitate marketing and distribution of scheduled crops through monitoring and dissemination of market information, including identification of the local supply demand situation, domestic market matching and overseas market intelligence and promotion activities on scheduled crops; enjoin the Ministry responsible for transportation and communications to effect an efficient, regular and economical means of transporting scheduled crops, for purposes of reducing marketing costs and ensuring stable consumer supply; promote the establishment of wholesale markets in identified major centres of the country; promote the establishment of agricultural produce collection centres in viable areas to serve as buying stations of farm products, packaging houses, pick-up points and meeting places of farmers' and growers' cooperatives; establish linkages with various governments and private research institutions for the conduct of studies and researches designed to promote the production, marketing and processing

of scheduled crops. Others include conduct farmers' training programs aimed at increasing their knowledge on production technologies and on market potentials and prospects for various types of crops, through farmer training institutions; establish experimental stations and seed farms for the development of varieties suitable to the agro-climatic conditions of the area and markets that will provide greatest value added to scheduled crops; devise and maintain a system for regularly obtaining information on current and future production, prices and movement in trade, to determine and effect a balanced distribution of scheduled crops by means of inter-trading or intra-trading among the established wholesale markets; establish and enforce standards in grading, sampling and inspection, tests and, analysis, specifications, units of measurement, code of practice and packaging, preservation, conservation and transportation of crops to ensure health and proper trading; ensure secure domestic food supply for the country; formulate policies and guidelines on dealing with other crops; promote and advise on strategies for value addition prior to the export of crops from Kenya; and recommend general industry agreements between farmers and processors of scheduled crops.

In summary, the following laws are also relevant to SCP:

- a. Agriculture and Food Authority (AFA) Act, 2013: This Act establishes the Agriculture and Food Authority with respective roles of the national and county governments in agriculture
- b. The Kenya Agricultural and Livestock Research Organization (KALRO) Act, 2013: The Act provides for organs of the Organization; mechanisms for the co-ordination of agricultural research activities in Kenya, among other things.
- c. The Science, Technology and Innovation Act, 2013: This is an Act that seeks to facilitate the promotion, co-ordination and regulation of the progress of science, technology and innovation in the country. This Act assigns priority to the development of science, technology and innovation; and entrenches science, technology and innovation into the national production system and for connected purposes.
- d. The Biosafety Act, 2009: The Act establishes a transparent, science based and predictable process for reviewing and making decisions on the development, transfer, handling and use of genetically modified organisms and related activities.
- e. Irrigation Act, 2019 - An Act of Parliament to provide for the development, management and regulation of irrigation, in order to support sustainable food security and socioeconomic

development in Kenya. It is noteworthy that there are a number of national irrigation schemes in the coastal region.

- f. Agricultural Finance Act, Cap 323, 1991 (revised 2012) - This Act provides for the establishment of the Agricultural Finance Corporation and regulates the granting of loans to farmers.
- g. Seed and Plant Varieties Act, Cap 326, 1991 (revised 2012) - Outlines the intervention measures the government pursues in research, extension, seed production, multiplication, processing, marketing and distribution.

In general, these laws, while dealing with production and food safety, do not adequately or directly address SCP as such, including food waste and food losses; and they have overlaps and ambiguities; some are rather old and have not been updated for long; and implementation and enforcement mechanisms are generally weak. For example, the Crops Act does not adequately address domestic food safety governance, which has direct and serious implications on protection of public health and trade in food.

The reviewed sector institutional mandates responsible for agriculture and food processing include the Ministry of Agriculture and Livestock; Ministry of Industry, Trade and Cooperatives; Ministry of Water, Sanitation and Irrigation, the Ministry of Mining, Blue Economy and Maritime Affairs (State Department of Fisheries and Blue Economy), among others. Key national institutions and agencies include Agriculture and Food Authority, National Biosafety Authority, Kenya Agricultural and Livestock Research Organization, Kenya Dairy Board, Kenya Bureau of Standards, Kenya Fisheries Service, Kenya Plant Health Inspectorate Service, and Pest Control Products Board, among others.

In general, these institutions' mandates often overlap and even conflict, and create production and related governance inefficiencies that lead to food waste and losses and compromise national food safety control systems.

2.1.4.3 Review of Relevant Sub National Policy and Legal Frameworks (per county)

For the devolved system of government, relevant frameworks include county specific frameworks such as county integrated development plans, county spatial development plans, policies, laws and regulatory frameworks relevant to agriculture and food processing, for each of the counties of concern: Mombasa, Kwale and Kilifi.

Key institutional mandates include the Council of Governors, county executive committees and directorates in charge of agriculture, livestock and fisheries, cooperatives and trade, health.

Kilifi county

Kilifi CIDP III (2023-2027)

This is the latest iteration of the County Integrated Development Plan (CIDP) that is mandated under the County Government Act 2012. According to the CIDP, the county is divided into five Agro-Ecological Zones (AEZ). These are; Coconut-Cassava Zone, Cashew nut-Coconut zone, Livestock-Millet Zone, Lowland Ranching and Coconut Cashew Nut – Cassava Zone. Figure XX below presents the locational map of Kilifi county. Kilifi borders Kwale County to the South West, Taita Taveta County to the West, Tana River County to the North, Mombasa County to the South, and Indian Ocean to the East. The county covers an area of 12,370.8km². Kilifi County has four major topographic features. The first one is the narrow belt, which forms the coastal plain and varies in width from 3km to 20km. The coastal plain lies below 30m above sea level with a few prominent peaks on the western boundary such as the Mwembetungu hills. This coastal belt, in which Malindi is located, has several creeks with excellent marine swamps that are richly endowed with mangrove forests and present great potential for marine culture, including marine sediments with corals, limestone, marble, clay and alluvial deposits that support agriculture. The other topographic features are: foot plateau with grassland and stunted shrubs, coastal range, and the Nyika plateau that constitutes the arid and semi-arid areas of the county, largely suitable for ranching.

In terms of climatic conditions, the county has a bimodal rainfall pattern with average annual precipitation ranging from 300mm in the hinterland to 1,300mm in the coastal belt. The coastal belt receives an average annual rainfall of about 900mm to 1,300mm while the hinterland receives average annual rainfall of about 300mm to 900mm. The short rain season is experienced in the months of October, November and December while the long rains are experienced in the months of March, April and May. For agriculture, the most important season to the hinterland is the short rains for pasture regeneration and water recharge while the long rain season is the most important season for the coastal area for crop production. Areas receiving highest average annual mean evaporation ranges from 1800mm along the coastal strip to 2200mm in the Nyika plateau in the hinterland. The highest evaporation rates are experienced during the months of January to March.

The annual temperatures range between 210C and 300C in the coastal belt and between 300C and 340C in the hinterland. The county experiences a very important wind field with relatively moderate wind speeds ranging from 4.8Km/h along the coastal strip to 12km/h in the hinterlands (CIDP III-2023-27)

In terms of agricultural potential and production, the five Agro-Ecological Zones (AEZ) define areas with similar production related characteristics such as annual mean temperatures, vegetation and humidity. These zones include the following: -

Coconut-Cassava Zone: This zone covers the coastal uplands and the low-level coastal plains and has the county's highest potential for crop production. The major farming activities in this area include fruit tree cropping (mango, citrus, cashew nut and coconut), vegetable farming (chili, brinjals, okra) and food cropping (maize, bananas, cowpeas, upland rice, green grams). Dairy farming also does well in this zone. The zone receives an average annual precipitation of 1,300mm per annum and a mean annual temperature of 240C.

Cashew nut-Coconut zone: this zone stretches northwards along the coastal plain up to the Arabuko Sokoke forest. The zone receives an average precipitation of 900mm and mean annual temperature of 240C. It has agricultural potential with the same crop types as the coconut-cassava zone but with slightly less production.

Livestock-Millet Zone: The zone is of lower agricultural potential with annual precipitation ranging from 700mm to 900mm. The area is suitable for dry land farming supporting drought tolerant crops and ranching activities.

Lowland Ranching Zone: This zone varies in altitude from 90m to 300m with annual mean temperature of 270 C and annual precipitation of 350mm to 700mm. The major activities within this zone are ranching and wildlife.

Coconut Cashew Nut – Cassava Zone: this zone is mainly located in Kilifi South and North constituencies and is the smallest of all the zones. It lies at an altitude between 30m to 310m above mean sea level with mean temperature of 270 C and annual precipitation of 900mm per annum. The area has a similar potential for the crops found in the coconut-cassava and cashew nut-cassava zones (CIDP III (2022-27)).

On agriculture and food production the CIDP provides extensively, alongside other productive and social sectors. In terms of review of the performance of the previous CIDP 2018-2022, agricultural production improved. There was reported increase in crop and livestock production including the major food crops such as maize and cassava. This was attributed to several interventions by the county such as subsidies for improved and certified crop varieties, more land under irrigation, increased acreage under crop production, adaptation of mechanization, and improved staff capacities including recruitment of 45 new extension officers. Moreover, livestock production improved, with 46% increase in milk production from 6,335,156 litres to 11, 020,979 litres, while there was also increased livestock export activities of animals and products to Oman and Middle East, and Burundi (CIDP 2022-2027)

On food trade, which is vital to agriculture, there was positive progress, including development of markets. The sector constructed 17 new markets and refurbished 5 markets, and also secured 6 markets with a wall fence (CIDP 2022-2027). This includes the new Mtwapa market that was visited by the research team. Of significance is also the support for cooperatives as enablers of agricultural production and development. Interventions included co-operative awareness and publicity events, extension and advisory services, facilitation of value addition of co-operative products that resulted in; registration of 54 new co-operative societies, and development of 8 strategic plans for agro-marketing co-operatives, among others (CIDP 2022-27).

On research and development, the county also conducted feasibility studies on revitalization of Dairy, Coconut and Cashew value chains: conducted baseline survey on status of co-operatives in the county and SMEs in Kilifi and Malindi municipalities (CIDP 2022-2027)

One key development challenge facing Kilifi agriculture is low crop production, caused largely by reliance on traditional farming practices, declining soil fertility, inadequate access to affordable quality farm inputs, inadequate access to extension services, pests and diseases, high post-harvest losses, and weak marketing structures. Some of the key constraints to crop production in Kilifi county are: inadequate financing, inadequate extension staff, inadequate research in crop production, inadequate weather information, and inadequate policy and legal framework. However, identified opportunities include: availability of land for agriculture, availability of underground water sources, climate smart agriculture technologies, new appropriate technologies on value addition, and availability of support from development partners (CIDP 2022-2027).

On the other hand, low livestock production in Kilifi is caused by inadequate access to affordable quality animal feeds, traditional livestock farming practices, inadequate access to livestock extension services, animal pests and diseases, weak marketing structures for livestock products, among others. Key constraints to livestock production include inadequate sector funding, staff capacities, and knowledge on livestock production. However, opportunities for development of livestock include modern livestock farming technologies, existence of veterinary services, and input subsidies strategy (CIDP 2022-2027).

As for poor cooperative promotion and development, there are several causes, including low uptake and dormancy in cooperatives, weak governance in cooperatives, inadequate co-operative awareness education, training and research, inadequate co-operative marketing infrastructure for value addition. Constraints include inadequate legal framework and inadequate funding, while opportunities include existence of a National Cooperative Policy and County Micro finance fund, existence of development partners and stakeholders, as well as potential for joint ventures and Public Private Partnerships (PPPs) (CIDP 2022-2027).

The CIDP 2022-27 aims to increase agricultural productivity and outputs and to promote market access and product development. The strategy also aims at increasing the land under irrigation to boost food security and local employment. On livestock production, the CIDP seeks to improve livestock production for wellbeing and wealth creation, mainly through improving the access to milk markets and income to farmers. Other livestock development strategies include: a) improvement of livestock production through the provision of veterinary services; b) facilitation of marketing of livestock and livestock products; and c) promotion, regulation and facilitation of livestock production for social economic development and industrialization. (CIDP 2022-2027)

Key strategies for improving agriculture include modernizing of agricultural and livestock production through horticultural development, appropriate modern technologies in land preparation, encouraging proper storage and timely harvesting, the use of disease resistant crop varieties, facilitate access of clean and disease-free planting materials by encouraging farmers to form marketing groups, encouraging small farm on value addition, promoting and enhancing capacity building to support agricultural activities, and intensification of extension services, and establishment of agricultural training institutes(CIDP 2022-2027)

Kilifi CIDP II (2018-2022)

The CIDP II (2018-2022) identifies agriculture as a key sector in the county's development priorities. Priorities under the agricultural sector for the 2018-2022 CIDP implementation period mainly focused on increasing the acreage under crop production in order to increase crop productivity, and sustainable crop management. As a flagship project under crop management, the CIDP proposed the development of countywide food banks to improve food security through post-harvest management of produce to reduce post-harvest food loss by 20% by 2022. However, there is no reference to reducing food waste in the CIDP. Specific laws on agriculture in the County include the Kilifi County Agricultural Development Fund Act, and the Kilifi County Coconut Act. The Kilifi County Agricultural Development Fund Act is specifically for the establishment of the Agricultural Development Fund, to support agricultural production.

The Kilifi County Coconut Act on the other hand, is focused on regulating the processing and marketing of coconut products. It establishes the Coconut Development Board which shall set standards for the production, promotion and marketability of coconut products. It also provides for the establishment of the Kilifi County Coconut Research Institute. The Act does not have any provisions on sustainable coconut resource utilization, or coconut waste management. In this regard, the problem of coconut shell/husk disposal is particularly noticeable, especially in Mombasa public beaches where “*madafu*” is popularly sold on the beach front.

Mombasa County

Mombasa County CIDP III (2023-2027)

In terms of climatic conditions, Mombasa County lies within the coastal strip in the hot tropical region where the climate is influenced by monsoon winds. The rainfall pattern is characterized by two distinct long and short seasons corresponding to changes in the monsoon winds. The long rains occur in April – June with an average of 1,040 mm and corresponds to the South Eastern Monsoon winds. The short rains start towards the end of October lasting until December and correspond to the comparatively dry North Eastern Monsoons, averaging 240mm. The annual average rainfall for the county is 640mm (CIDP 2023-2027).

The annual mean temperature in the county is 27.90C with a minimum of 22.70C and a maximum of 33.10C. The hottest month is February with a maximum average of 33.10C while the lowest temperature is in July with a minimum average of 22.70C. Average humidity at noon is about 65 per cent (CIPD 2023-2027). Climate change induced rising temperatures will also likely exacerbate the drought conditions and may have a significant impact on water availability and general human well-being in Mombasa and other coastal counties. Mombasa county is susceptible to sea level rise, which affects fresh water aquifers and exacerbates fresh water scarcities and salinization of soils, as well as flooding. Mombasa city is particularly exposed, with an estimated area of 4-6 km² likely to be submerged with a rise in sea level of only 0.3 meters. Water logging of soils and the resulting salt stress might reduce crop production. Additionally, the health of coastal populations is at risk as saline intrusion affects coastal aquifers, and the permanent inundation of low-lying areas renders them uninhabitable (CIDP 2023-2027).

In terms of performance review of CIDP II (2018-2022), the County sought to improve the livelihoods of its residents through promotion of competitive agriculture and innovative research; sustainable livestock and fisheries development; and growth of a viable cooperatives sub sector. There was increase in production of major crops like maize by 38 % from 1125 tonnes to 3000 tonnes, leafy amaranth from 75 tonnes to 150 tonnes, tomatoes from 23 tonnes to 37.2 tonnes, spinach from 9 to 18 tonnes, and cowpeas leaves from 120 tonnes to 160 tonnes in 2022(CIDP (2023-2027). The increase in production was attributed to interventions implemented by the sector, including farm input subsidy programme that targeted vulnerable farmers where over 4000 benefited from certified maize and cow peas seeds, assorted horticultural crops seed, fruit tree seedlings, inorganic fertilizers, foliar feeds, assorted chemicals for pests and disease control and climate smart farming equipment (CIDP 2023-2027).

An important challenge identified in the CIDP II era is scarce land for agricultural development in urban and peri-urban areas. Land for crop production is reducing due to increasing urbanization in Mombasa county (CIDP 2023-2027). Considering Mombasa county's land size, this is indeed a significant challenge for agricultural production. Moreover, another identified challenge is weak legal and regulatory framework, necessitating the need to develop agricultural policies and strategic plan (CIDP 2023-2027).

On livestock development, some of the identified challenges include lack of County policy regulations on livestock development and animal welfare and control, as well as lack of county livestock infrastructure including abattoirs, sales yards, hides, skins and processing and value addition (CIDP 2023-2027). And on cooperatives, lack of capacity building for supervisory responsibilities of co-operative savings, credit, and banking services is a key challenge. (CIDP 2023-2027).

Among the key development issues in Mombasa county are: high incidents of pests and diseases; overdependence on rain fed agriculture; high cost of farm inputs; diminishing arable land; low adoption of modern agricultural technologies; declining soil fertility; inadequate extension services; low value addition of crop products; and lack of ornamental, cosmetics and pharmaceuticals plants. Key constraints include poor climatic conditions due to climate change; unreliable rainfall for crop production; low practice of irrigated farming; unfavorable subsidies policies; increased population/urbanization; lack of urban & peri -urban agriculture policy; limited uptake of agricultural innovation and technology; limited financial resource; and lack of a county revolving subsidy fund. Others include low usage of organic and inorganic fertilizers; lack of a value addition infrastructure; inadequate value addition equipment; inefficient value addition technologies by staff and stakeholders; lack of cold storage facilities in the markets for agribusiness development. (CIDP 2023-2027).

Key opportunities for Mombasa agriculture include: availability of fresh farm produce & value added products markets; availability of certified seeds, cuttings & vines; availability of County & National farm inputs subsidy program; availability of county programmes & stakeholders supporting agricultural development; existence of urban agriculture and climate smart technologies; existence of integrated pests and diseases management; collaborative research on invasive and emerging pests & diseases control; and existence of small scale irrigation systems. Others include availability of water harvesting technologies; collaborative agroforestry and urban tree cover programme; existence of financial institutions; availability of national policy supporting public-private-partnerships (PPP) model; availability of public and private extension providers; availability of national agriculture policy and legislations; availability of agricultural research institutions e.g. KALRO, KEFRI, CABI, KEPHIS; existence of 4k & young farmers clubs and ECD centres; availability of County tractors for agricultural mechanization and availability of cooperative sub department. (CIDP 2023-2027).

In the current CIPD, agriculture is coupled with blue economy, and is envisioned as an innovative, commercially oriented and modern sector, intended to improve livelihoods of communities through, inter alia, sustainable crops and livestock development. The stated strategic goal is to improve livelihoods by promotion of competitive farming, appropriate policy development, effective support services, good corporate governance and sustainable agricultural practices (CIDP 2023-2027). In order to improve crop production, productivity and agribusiness, several strategic interventions are proposed. These include promotion of integrated pests and diseases management and collaborative research; development of water harvesting infrastructures, and other land development technologies; promotion of a robust County and National subsidy program; promotion of mechanized crop production systems, modern farming and climate smart agriculture. Others include promotion of consumption of nutritious foods in children through vegetable production in the ECD centres; promotion of soil testing and use of organic and inorganic fertilizers; strengthening of agricultural extension service provision & staff capacity building; enhancement of postharvest management & increased linkages of value chain actors to financial institutions; construction & equipping of value addition infrastructure under PPP; capacity building of staff & farmers on modern value addition technologies; development of County agriculture policy and legislation; promotion of crop diversification and promotion of drought tolerant crop seeds, cuttings and vines, as well as promotion of formation of value chain actors' cooperatives

As for livestock development and productivity, the CIDP proposes a number of strategic interventions, including promotion of a robust county and national subsidy program; development of strategic vaccination programs and enhancement of animal disease surveillance in collaboration with partners; strengthening livestock extension service provision; up taking of climate smart livestock technology; construction of livestock and veterinary infrastructure; promotion of fodder conservation and livestock development technologies; promotion of value addition of livestock products; promotion of a robust County subsidy program; development of policy and legislation on animal welfare and control. Others include promotion of use of drought tolerant breeds of livestock; promotion of consumption of livestock and livestock products by vulnerable populations for improved nutrition; promotion of formation of value chain actors' cooperatives (CIDP 2023-2027).

Mombasa County CIDP II (2018-2022)

Despite land ownership remaining a challenge, subsistence farming and livestock rearing is practiced by a significant population living in the county's peri-urban areas. Farming is largely on cassava, sorghum, millet and maize, which are disease and pest resistant crops. Since only about 400ha is utilised for food crop farming, the county is heavily reliant on food and agricultural products importation from other parts of the country and from neighbouring countries, raising the cost of food.

On the other hand, farming of fruit trees such as mango, coconut, lime, orange and grape fruit tree farming is prevalent in the County. The County has a Coconut Development Authority, established to promote economic use of the coconut trees in the region. The Authority has since introduced fast-maturing coconut varieties to make the crop more economically viable. However, it appears the ubiquitous problem of disposal of coconut shells/husks along the public beaches is not being addressed especially in busy public beaches where sale of "madafu" is prevalent. Interventions are needed to help stem the public nuisance, and also to consider value addition of the coconut shells/husks, including producing animal feeds and/or compost manure for use by peri-urban crop and livestock farmers. Other uses of the coconut shells could include as home and work place accessories such as desktop organizers/pen holders, salt and sugar dishes, flower vases, ash trays, calabashes, decorative and ornamental artefacts, fibre and fabrics (including mats, baskets, hats, etc),

The 2018-2022 CIDP identifies high post-harvest food loss as a challenge in the county's Agricultural sector, and attributes it to lack of adequate storage facilities and lack of knowledge by farmers on post-harvest handling of agricultural products. The intervention strategies proposed are the construction of adequate storage facilities to reduce loss, capacity building for farmers on post-harvest handling of agricultural products, and introducing post-harvest management technologies. However, there is no reference to food waste.

Mombasa County Climate Change Policy

The policy proposes interventions to address the agriculture, fisheries and livestock sectors in order to enhance resilience in agricultural production. It proposes that the County should, among others, promote climate smart crop and livestock production technologies, and promote climate proof agriculture and fisheries value chain from farm to the consumer, to address post-harvest loss. However, again, there is no mention of food waste. There appear to be no other laws or policies on agriculture in the county.

Kwale County

Kwale County CIDP 2023-2027

The physical and topographical features of Kwale county are generally favourable to agricultural and food production. They include the coastal plain, foot plateau, coastal rangelands/uplands, and Nyika plateau. The Coastal plain is sometimes referred as the “coral rag”. It is a narrow strip of land, three to 10 kilometres wide, with approximately 255 kilometres from Likoni to Vanga. It lies 30 meters above sea level and extends 10 kilometres inland. This strip of land consists of corals, sand, and alluvial deposits. Ukunda-Diani straddles this zone.

Behind the coastal plain is the foot plateau. It lies at an altitude of between 60 and 135 meters above sea level on a flat plain surface with high potential permeable sand hills and loamy soils. This is the sugar cane zone of the region. Commonly known as Shimba Hills, the area rises steeply from the foot plateau to an altitude between 150 metres and 462 meters above sea level. This topographical zone is made up of many sandstone hills. The hills include Shimba Hills (420 m), Tsimba (350 m), Mrima (323 m) and Dzombo (462 m). This is an area of medium to high agricultural potential.

The Nyika plateau stands at an altitude of about 180 to 300 meters above sea level on the western boundary of the region. The zone is underlain by a basement rock system with exception of reddish sand soils. Occupying over a half of the region, it is semi-arid except for occasional patches of reddish sand soils and is, therefore, generally poor. The main activity in the area is livestock rearing (CIDP 2023-2027).

In terms of climatic conditions, Kwale is generally favorable to crop farming and livestock development, the County has a tropical type of climate influenced by the monsoon seasons. The average temperature is about 23°C with maximum temperature of 25°C being experienced in March during the inter-monsoon period and minimum temperature of 21°C experienced in July a month after the start of the southwest monsoon (also known as Kusi). Rainfall is bi-modal with short rains (*Mvua ya Vuli*) being experienced from October to December, while the long rains (*Mvua ya Masika*) are experienced from March/April to July. There is a strong east to west gradient of decreasing precipitation with eastern (coastal) parts of the County receiving greater than 1000 mm of precipitation per year, while a majority of the County central to west around 500-750 mm. Some areas along the western side of the County receive less than 500 mm of precipitation per year. As such, heat stress, dry spells, and drought are hazards that strongly contribute to agricultural risks in the County, especially in the central and western parts of the County. However, flooding due to intense rains has also occurred historically and as such is a risk to the County, especially in the central to eastern parts (including the coast) of the County (CIDP 2023-2027).

In terms of ecological conditions, the county is divided into agro-ecological zones in terms of agricultural potential. Moderate potential and marginal lands constitutes 15% and 18% of the total land area respectively. The rest 67% is range, arid and semi-arid land suitable only for livestock and limited cultivation of drought resistant crops. Annual precipitation is less than 800mm on the average and is extremely unreliable (CIDP 2023-2027).

Table 1: Kwale County agro-ecological zones

Zones	% of land area	Economic Activities
Coastal lowlands CL2 zone (lowland marginal sugar cane zone)	3	Main production area for rain fed rice. Most of the food crops grown in the district are found here.
Coastal lowlands CL3 zone (coconut & cassava zone)	13	Tree crops, food crops and livestock. Crops are cashew nuts, maize and beans.
Coastal lowlands CL4 zone (cashew nut & cassava zone)	12	Marginal agricultural potential with cashew nuts dominating the cash crops. Livestock is kept and crops produced on small scale
Coastal lowlands CL5 zone (livestock & millet zone).	40	Livestock (cattle, poultry and goats). Subsistence crops (maize, sorghum, cowpeas, groundnuts, cassava and green grams
Coastal lowlands CL6 zone (ranching zone)	32	Very little crop production potential. Majority of farmers concentrate on keeping of local cattle and goats as their main source of livelihood.

Kwale County CIDP (2018-2022)

One of the CIDP's strategic objectives is to improve agriculture productivity, food security and nutrition. Similar to the other two counties, among the Plan's development priorities in the sector

is to establish infrastructure for strategic food and feed reserves at the county level. To reduce post-harvest losses, the county will increase the number of cereal stores, and build the capacity of management committees to improve post-harvest management. There are no other laws or policies (online) on agriculture in the county.

CHAPTER THREE

KEY FINDINGS

3.1 Analysis of Desktop Reviews

This chapter focuses on key findings, particularly on the matter of food loss and food waste. This has been identified as perhaps the most important SCP is in the agricultural and food production sector. In understanding the concept of food loss and waste (FLW) it has been argued that it can appear to be deceptively simple, but there is no commonly agreed definition of food loss and waste. The various definitions often reflect the different problems that stakeholders or analysts focus on or associate with food loss and waste. Consequently, analysis of food loss and waste is hampered by lack of a common definition (FAO 2019). The Food and Agriculture Organization (FAO) defines food loss and waste as the decrease in quantity or quality of food along the food supply chain. “Food losses” occur along the food supply chain from harvesting/slaughter/catch, up to but not including retail level. “Food waste” occurs at the retail and consumption level. However, food diverted to other economic uses, for example animal feeds, or inedible parts of food, are not considered as food loss or waste. The difference between food loss and food waste aligns well with the distinction implicit in SDG 12.3. It is also apparent that food loss or waste has been typically measured in physical terms using tonnes as reporting units.

According to Kenya’s Agricultural Policy 2021 (p 16), post-harvest management refers to handling and storage of agricultural, fish and fishery products to limit losses and damages. Inefficient post-harvest management occasions massive losses including losses in nutritional value and damages to crops, livestock, fish and fishery products. On average, post-harvest losses in fisheries reach 25%. Post-harvest losses of crops and livestock are not well documented however; postharvest

losses for major grains are estimated at 20 - 30% with maize post-harvest losses estimated at 21%. Unpredictability of the markets prompts farmers to stay longer with their produce without suitable preservation and storage; deterioration occurs leading to losses and food products of low nutritional value. Post-harvest handling determines the level of contamination and rate of spoilage of agricultural, fish and fishery products, which has an impact on human health. Inappropriate processing, poor storage and inadequate transport facilities increase post-harvest losses and damages. Unreliable energy supply adversely impacts processing and storage of agricultural, fish and fishery products.

According to the World Bank (2018), across global food systems, food loss and waste, is a widespread issue, posing a challenge to food security, food safety, the economy, and environmental sustainability. No accurate estimates of the extent of FLW are available, but studies indicate that FLW is roughly 30 percent of all food globally (FAO 2015). This amounts to 1.3 billion tonnes per year. FLW represents wastage of resources, including the land, water, labor, and energy used to produce food. It strongly contributes to climate change because greenhouse gases are emitted during food production and distribution activities, and methane is released during the decay of wasted food. FLW also affects food supply chains by lowering income for food producers, increasing costs for food. Minimizing FLW could lead to substantial food security and environmental gains.

The causes of FLW vary across the world and depend on specific local conditions. Typically, FLW in low-income countries occurs at the production, post-harvest handling, storage, and processing stages and is caused predominantly by managerial and technical limitations. FLW mostly occurs in the distribution and consumption stages in middle- and high-income countries, although it can happen in earlier stages such as when agricultural subsidies lead to overproduction of farm crops. These challenges relate to consumer behavior and government policies and regulation. Improving coordination among actors along the different stages of the supply chain could address some of the FLW issues globally. Measures to reduce FLW in low-income countries could involve investment in infrastructure and transportation, including in technology for storage and cooling. Small-scale farmers could also be supported by provision of improved financing and credit to allow them to diversify or scale their production. In high-income countries, consumer education

for behavior change is key to decreasing FLW. In addition to decreasing FLW along the supply chain, discarded food could also be managed productively for composting and energy recovery (World Bank 2018)

Regional and international stakeholders are taking action to address FLW. The African Union is working with 14 governments to translate the “Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods,” including food loss reduction, into proper national policy and strategies in Africa (African Union Commission 2014). The Deputy-Secretary General of the United Nations called on all partners to adopt a more holistic approach to food security, one that prioritizes FLW, builds new coalitions, scales up current work, and innovates (Helvetas 2018). The Food and Agriculture Organization has been working on developing new metrics and methodologies to measure FLW, and the organization’s SAVE FOOD Initiative works with civil society to address the issue (FAO 2018). The World Food Programme(WFP) is including food loss as part of some five-year country plans in Africa and launched the Farm to Market Alliance to structure local markets and promote loss reduction technologies among smallholder farmers (WFP 2017). The World Bank is tackling the issue through loans, such as in Argentina, and by coordinated food waste management and the establishment of a cross-sectoral strategy (World Bank 2015).

Several national and local governments have also taken action. In 2016, the government of Italy approved a law to enhance collaboration among key stakeholders, educate the public, encourage food donations from business through financial incentives, and promote reusable and recyclable packaging (Azzuro, Gaiani, and Vittuari 2016). In 2016, France became the first country in the world to ban supermarkets from throwing away or destroying unsold food, forcing them instead to donate it to charities and food banks (Chrisafis 2016). In 2009, the city of San Francisco in the United States passed an ordinance requiring all residents and tourists to compost food waste (McClellan 2017). The city of Ningbo in China diverts food waste from apartment buildings to an anaerobic digestion facility (Lee et al. 2014). In several cities in Sweden, biogas is produced from food waste to power vehicles and generate heat (Swedish Gas Centre, Swedish Gas Association, and Swedish Biogas Association 2008). In cities like Linköping, Sweden, the majority of public buses have been converted to use recovered biogas. The optimal strategy to reduce loss and recover

food waste depends greatly on the local context, but the increasing global action reveals the many policy, technology, and educational avenues available. (World Bank 2018).

According to the 2019 FAO report entitled ***“The State of Food and Agriculture: Moving Forward on Food Loss and Waste Reduction”*** the need to reduce food loss and waste is firmly embedded in the 2030 Agenda for Sustainable Development. FLW reduction is considered important for improving food security and nutrition, promoting environmental sustainability and lowering production costs. However, according to the report, efforts to reduce FLW will only be effective if informed by a solid understanding of the problem. Indeed, the report is substantially about understanding the problem of FLW on a global scale, including constraints of data and methodology. While the reduction of FLW appears as clear and desirable objective, actual implementation of it is not simple and its complete elimination may not be realistic. The need to reduce FLW presents new insights on what is known and what is not, and provides guidance on how to target interventions and policies depending on policy makers’ objectives and the information available (FAO 2019).

The report provides new estimates of the percentage of the world’s food lost from production up to the retail level. The report also finds a vast diversity in existing estimates of losses, even for the same commodities and for the same stages in the supply chain. The report affirms that clearly identifying and understanding critical loss points in specific supply chains – where considerable potential exists for reducing food losses – is crucial to deciding on appropriate measures. The report provides some guiding principles for interventions based on the objectives being pursued through FLW reductions, which may primarily include: improved economic efficiency, food security and nutrition, or environmental sustainability.

The critical loss points, presented as potential direct causes and indirect drivers of FLW, include agricultural production and harvest/slaughter/catch, storage and transportation, processing and packaging, whole and retail, and consumption (households and food services). At the stage of *agricultural production and harvest*, food loss occurs when produce is left in the fields due to quality standards or sharp drop in prices, poor production and agronomic practices and choices

such as crop or seed varieties, machine or human damage, and poor harvesting scheduling, among others (FAO 2019).

At the stage of *storage and transportation*, another critical loss point, suppliers and consumers may fail to have adequate or appropriate storage to enable them to optimize the timing of marketing and marketing decisions. Storage provides stability for producers by helping prevent losses. However, the lack of refrigerated warehouse spaces or other cold storage facilities, especially in Sub-Saharan Africa and elsewhere in the global south, significantly increases food losses. Transportation introduces a time gap between various stages of the food supply chain, from production to consumption. The time gap increases the risk that food products, especially perishable ones, may be damaged or lost either due to excessive heat or cold, damage in transit, contamination, or the like (FAO 2019).

At the stage of *processing and packaging*, the amount of food lost depends in large part on the type of raw material and the nature of the processing operations. Lower income countries, including Sub-Saharan Africa, often suffer from inadequate or non-existent processing facilities especially for products that are highly perishable such as milk and fish, or seasonal such as mangoes and other fruits. As a category, fruits and vegetables are generally highly perishable, and once harvested need to be handled and packaged with care and speed, using appropriate practices to maintain their quality. Transport is a critical loss point in the supply chains of fruits and vegetables, owing largely to inadequate use of bulk packaging and poor temperatures and humidity management. Losses occur from mechanical damage evidenced by bruising, distortion in the shape of produce, cracking and punctures, which leads to discoloration, accelerated ripening, weight loss due to increased transpiration and accelerated decay, which all lead to economic losses (FAO 2019).

Another critical loss point is *wholesale and retail*. The causes of food waste at this stage are linked to the limited shelf life of perishable foods, private quality standards of buyers, and variability of demand, especially for fresh produce. Actions and decisions taken by retailers often dictate those of their suppliers. Storage conditions, packaging quality and handling practices greatly impact on the quality, shelf life and acceptability of food products (FAO 2019).

Finally, according to the FAO report, the *consumer and food services* is a critical loss point. Food waste by consumers is a problem especially associated with and reported in high income countries, and only to a smaller extent in low and middle income countries. Indeed, emerging economies are increasingly faced with this problem. The higher the household wealth, the more food consumers waste. Growing incomes and demographic and cultural changes over the past decades have led to changes in eating habits which often favor convenience. Consumer waste is particularly highest in perishable foods, such as animal products (14-37%) and fruits and vegetables (9-20%). In this regard, most consumer waste studies take place in high income countries where the problem is particularly acute, and especially in the United States of America (USA) and Europe) (FAO 2019).

Of the most critical loss points, in Africa, the highest levels of loss for cereal grains and legumes are consistently at the harvesting and on farm storage stages, regardless of location or climate. This also applies for roots, tubers and fruits, which are also impacted at the packing (handling and treatment operations) and transportation. The causes of harvesting losses frequently reported by farmers include attacks by pests and insects and the effects of diseases, adverse climatic conditions such as heavy rains during harvesting, inappropriate timing of the harvest and lack of labor or funds. Inadequate or inappropriate storage facilities and poor handling practices are among the main causes of on farm food losses. For fruits, the most frequently reported causes of loss during harvest relate to the stage of maturity, timing and scheduling, poor sorting, handling and harvesting methods, adverse climatic and weather conditions, diseases and attacks by insects and birds. Losses during packing and transportation were mostly associated with poor handling, inadequate storage conditions and inappropriate packaging (FAO 2019).

A first estimate of overall food loss throughout the FAO report concludes that globally, 13.8% of all food is lost from post-harvest up to but excluding retail and beyond. However, while the food loss estimates help draw attention to the problem and incite action, effective interventions to reduce food loss and waste must be based on more detailed information regarding where it occurs in the food supply chain, for which foods and in which regions its occurs, and the extent of the problem and underlying reasons (FAO 2019). This means that there are huge data and information gaps that ought to be filled in order to help better understand the problem and design appropriate responses.

The report also urges that a business case be made out, with a system of incentives, investments and regulations which should be established, especially to enable private actors to reduce food loss and waste. It argues that actors in the food supply chain are driven by self-interest: producers aim to maximize profits and consumers their well-being. As rational decision makers, they reduce food losses or waste as long as the benefits outweigh the costs. The report also states that completely eliminating all food loss and waste is unrealistic as the costs would be exorbitant (FAO 2019).

There is a persuasive case for public sector involvement in the food loss and waste management, based on both business case and economic case. There are tangible benefits of public sector investment in this regard, including food and nutritional security, environmental sustainability and mitigation of climate impacts, and increased productivity and economic growth. The business case for reducing food losses and waste, where incentives and adequate information can encourage the private sector to reduce food loss and waste in their own interest, should be completed by an economic case for waste. The economic case goes beyond the business case, and focuses on the broader benefits that can accrue to society from reducing food loss and waste, and this may include improved incomes for other actors in society, improved food security and nutrition, and environmental sustainability.

The FAO 2019 Report also finds that both global and national estimates of food loss are important to monitor progress over time, but additional information is needed to understand the variability of food loss and waste percentages across different contexts and at critical loss- points along the food supply chain. Also, information on the location, extent and underlying causes of food loss and waste is fundamental in drawing up strategies aimed at food loss and waste reduction. Moreover, representation of food loss and waste data is imbalanced. Most studies focus on fruits, vegetables, cereals and pulses at the farm level, and these are mostly from Central and Southern Asia, Sub-Saharan Africa and Eastern and South Eastern Asia. The report also finds that loss and waste percentages are generally higher for fruits and vegetables than for cereals and pulses, especially in situations where cold storage or processing conditions are inadequate. The wide variability of food loss and waste across commodity groups and supply chain stages, particularly

in Sub Saharan Africa and Eastern and South Eastern Asia, points to the need for improved data collection to inform targeted reduction strategies (FAO 2019)

The **UNEP (2021) Food Waste Index Report** complements the **FAO (2019) Food Loss Index**. The *Food Waste Index* covers the later stages of food's journey – food waste – occurring at household, food service and retail levels.

According to **UNEP (2021) Food Waste Index Report**, which focuses on a global scale, food waste reduction offers multi-faceted wins for people and planet, improving food security, addressing climate change, saving money and reducing pressures on land, water, biodiversity and waste management systems. Yet this potential has until now been woefully under-exploited. This potential may have been overlooked because the true scale of food waste and its impacts have not been well understood.

According to the UNEP Report, global estimates of food waste have relied on extrapolation of data from a small number of countries, often using old data. Few governments have robust data on food waste to make the case to act and prioritize their efforts. Sustainable Development Goal 12.3 (SDG 12.3) captures a commitment to halve food waste at the retail and consumer level and to reduce food loss across supply chains.

The **UNEP (2021) Food Waste Index Report** aims to advance progress on SDG 12.3 in two ways: firstly, it presents the most comprehensive food waste data collection, analysis and modelling to date, generating a new estimate of global food waste. Country-level food waste estimates have been calculated, and while confidence intervals for estimates vary by region and by sector, they offer new insight into the scale of the problem and into the substantial prevention potential in low-, middle- and high-income countries. • Secondly, the report publishes a methodology for countries to measure food waste, at household, food service and retail level, in order to track national progress towards 2030 and to report on SDG 12.3. Countries using this methodology should generate strong evidence to guide national strategies on food waste prevention, food waste estimates that are sufficiently sensitive to pick up changes in food waste over two- or four-year intervals, and that enable meaningful comparisons among countries globally.

According to Inger Andersen, the Executive Director of UNEP, “If food loss and waste were a country, it would be the third biggest source of greenhouse gas emissions. Food waste also burdens waste management systems, exacerbates food insecurity, making it a major contributor to the three planetary crises of climate change, nature and biodiversity loss, and pollution and waste. This is why Sustainable Development Goal 12.3 aims to halve food waste and reduce food loss by 2030” (UNEP 2021).

In support of this vital target, UNEP’s first *Food Waste Index Report* provides insights into the scale of food waste and a methodology that enables countries to measure baselines and track progress in meeting the SDG target. The report estimates that food waste from households, retail establishments and the food service industry totals 931 million tonnes each year. Nearly 570 million tonnes of this waste occurs at the household level. The report also reveals that the global average of 74 kg per capita of food wasted each year is remarkably similar from lower-middle income to high-income countries, suggesting that most countries have room to improve.

From both the UNEP 2021 *Food Waste Index Report* and the FAO 2019 report, Kenya is not among the “List of countries officially reporting data on food loss to FAO for at least one year between 1990 and 2019”.

An earlier publication by FAO (2014), *Building a Common Vision for Sustainable Food and Agriculture*, states that FAO’s ultimate vision is that of “a world free from hunger and malnutrition, where food and agriculture contribute to improving the living standards of all, especially the poorest, in an economically, socially and environmentally sustainable manner”. Its focus is on food security, elimination of poverty, sustainable management and utilization of natural resources. FAO’s Strategic Objective No 2 is to assist member countries in identifying and implementing policies, strategies and technologies that contribute to sustainable and enhanced provision of products and services from agriculture, forestry, and fisheries. The common vision and coordinated approach is towards sustainable food and agriculture that is knowledge based, as well as being responsive to the needs of member states. It envisions a higher but more sustainable agricultural production, at 60% by 2050, and 100% in developing countries if it is to meet current demands of

consumption. It calls for technological innovation and improvements leading to significant gains in agricultural production and productivity.

The FAO 2014 Report proposes that just like the Green Revolution in South Asia, farming systems should use high yielding varieties, irrigation and high levels of chemical inputs, and thereby practice agricultural intensification that allows farmers to feed the world, but save millions of acres of land from conversion to farmland thereby saving an unquantifiable quantity of ecosystem services and avoid the release of estimated 590 billion tonnes of carbon dioxide into the atmosphere (Burney *et al* 2010).

According to the FAO 2014 Report, the current trajectory of growth in agricultural production and productivity is unsustainable. Food production on land and in aquatic systems already dominates much of the global terrestrial surface, and has major impacts on the Earth's ecosystems. Agricultural production systems and the policies and institutions that underpin global food security are increasingly inadequate. – The world's food systems are headed towards an unprecedented confluence of pressures over the next 40 years (Foresight UK, 2011), and if the trajectory is sustained it will seriously compromise long term global capacity to produce both food and economic benefits needed for food security. Consequently, some of the anticipated trends include inadequate diets and unsustainable consumption patterns, as well as increased poverty, inequities, hunger and malnutrition and the reality that current food production and distribution are failing to feed the world. Unfortunately, financial and environmental resources are being spent to produce food that is lost or wasted. There are also challenges with loss of biodiversity, climate change and stagnation in agricultural research, which undermine agricultural production and productivity.

FAO defines the sustainable agricultural development as “the management and conservation of the natural resource base, and the orientation of technological change in such a manner as to ensure the attainment of continued satisfaction of human needs for present and future generations. Sustainable agriculture conserves land, water and plant and animal genetic resources, and is environmentally non degrading, technically appropriate, economically viable and socially acceptable” (FAO 1988).

The FAO reports that initiatives such as “local production for local consumption” and government procurements from family farmers for school meals programs have been very effective in increasing production and incomes, while improving food security in Brazil and other countries (Ministry of Agrarian Development 2011). Sustainability, therefore, is much more than ensuring protection of the natural resource base. To be sustainable, agriculture needs to meet the needs of present and future generations for its products and services, while ensuring profitability, environmental health, and social and economic equity. Sustainable agriculture would contribute to all four pillars of food security- availability, access, utilization and stability, in a manner that is environmentally, economically and socially responsible over time. As agriculture depends largely on the services provided by ecosystems, to be sustainable, it must minimize negative impacts on ecosystems and the environment in general, while optimizing production by protecting, conserving and enhancing natural resources and using them efficiently. It must also strike a balance between protecting agro-ecosystems and meeting society’s growing needs by offering decent and resilient livelihoods for rural populations. There is therefore a need to provide a clear understanding of what is sustainable food and agriculture, as well as the most appropriate strategies and approaches to its implementation (FAO 2014).

The FAO 2014 Report provides a conceptual model for sustainable agriculture and food systems. In this respect, agriculture is the mechanism that utilizes natural resources (land, water, biodiversity, forests, fish, nutrients and energy) and environmental services and transforms them into agricultural products (food, feed, fibre, fuel) and the associated economic and social services (food security, economic growth and poverty reduction, health and cultural values). The institutions that govern agricultural production, because they determine what is produced, who produces it, with which types of technology and practices, and the level of returns, are all key levers for regulating the type and distribution of the products and services that can be derived from agriculture. Achieving sustainability in food and agriculture is envisioned as an on-going process of identifying and striking a balance between agriculture’s social, economic and environmental objectives and between agriculture and other sectors of the economy (FAO 2014).

The interactions and tradeoffs with human and natural systems within both and over time, have gained the most attention, including the human systems’ level of consumption which has grown to

unprecedented levels, leading to rapid depletion of natural resources and the disruption of ecosystem services through, for example, climate change and biodiversity loss. In this respect, what is envisioned is greater production efficiency, which includes tradeoffs between use of natural resources and ecosystem services. Tradeoffs also occur in space when allocating areas for agriculture, recreation and conservation (FAO 2014).

The conceptual model underpinning the FAO 2014 Vision has five interlinked components. These include environmental services (climate, nutrient cycling, biodiversity, water cycles, coastal protection); natural resources (land, oceans, water, genetic resources, forest resources, aquatic systems, nutrients, energy); agriculture (crops, livestock, forestry, fisheries, aquaculture); agricultural production (food, feed, fiber, fuel); and economic and social services (growth, poverty reduction, employment, stability, health and nutrition). The *Vision* also vouches for cross sectoral integration and synergies as between the agriculture and food sub sectors-crops, livestock, forestry, fisheries, and aquaculture. However, the excessive separation of the sub-sectors often creates a “silo syndrome” in which these sub-sectors compete with each other for space, political support and natural resources, thus resulting in conflicts and in sub-optimal allocation and management of resources. It is more desirable to have a holistic vision of sustainability which looks beyond simply balancing tradeoffs and explore, as well, opportunities in creating synergies that would reduce or even reduce conflict and competition. Synergies between livestock and crop production are especially significant. Crops provide fodder and feed and grasslands contribute to sequestration of some of the greenhouse gases emitted by livestock, In turn, livestock produces manure that contributes to crop productivity (FAO 2011 b).

Some of the key principles for sustainability in food and agriculture articulated, which are all inter connected, include: improving efficiency in the use of resources (“getting the right mix”); protecting and improving rural livelihoods, equity, and social well-being; enhancing resilience of people, communities and ecosystems; and enhancing responsible and effective governance mechanisms.(FAO 2014). To actualize these principles, some of the suggested examples of key policies and practices include getting genetically diverse portfolio of crops, livestock, forestry or aquaculture, practicing conservation agriculture, judicious use of organic and inorganic fertilizers, improved soil moisture management, improved water productivity and integrated pest

management. Others are: use of better practices for biodiversity protection such as *in situ* and *ex situ* conservation of plant genetic resources; use better practices for soil management including land rehabilitation; use better practices for water management including irrigation and prevention of water pollution, and set payments for using and for providing environmental services such as pollinators and carbon sequestration.

On the national front, Kenya's *Climate Smart Agriculture Strategy 2017-2026* states that "Climate change is real and has become an impediment to sustainable development globally. Climate change will have a range of positive and negative impacts in agriculture depending on the regions of the world. The negative impacts are expected to be more adverse in developing countries, particularly those in sub-Saharan Africa such as Kenya which has experienced increasing temperatures from 1960's coupled with increased frequency and intensity of extreme weather events such as El Niño and La Niña. Effects of the negative impacts will include declining agricultural productivity and loss of crops, livestock, fish and investments in agriculture due to changing temperatures and precipitation regimes and increased frequency and intensity of extreme weather events.

Further, according to the Strategy, fisheries and aquaculture are affected through acidification of the water bodies, changes in water temperatures and circulation patterns which alter the physico-chemical properties of the fish habitats and ultimately their productivity. Agriculture is not only impacted upon by climate change but also contributes to the problem. The country's agriculture is predominantly rain-fed and therefore vulnerable to climate change particularly changes in temperature regimes and precipitation patterns, and extreme weather events. This leads to, among others, unsustainable land and agricultural water management. Kenya's greenhouse gas (GHG) emissions were estimated to be 73 million tons of carbon dioxide equivalent (MtCO₂ e) in 2010 and are expected to rise to 143 MtCO₂ e in 2030 unless appropriate mitigation actions are taken (GoK 2017).

According to the Strategy, **Agriculture is the largest source of GHG emissions; it was responsible for one-third of Kenya's total emissions in 2010.** Agricultural emissions are likely to increase from 20 MtCO₂ e in 2010 to 27 MtCO₂ e by 2030, largely driven by livestock methane emissions and land use change, which account for 90% of agriculture emissions and 30% of overall

national emissions. Weak policies, legislations, enforcement, and overlap of mandates among institutions involved in regulation coupled with poor coordination and collaboration among institutions and stakeholders in climate smart agriculture (CSA) have contributed to the country's inability to effectively address vulnerability and GHG emissions (GoK 2017).

3.2 Analysis of Field Based Responses (Site visits and FGDs)

The project team made numerous field and site visits to Ukunda/Diani and Kwale Town and its surrounding- peri-urban areas in Kwale County, Msambweni and Shimoni areas of Kwale County, Malindi and Kilifi towns, as well as Magarini in the hinterland of Kilifi County, and Mombasa City and peri-urban areas in Mombasa County, including Mwakirunge dumpsite in Kisauni constituency.

In Kwale, local sites visited included the municipal dumpsite (Ukunda), while in Kilifi County the project team visited Mtwapa Retail Food Market and Oloitiptip Retail Market. In Mombasa City the project team also visited Mombasa City's Kongowea Market and peri-urban areas. We undertook focus group discussions (FGDs) in Ukunda/Diani, Kwale town, including Ukunda municipality dumpsite, and Malindi and Kilifi towns, Oloitiptip Retail Market, Mtwapa Retail Market (Kilifi County). The Directorate of Agriculture and Cooperatives at the Kilifi County Government provided a lot of information during 2no FGDs with them. In Mombasa, 2no FGDs were held in Kongowea Market.

From the series of targeted field/site visits and FGDs conducted during 2021-23, there were various useful responses and findings. The research team focused mainly on county departments and directorates of agriculture and trade (Kwale, Mombasa and Kilifi), retail/wholesale food markets, and landfills/dumpsites. We also covered large sections of peri-urban Ukunda/Diani, Mombasa, and Malindi. The focus on the departments and directorates was because we needed to discuss with policy makers and managers of the sector, while retail and wholesale markets enabled us to address food trade and food loss and waste. This also applied to the focus on dumpsites/landfills.

Peri-urban areas have potential for peri urban farming and food production as part of the circular economy proposed for the coastal cities.

In Kwale County, the directorate briefed us (19-09-2022) that there are three ecological zones in the county, including mixed agriculture zone with food crops such as maize and root crops, pastoral/livestock zone and the marine/coastal zone. The county also produces fruits including citrus and paw paw, industrial crops such as sugar cane, bixa and coconut. Soils are generally fertile and rainfall is reasonable (600-1700mm). Some of the projects supported by the county government have recorded progress. These include two farm tractors per ward to help farmers prepare their land, provision of seed for one acre per farmer- and covering at least 300 farmers per ward. There are also extension services in the wards. The national Government through the National Agricultural and Rural Inclusive Growth Project (NARIGP) supports farmers with provision of seed, while the Agricultural Sector Development Support Programme(ASDPD) supports value addition, including in local poultry, green grams, tomatoes and cow-peas. The Kenya Cereal Enhancement Programme(KCEP) supports the maize value chain, as well as cow peas. The Kenya Marine Fisheries and Socio Economic Development (KMSFED) project deals with the blue economy.

There is also support for small scale micro-irrigation where farmers are supported with materials to develop and conserve irrigation water in water pans.

However, the key challenge is sustainability of the government supported projects and interventions. Food production in Kwale does not supply sufficiently to meet local demands. Most of the food in food markets in Kwale is sourced from Kongowea market in Mombasa and from across the border in Tanzania.

Key challenges that undermine agricultural production in Kwale include technical capacity for key strategic and operational support services like staff for extension services. Training opportunities are not adequate, while financial resource allocations are typically small and inadequate.

Moreover, other key challenges include diseases and pests especially the army worm, which reduces food production and increases the load of food losses; post-harvest losses which are up to 40% at farm level; high cost of farm inputs like seeds and fertilizers; climate change and unreliable rains; and declining soil fertility especially because of use of chemicals and fertilizers.

Among the key interventions suggested to ameliorate the challenges include: employing new officers to address capacity gaps and to set aside funds for training requirements; enhance water harvesting and small irrigation schemes; cold storage for fisheries; capacitation of beach management units (BMUs) including through fishing boats. Others are improved breeds, mass vaccination, construction of cattle dips; establishment of produce collection centres for produce like fruits and maize, as well as establishment of major markets at Kombani/Mwembe, Ukunda and Samburu. Other proposed interventions include contract farming between the county government and private companies e.g. Feast Foods Ukunda; planned memorandum of understanding (MoU) between the County Government of Kwale, private companies and the Kenya Commercial Bank (KCB). There is a coconut factory in Ukunda, a mango factory, and one for bixa in collaboration with national Government, and sugar cane farming which includes out growers.

According to our respondents, while Kwale county cannot at present feed itself, with the foregoing interventions it is feasible to significantly improve food production. With the hybrid seed in use, there is greater scope for achieving higher levels of production.

Also, while the volumes of waste in Diani/Ukunda are a matter of concern, Ukunda's spatial plan should provide for organized markets for fresh produce, green spaces and cultural sites.

Kwale's abattoirs/slaughter houses are located in the livestock zone, including along the Mombasa-Nairobi highway, and along the Kwale/Kilifi boundaries, often concurrently with the main livestock markets at Mwangulu, Kinango, Samburu.

We also found that, in general, pressing needs for Kwale's agriculture include inputs, value addition, and food losses on farm. Another expressed need is for small scale irrigation, and a county irrigation policy. Good potential and opportunities for agricultural production lie in agro-

forestry particularly casuarina trees; dairy farming especially in Msambweni, Lunga Lunga and Matuga; poultry, and bee keeping.

We noted unsegregated food waste in the Kinondo landfill/dumpsite on the outskirts of Ukunda. Food waste originates in the retail markets, households and hotels and catering establishments, among others. According to the management of Ukunda/Diani Municipality, the land fill is designed to handle segregated waste, and there are plans for recycling of waste. Remarkably, the Kinondo landfill/dumpsite is secured by a high concrete wall, and is large by local standards.

Agricultural production in Kilifi county is also significant, according to the directorate of agriculture, cooperatives and trade. There is great scope for livestock production, including dairy, beef and mutton. Crop production, like for Kwale, includes cereals and pulses, fruits, and vegetables. There is also scope for irrigation, including in the peri-urban areas of Malindi, Kilifi and others.

Mombasa, with clearly the least amount of available arable land, has potential for kitchen farming for vegetables and fruits, mushroom farming and dairy production, and poultry. Ironically, Mombasa has the highest market demand for food owing to the large population in the city. Consequently, most of the food in Mombasa comes from up country counties, and its largest markets like Kongowea and Mwembe Tayari supply food to other neighboring counties. Therefore, while it is comparatively low on agricultural production, Mombasa is tops on consumption and waste generation. Mombasa is also tops on food processing and command of the food supply value chain.

The field/site visits to and FGDs at the wholesale and retail food markets in Mombasa and Kilifi counties yielded interesting results and responses. At Kongowea, (20/22-09-2022) which is the largest retail/wholesale food market in Mombasa city and by extension the whole of the coastal region, we established that it is a large and busy food market with complex food operations on both sides of the supply-consumption divide, and a county governance system that sectorally places the market in the department of trade, while leaving waste management including food waste, to the department responsible for environment. Our observations were that there are significant levels of food waste.

However, there were no data sets or information on amount of food waste recorded. This is partly due to shortage of cold storage facilities, as some of the existing ones are privately owned and operated on a tenancy basis. There are also public coolers for rent. Moreover, there are also few satellite markets, which places additional pressure on Kongowea and somewhat leads to unintended food losses. Also, the market has both whole sale and retail sections, and designated sections for particular produce for example tomatoes, bananas, cereals etc. Stalls traders pay token amounts to the county for operating space (Ksh 800), and those who operate within the market but outside the building (open air) pay smaller daily amounts.

Structural problems in the market that contribute to food waste include power interruptions especially in the upper floors of the buildings, broken pipes and leaking roofs which affect foodstuffs during rains, inadequate cold storage facilities especially important for ripening bananas and tomatoes. Other challenges include market politics and governance problems, and widespread general market and food waste. Although, thankfully, demand is rising for animal feeds especially for green maize husks and remnants of vegetables like cabbages, food waste is a major and ubiquitous problem, especially affecting fruits and vegetables. Open air sales contribute to food waste mainly due to hot weather/sunny conditions. Some of the produce that is easily lost is spinach and other vegetables, mangoes, oranges, tomatoes and melons.

The suggested interventions to address food waste at Kongowea include cold storage facilities, de-congestion and de-centralization by establishing or expanding other satellite markets such as Markiti, Majengo and Mwembe Tayari. The latter will enhance access to fresh produce in a timely manner. Others are efforts to encourage, educate and enforce “under the shed” stalls to avoid food waste, as well as modelling Kongowea into a robust and modern market with superior facilities and customer experience. Finally, a critical need is a systematic data base to track food waste in order to inform timely and effective interventions, with a view to meeting the commitments made under SDG 12.3 as well as by the county government of Mombasa.

There were similar, albeit smaller, scenarios in the municipal/retail food markets in Kilifi, and particularly Malindi, Mtwapa and Oloitipiti markets. The latter were included for comparison,

and especially because Mtwapa market is relatively new and was said to be installing a major cooling system. The interesting phenomena where many traders prefer open air stalls outside the market building was also prevalent in Mtwapa and was associated with “*mazoea*”. (habit). It was clear that such open air practices especially pre-dispose fresh produce like fruits and vegetables to loss of quality and early waste. Even in these relatively new and smaller markets, waste problems are noticeable. As in other counties, markets fall under trade, but the waste management component is under department of Environment.

CHAPTER FOUR

Best Practices and Examples from Other Jurisdictions

4.1 Best Practices and Lessons from Other Jurisdictions

Among the best practice examples include those from the European Union (EU) and Mexico. A few such case examples are described below.

i. EU and Food Loss and Waste

The EU is committed to the global fight against food loss and waste. Food waste prevention was singled out as a priority area in the *EU Circular Economy Action Plan*, adopted in 2015. This called on the European Commission to establish a multi-stakeholder platform dedicated to food waste prevention. The EU Platform on Food Losses and Food Waste, established in 2016, brings together all key actors representing both public and private interests from farm to fork to advance EU progress towards SDG Target 12.3. Members include international organizations (FAO, UN Environment, the Organization for Economic Co-operation and Development OECD), EU institutions, experts from EU Member States, and stakeholders from the food supply chain, including food banks and other NGOs

The Platform aims to support all actors in defining measures to prevent food waste, including possible recommendations for EU-level action, sharing best practices and evaluating progress. With the support of the EU Platform on Food Losses and Food Waste, the European Commission has adopted EU guidelines to facilitate food donations and the redirection of food no longer fit for human consumption into feed. It has developed a food waste measurement methodology and is working to improve date labelling practices. Measurement is critical to food waste prevention. Revised EU waste legislation adopted in May 2018 has introduced specific measures which will provide the EU with new and consistent data on food waste levels.

On 3 May 2019 the European Commission adopted a Delegated Act laying down a common food waste measurement methodology to help Member States quantify food waste at each stage of the food supply chain. Based on a common definition, the methodology will ensure coherent

monitoring of food waste levels across the EU. The Delegated Act was expected to come into force in 2019. EU Member States are expected to provide data separately for five stages of the food supply chain: primary production, processing and manufacturing, retail and other distribution of food, restaurants and food services, and households. This covers the scope of both sub-indicators proposed to measure progress towards SDG Target 12.3 – the FLI and the FWI. The collected data will contribute in a significant way to reporting for both indices. The European Commission’s Reflection paper, “Towards a sustainable Europe by 2030”, highlights the importance of pursuing the EU Action Plan to fight food waste to strengthen the sustainability of EU food systems. The EU also promotes agriculture, forestry and nature conservation around cities and towns (UNEP 2021)

ii. Minimizing Food Loss and Waste in Mexico

In Mexico, more than 50 percent of waste is organic, a large share of which originates from food loss and waste (FLW). Food loss occurs during the production, storage, and distribution of food products, and food waste occurs when consumable food is thrown away. Of the many environmental consequences associated with FLW, a major impact is its contribution to greenhouse gas emissions (FAO 2013). In Mexico, conservative estimates from the Ministry of Environment and Natural Resources (2015) state that by 2020 the solid waste sector, including FLW, was the fifth-largest source of greenhouse gas emissions in the country. In 2016, the quantity, magnitude, and composition, as well as the environmental, social, and economic impacts of FLW in Mexico were comprehensively measured and assessed through a study supported by the World Bank (Aguilar Gutiérrez 2016). The study led to a legal reform that provided incentives for food donation and a call for the development of a national strategy. The following findings emerged from the study conducted in Mexico, and likely reflect similar situations in other countries in the region:

- More than 35 percent of total annual food production is lost or wasted at an annual economic cost of more than US\$25 billion per year, or more than 2.5 percent of GDP.
- Greenhouse gas emissions from FLW are at least equal to that produced by 14 million cars per year.
- The estimated water loss associated with FLW is 39 billion liters per year.

- Estimated FLW in Mexico amounts to more than 20.4 million tonnes per year. The largest share of food loss occurs at the production stage, specifically during distribution and wholesale, while the largest share of food waste occurs at distribution centers and urban centers.
- More than 11 million people are living in extreme poverty in Mexico, often suffering from food insecurity, undernourishment, and malnourishment. The quantity of FLW exceeds the food requirements of this population.

Food Banks are a key part of the FLW solution. The Mexican Food Banking Network (BAMX) is a key organization responsible for promoting the reduction of FLW in the public and private sector's agenda and for motivating the recovery and channeling of food to combat hunger (BAMX 2015). BAMX began its operations as a nonprofit organization in 1995 to recover food to fight hunger and improve nutrition for vulnerable populations in Mexico. One in four Mexicans suffers from food shortages and undernourishment, and since its inception, BAMX has effectively helped this vulnerable population while substantially reducing FLW. BAMX was one of the founding entities of the Global Food Banking Network, an organization comprising 792 food banks in 32 countries. The Global Food Banking Network is the second-largest network after that of the United States. BAMX is a key civil society organization in Mexico (World Bank 2016). BAMX leads food rescue efforts resulting in savings of more than 120,000 tonnes annually and has benefited more than 1,137,000 people. It also purchases about 8,000 tonnes of food per year to achieve nutritional balance in the food donated to social causes.

In addition to supporting Mexico's efforts to fulfill the United Nations Sustainable Development Goals(SDGs) for 2030 (specifically, Goal 12.3 for Responsible Consumption and Production), BAMX has also been a key advocate for several policies and legal proposals:

- In 2000, Mexico's General Law of Health was modified to encourage food donation;
- An amendment to the Income Tax Law provides tributary benefits to companies that donate their products five days before the expiration date;
- As part of a presidential decree, companies that make food donations to food banks only receive an additional 5 percent fiscal incentive

- b. Overall, FLW and anti- hunger efforts and outcomes are improving in Mexico as effective food banks are complemented by support from the government, the private sector, and international agencies (World Bank 2018). **BSI (UK): 10 Ideas That Could Make a Difference to Food Waste**

According to BSI(UK), there is no one measure that will address food waste, but these initiatives could make a difference:

1. Gleaning

Simply finding a home for unwanted food is part of the solution. This might involve letting community groups access leftover crops that are slightly past their best, or where market fluctuations reduce demand. The same principle applies to food waste from restaurants, shops and farms. Organizations like FareShare and Oddbox are helping to redistribute this food.

2. Accepting imperfect produce

Huge volumes of produce are wasted because they don't meet cosmetic criteria – the wrong size, bumpy or blemished. So-called 'wonky' product lines **already provide imperfect produce at a lower price point**, however further education is required to save more 'imperfect' produce from landfill.

3. More efficient machinery

Inefficient machinery causes waste on farms and in factories. Investment schemes (such as the Farming Equipment and Technology Fund in the UK), good maintenance and modern management practices can reduce waste occurring in this way.

4. Invest in transport infrastructure

Bad roads increase food waste due to longer journeys and bruising – in hotter countries with a shortage of refrigerated trucks, this is a particular problem. Improved infrastructure could help, as well as processing facilities so food can be dried or packaged to preserve it.

5. Redesign food packaging

Whilst food packaging is often a major source of plastic waste, it also plays a role in preventing food spoilage. Good packaging needs to balance plastic reduction with food protection to extend shelf life. Products being sold in a range of sizes can prevent waste in smaller households, while labelling about storage, cooking and freezing can ensure more food gets eaten.

6. Improve forecasting

Food is produced to fulfill orders from customers, but if calculations change and an order is reduced, waste can occur at factory or farm level. Artificial intelligence (AI)-powered forecasting models can provide greater clarity about the quantities that suppliers will need to provide to retailers.

7. Encourage meal planning

Around 70% of food waste in the UK occurs at household level. Menu planning and using a shopping list can help consumers make healthy choices as well as avoiding food heading to the bin. Education about food storage can also prevent waste.

8. Choose local produce

The further a product travels, the more chance there is of temperature variation or friction causing spoilage. Road miles also add to the carbon cost of food. Eating food that is produced locally and avoiding exotic or out-of-season produce can help reduce waste.

9. Change how food is displayed

Supermarkets can predict how much produce they will sell, but often put more than this on display to create a sense of abundance. Changing customer expectations or using smaller display units may help to ensure that food isn't put out for show only to be discarded.

10. Scrap best before dates

Many UK supermarkets have scrapped best before dates from produce such as apples, potatoes and pears. Some products still have a use by date that confirms when a product might become unsafe to eat, rather than slightly less fresh(<https://knowledge.bsigroup.com/articles/how-do-we-put-the-global-food-system-on-a-low-waste-diet>)

c. EBRD/3Keel: Establishing Best Practice Guidelines for Food Loss and Waste Prevention; Turkey's 5 Priority Areas for FLW

In accordance with the objectives of the European Bank for Reconstruction and Development (EBRD's) Agribusiness Strategy (2019-2023) and the Green Economy Transition Approach (GET), the EBRD supports sustainable private sector investment in food and agriculture and engages with national authorities and stakeholders.

The objective of the *Food Loss and Waste Guidelines for Greece and Turkey* (“the Guidelines”) is to identify and promote policies, regulatory measures and business practices that would have a positive impact on prevention, reduction and management of FLW at supply and retail levels. In addition, the Guidelines highlight good sector practices for the integration of the circular economy approach into the relevant stages of the food supply chain. This initiative has been implemented in partnership with FAO (<https://www.ebrd.com/what-we-do/sectors/legal-reform/sustainable-food-retail.html>)

In Turkey five priority areas for FLW reduction were identified in a study that also involved Greece. These are most likely to deliver FLW reduction in the food retail sector, and associated financial and climate change mitigation benefits:

1. **Improving cold chain and post-harvest practices:** A reliable and efficient cold chain is essential for reducing food losses and waste. Globally, approximately 20% of foods are lost due to poor cold chain infrastructure and practices.
2. **Data-led supply chain & retail management:** Greater value chain collaboration and the use of data-led approaches to reducing food loss and waste in stores, depots and factories offer potentially significant economic savings for food businesses who invest in these technologies.
3. **Product labelling and consumer awareness:** Product shelf-life and storage advice has a significant impact on food waste in the home and store. Raising awareness and ensuring best practice is adopted can help ensure no edible food is thrown away unnecessarily.
4. **Food surplus and by-product valorisation:** Valorisation is a critical element of the food circular economy. Creation of new products from industry by-products and surplus food, ranging from animal feed to high value food industry compounds.
5. **Surplus food redistribution & selling:** When some food surpluses do inevitably occur in food chain businesses, systems can be put in place to enable these to be resold or sent to charities (e.g. food banks). This ensures the human consumption of produced food is maximized (<https://www.3keel.com/establishing-best-practice-guidelines-for-food-loss-and-waste-prevention/>)

CHAPTER FIVE

Policy Options and Recommendations

5.1 Proposed Options and Recommendations

Policy options on SCP include having a *JKP*- wide strategy and action plan to address improved domestic food production, storage and agro-processing, access to and quality of markets, food trade among others, in accordance with national policy frameworks, including the National Agricultural Policy 2021, National Food and Nutrition Security 2011 and the Agricultural Sector Development Strategy 2010-2020. County governments are also expected to promote appropriate on farm storage and community commodity banking, as well as the evaluation and documentation of post- harvest losses. The *JKP* counties should have a common strategy to manage food loss and waste, apart from agricultural and food production. This means that *JKP* counties should consider having unified and concerted approaches to agricultural production and addressing food loss and waste.

An important policy option is the promotion of public-private-partnerships(*PPPs*) for production, as well as post- harvest management to mitigate food losses and waste along the food value chain. In this way, *JKP* counties will mitigate high post-harvest losses and food waste, and improve agricultural production. Emphasis should be placed on fostering partnerships between government institutions, private sector actors, research institutions, and farmers' associations to jointly address food losses and waste including encouraging private sector investments in post-harvest infrastructure, technological innovation, and capacity building programs.

Addressing food losses and waste is crucial for achieving sustainable agriculture in Kenyan coastal counties. It requires a comprehensive approach that integrates policy, governance, and institutional frameworks. By promoting efficient post-harvest practices, enhancing coordination among stakeholders, and strengthening institutional capacity, the region can reduce food losses, enhance

food security, protect the environment, and promote socio-economic development. Some of the broad policy propositions include:

- i. **Policy Development and Implementation**, including formulation and implementation of comprehensive policies and strategies to promote sustainable agriculture, focusing on reducing food losses and waste; and integration of food loss and waste reduction targets into national and county-level agricultural plans.
- ii. **Infrastructure Development**, including investing in the development of post-harvest infrastructure, such as storage facilities, transportation networks, and market access points. Improve cold chain systems to reduce spoilage and preserve perishable produce.
- iii. **Awareness and Education**, including conducting targeted awareness campaigns to educate farmers, traders, and consumers about sustainable agriculture practices, post-harvest handling, and waste reduction techniques; as well as promoting knowledge sharing platforms and training programs. To effectively address food losses and waste in Kenyan coastal counties, it is essential to draw inspiration from successful practices and initiatives implemented globally and within the African continent.
- iv. **Research and Innovation**, including allocating funding for research and innovation in sustainable agriculture practices, post-harvest management, and waste reduction technologies and support collaboration between research institutions, universities, and farmers to develop context-specific solutions.
- v. **Monitoring and Evaluation, including** establishing a robust monitoring and evaluation system to track progress, identify bottlenecks, and make informed policy decisions and regularly assess the effectiveness of interventions and adjust strategies accordingly.

The FAO 2019 report argues that when considering actions and policy options on food loss and waste, they should be seen as a way to achieve other objectives, notably improved efficiency in the food system, improved food security and nutrition, and improved environmental sustainability. It is up to policy makers to prioritize these interventions.

There are some generic policy proposals followed by specific policy proposals concerning agriculture and food processing, including food loss and waste.

1. National and county governments should undertake studies to fill data and knowledge gaps, including development of methodologies and tools for measuring food loss and waste and

other waste. There are huge data and knowledge gaps in the entire spectrum of SCP sectors of concern: agriculture and food processing, tourism and hospitality, construction and infrastructure development, and environment and natural resources. Interventions should aim at making and sustaining incremental gains in data and knowledge.

2. National and county governments should adopt and implement circular economy frameworks and solutions- across the spectrum of the SCP sectors of concern herein, including agriculture and food processing, emphasizing on the inter linkages, convergences, possible tradeoffs and integrated approaches. In this regard, there should be closer multi-sectoral and inter-sectoral synergies and integrated approaches.
3. National and county governments should make major public investments in capacity development and enhancement across the SCP sectors of concern and their associated ecosystems, including agriculture and food processing, through developing both business case and economic case for key interventions such as waste management including food loss and waste. Persuasive business cases would appeal to key stakeholders in the respective value chains, while the economic case will demonstrate the overall benefits to communities and the country.
4. On enhancing agricultural and food production, it is recommended that governance and policy frameworks should be developed or enhanced as follows:
 - Strengthen peri-urban farming in the hinterlands across the agricultural sub sectors- crop, livestock and fisheries;
 - Promote community involvement, public awareness and participation, including establish farming clubs and communities, especially youth and women groups;
 - Promote regenerative agriculture, including low carbon agricultural practices, better agronomic and soil management measures;
 - Promote value addition and food processing;
 - Explore irrigation potential especially for vegetables and horticultural produce in peri-urban areas;

- Encourage and promote public private partnerships in agricultural and food production and consumption value chains;
- Commit increased county and national government financial allocations to food production and food loss management;
- Undertake farmer training programmes to alleviate onfarm losses, such as better harvesting procedures and practices/technologies, storage, packaging and transportation, good soil management practices, etc.(FAO 2019);
- Undertake data collection and management on food losses across the food value chain. (FAO 2019);
- Design and implement a system of incentives, investments and regulations to address both production of food, as well as management of food loss and waste((FAO 2019);
- Technological innovation and improvements leading to significant gains in agricultural production and productivity;
- Encourage and promote consumption of local produce, including through irrigation and agricultural intensification;

5. To address food loss and food waste, it is recommended to:

- Develop and implement frameworks towards zero waste or loss of food and feeds;
- Adopt circular economy models where all food and feed losses and wastes go back to farm, as well as valorisation of food and feeds; and thereby seek to achieve minimal or zero net agricultural loss or waste.
- Make financial and other investments in food waste and food losses management in order to reduce food losses and waste both on farm and in the markets and along the value chain, including cold room storage in major municipal markets, improved supply systems, etc. Adequate cold storage is deemed crucial to prevent or reduce food waste.
- Commercialize agricultural and food wastes, including through undertaking value chain analysis of key crops which yield significant losses and wastes. For example, coconut husks that are the byproducts of the consumption of “*madafu*” and coconut, are largely left on ocean beaches and city streets and market areas without regard that they may have other, secondary values. Coconut “wastes” could be

commercialized through value addition and application or use as ornaments and decorations, baskets and door/floor mats, charcoal briquettes, office and domestic accessories as desktop organizers/ pen and pin holders, flower vases, or even calabashes.

- Raise awareness and public information on the benefits of reducing food loss and waste;
- In terms of the National Agricultural Policy 2021, County governments should promote appropriate on farm storage and community commodity banking, as well as the evaluation and documentation of post- harvest losses.
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Annexes