

**EMERGING STRATEGIES TOWARDS SUSTAINABLE FOOD SECURITY IN
HOMA BAY COUNTY KENYA**

BY

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DECLARATION

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DEDICATION

This work is dedicated to my family for their patience, prayers, and encouragement which were very instrumental in the pursuit of my Masters journey.

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LIST OF ACRONYMS AND ABBREVIATIONS

ADB	African Development Bank
AMCS	Aquaculture Multipurpose Cooperative Society
ASALs	Arid and Semi-Arid Lands
ASDSP	Agricultural Sector Development Support Programme
CFS	Committee on World Food Security
CFSVA	Comprehensive Food Security and Vulnerability Analysis
CHI	Coping Strategies Index
CIDP	County Integrated Development Plan
DHS	Demographic and Health Survey
FAO	Food and Agriculture Organization
FCSCSI	Food Consumption Score and Coping Strategy Index
FSC	Food Consumption Score
GDP	Gross Domestic Product
GoK	Government of Kenya
HDDS	Household Dietary Diversity Scale
HFIAS	Household Food Insecurity and Access Scale
HHS	Household Hunger Scale
HYV	High Yielding Variety
ICIPE	International Centre of Insect Physiology and Ecology
IFPRI	International Food Policy Research Institute
KAPP	Kenya Agricultural Productivity Program
KARI	Kenya Agricultural Research Institute

KDHS	Kenya Demographic and Health Survey
KMD	Kenya Meteorological Department
KNBS	Kenya National Bureau of Statistics
KNFSP	Kenya National Food Security Program
LPVCCS	Local Poultry Value Chain Cooperative Society
MOA	Ministry of Agriculture
MoALF	Ministry of Agriculture, Livestock and Fisheries
NAAIAP	National Accelerated Agricultural Input Access Program
NACOSTI	National Commission for Science, Technology and Innovation
NALEP	National Agriculture and Livestock Extension Program
NCPB	National Cereal and Produce Board
NEPAD	New Partnership for Africa's Development
NGO	Non-Governmental Organization
NMK	<i>Njaa Marufuku</i> Kenya
PVCCS	Peanut Value Chain Cooperative Society
RDCS	Rangwe Dairy Cooperative Society
SAFS	Self-Assessed Measure of Food Security
SDGs	Sustainable Development Goals
TLU	Total Livestock Unit
USAID	United States Agency for International Development
WFP	World Food Program
WHO	World Health Organization

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ABSTRACT

The main challenge facing nations in Africa, Kenya included, is of devising appropriate strategies that will not only increase food production but also enhance food sustainability. This is informed by prevailing situation where majority of those strategies that have been adopted, have not fulfilled the expectation of sustainable development in spite of the enormous investment. The study therefore identified and analyzed the emerging strategies on sustainable food security in Homa Bay County. Based on the modernization theory which postulates that modern systems lead to efficiency and effectiveness hence improved outcomes, the study adopted a concurrent mixed method research design. The specific objectives were to: evaluate food situation in Homa Bay County; assess strategies being employed towards food security sustainability in the study area; examine the effect of emerging strategies on sustainable food security in Homa Bay County and; determine challenges hindering improvement of sustainable food security in the study area. The target population for the study was households in Homa Bay County. Stratified and purposive sampling procedures were employed in selecting the respondents. The sample size for the study was 436. Instruments of data collection were the questionnaire, interview schedule and observation guide. The household was the unit of analysis. Both descriptive and inferential statistics were used for data analysis. Descriptive statistics, Pearson correlation coefficient and Logit regression models were used to analyze the emerging strategies identified to affect sustainable food security. Qualitative responses were analyzed using thematic analysis approach. The study findings indicated that majority (72.4%) of the households, and the general view of key informants was that Homa Bay County is food insecure. The food security strategies employed were insufficient due to numerous challenges that could be mitigated to curb food insecurity. The study identified several strategies that are considered emerging to boost sustainable food security such as price subsidy, agricultural extension, post harvest food processing and improved crop and livestock varieties. The study found that all variables analyzed positively affected food security. Input (fertilizer/ certified seed) and price subsidy was positive (2.70) and statistically significant at 99% confidence level. Asset endowments had a positive coefficient of 2.28) while coefficient for household income was 2.27 and the effects were also significant at 99% confidence level. The effect of membership to groups (coefficient of 2.27) and access to markets (variable coefficient of 2.37) was positive and statistically significant at 95% level. However, effects of the rest of the variables were positive but not significant at 95% significance level. The study therefore rejected the hypothesis. Challenges affecting sustainable food security in Homa Bay County include unfair distribution of subsidized farm inputs, limited agricultural extension services, inadequate and unreliable cash transfers to vulnerable groups and high cost of production inputs, and limited size of land. Others emerged as pests and diseases, drought in face of limited water irrigation. The study concluded that Homa Bay County is still not food secure despite the numerous emerging promoted food security strategies. The study recommends that National and County governments as well as development agencies to engage and monitor fair distribution of subsidized farm inputs to increase food production. There is also need for mixed crop farming due to land scarcity, growing of drought resistant crops due to prolonged droughts as well as increased irrigation activities to ensure households remain food secure.

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OPERATIONAL DEFINITION OF TERMS

Effectiveness: refers to a measure of the success of plans put in place to address food security.

Emerging Strategy in this study means a prominent plan recently put in place by the national and/or the county government in the study area to achieve food security.

Food Security refers to food availability and accessibility in terms of affordability, adequacy in quantity and quality to meet household dietary needs.

Food insecurity means limited or lack of sufficient amount of food that is available and accessible by household to meet their dietary needs.

Household: is used in this study to represent a decision making unit at the family level. It refers to a group of individual sharing a common kitchen.

Sustainable is the ability of the strategy to meet long term household food requirements.

Sustainable Development: refers to economic development that is conducted for the benefit of present generation without depletion of natural resources for the future.

Sustainable Development Goals: are a collection of 17 global goals designed to be a blueprint for achieving a better and more sustainable future for all.

Resources: refer to something of value that can be sold, utilized or exchanged to access food or to meet household food requirements.

CHAPTER ONE

INTRODUCTION

This chapter provides the background to the study. The chapter is subdivided into the following sections: background to the study; problem statement; objectives of the study; hypotheses/ research questions; justification of the study and; scope of the study.

1.1 Background to the Study

According to Committee on World Food Security(CFS, 2011), food security exists when all people at all times have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. The nutritional dimension is integral to the concept of food security. Food security can be looked at both at global and household levels.

At global level food security exists when all people at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (FAO, 2002).At the household level, food security refers to the ability of the household to secure, either from its own production or through purchases, adequate food for meeting the dietary needs of all members of the household (FAO, 2010). Households are food secure when they have year-round access to the amount and variety of safe foods their members need to lead active and healthy lives.

Food security is broken down into four pillars namely: food availability, food access, utilization and stability. Food availability refers to the physical existence of food (CFS, 2011). On national level food availability is a combination of domestic food production, commercial food imports and exports, food aid and domestic food stocks in a given country. On household level food could be from own production or bought from the local markets. Food availability can be affected by factors such as population growth, pressure on existing natural resources and climate change hence posing a threat to long-term food security. Food availability can be improved through use of suitable adaptation measures to soil such as irrigation, adoption of improved agricultural technologies, infrastructure development and reduction in production risks.

Access is ensured when all households have enough resources to obtain food in sufficient quantity, quality and diversity for a nutritious diet. This depends on amount of household resources and on prices. Accessibility depends on availability. Drastic changes in physical, social and policy environment may seriously disrupt production strategies hence limiting food availability and threatening household food access. Food accessibility may be affected by severe droughts or floods that shrink harvest volume leading to increased food prices.

According to CFS (2011), food use describes the socio-economic aspects of household food and nutrition security, determined by knowledge and habits. This assumes that nutritious food is available and accessible so that the task of the household is to decide what food to purchase and how to prepare, consume and allocate it within the household.

Another aspect is the biological utilization relating to the ability of the human body to take food and convert it to energy for use. This gained energy is important when it comes to daily physical activities, for example engaging in agricultural production (CFS, 2011). Utilization requires a healthy physical environment and adequate sanitary facilities as well as the understanding of proper health care, food preparation, and storage processes. Clean water is therefore necessary for drinking, food preparation and for ensuring a clean and healthy environment for the population to utilize food properly.

According to CFS (2011), food stability describes the temporal dimension of food and nutrition security. Stability is achieved when the supply on household level remains constant during the year and in the long-term. That includes food, income and economic resources. Furthermore it is important to minimize external risks such as natural disaster and climate change, price fluctuations, conflicts or epidemics through activities and implementations that improve resilience of households. Such measures include insurances against drought and crop failure as well as environment protection and sustainable use of natural resources like land, soil and water.

According to the FAO (2019), an estimated 820 million people globally did not have enough to eat in 2018, up from 811 million in 2017, which was the third year of increase in a row (FAO, 2019). This underscores the immense challenge of achieving the Sustainable Development Goal of Zero Hunger by 2030. Many factors have contributed to the current world hunger problem. In the recent past, the changing climate, growing population, rising food prices, and environmental stressors have brought in significant

yet highly uncertain impacts on food security. Sustainable new and adaptable food security strategies and policy responses to global change, including options for water allocation, land use patterns, food trade, post-harvest food processing, and food prices and safety are needed. With the rising hunger situation in many developing countries there have been efforts to promote emerging sustainable food security strategies. Adoption of the emerging food security strategies is likely to increase income of rural smallholder farmers through increased production and indirectly decreasing the price of output. This will improve food security, alleviate poverty and encourage smallholder farmers to produce for the market.

Sustainable food security which is a subject of this study refers to long term food availability and accessibility in terms of affordability and continuous adequacy in quantities and qualities. It can be viewed at both macro and micro level. At macro level, it implies that adequate supplies of food are available through domestic production or through imports to meet consumption needs of all people in a country. At the micro level (household or individual), food security depends on a number of factors which are related to various forms of entitlements to income and food producing assets, as well as the links between domestic and external markets. This means that food security are not just production or supply issues but also a function of income and purchasing power among other factors, hence its relationship with poverty.

The influence of the private sector especially food retailers in the food situation is also rapidly increasing. Analyzing and interpreting food security strategies and challenges is

essential as it provides policymakers with the necessary information to mobilize adequate responses at local, national, regional, and international levels that will enhance food sustainability. It is also critical for helping to appropriately adjust research agendas in agriculture, nutrition and health sectors of economies. Global focus therefore should be on role of agriculture in enhancing sustainable food security. The Food and Agriculture Organization (FAO, 2000) noted that food supply is conditioned by rules of global food market and global geopolitics, which affect decisions concerning production and distribution of food at national and local levels. According to FAO (2007), the effective demand (purchasing power) of high income buyers has precedence over real demand for nutritional needs of populations. For most people, access to food depends on access to money and, for some, on access to charity.

Lessons learnt from the “Green revolution” in Asia shows that use of fertilizer and high yielding seed leads to dramatic increase in food production ensuring food security despite high population. Therefore, increased use of these inputs is perceived to be key in breaking low productivity cycle through transformation from production for household subsistence to production for the market in order to enhance smallholders' welfare. Kenya has adopted strategies that mainly combine long-term action to enhance productive potential and incomes with programs and policies that respond to immediate needs of the poor and food insecure. The expansion of agribusiness in the third world countries has affected their self-sufficiency in food. Food trade and food markets have become subject to rules over which majority of farmers have no control, and this has serious implications on the livelihoods of entire populations. There is therefore need for small-scale production to meet household food consumption requirements.

Otieno *et al.* (2012) noted that most smallholder farmers had limited access to necessary production skills, lacked market information and there was weak linkage between smallholder farmers and available markets that led to inappropriate use of inputs thus low agricultural productivity and growth. Agricultural sector however is expected to play an important role in national economic growth (Oluoch-Kosura, 2010). In Kenya, 30% of the food consumed by rural households is purchased, while 70% is derived from own production. On the other hand, 98% of food consumed in urban areas is purchased while 2% is own production (FAO, 2006). This emphasizes the strategic role played by rural households in food security not only in Kenya but also in many African countries. Agricultural policies formulated therefore should focus on how to increase productivity and market efficiency in rural setups (FAO, 2006). Agricultural production remains the single most important strategy to improve a region's food security and sustainability. Economic growth is only sustainable if all countries have food security. Without country-owned and country driven sustainable food security strategies, there will be obstacles and additional costs to global, regional and country-level economic growth. Sustainable food security also needs to encompass women and other vulnerable and disadvantaged groups (www.ifpri.org).

According to FAO (2017), agriculture is the engine of Kenya's economic growth contributing to about 75% of Kenyans' income earnings and accounts for 33% of the gross domestic product (GDP). Despite continuous population growth, agricultural productivity has stagnated in recent years. Only 20% of Kenyan land is suitable for farming and that land is not utilized efficiently. Recurrent crises such as drought add to agricultural

challenges. In response to the challenges, USAID is increasing productivity for smallholder farmers.

The efforts to increase food security by the GoK include revamping development and application of improved technologies in agricultural production as well as reviving agricultural extension services (GoK, 2017). In this report, the GoK in collaboration with development partners put in place projects and programs geared towards building smallholder farmers' capacity. These programs made use of group approaches to achieve economies of scale in extension services, input procurement and sale of farm produce. The programs include: National Agriculture and Livestock Extension Program (NALEP), *Njaa Marufuku* Kenya (NMK) that is 'Eliminating Hunger' in Kenya, Kenya National Food Security Program (KNFSP), Kenya Agricultural Productivity Program(KAPP) and National Accelerated Agricultural Input Access Program(NAAIAP).All the efforts target increased food production leading to sustainable food security.

Vhurumuku (2014)highlighted a number of measures of food security. First is dietary diversity and food frequency proxy. This type of metric captures the number of different kinds of food or food groups that people eat and the frequency with which they eat them. This involves weighting the groups to obtain a score that represents the diversity of intake but not necessarily the quantity. The scores have been shown to be significantly correlated with caloric adequacy measures(Coates *et al.*, 2007). The others are those related to the consumption behavior known as consumption behaviors measures. These measures capture food security indirectly by measuring behaviors related to food

consumption. The measures are used as proxies for food security. Behavior proxies, known as the Coping Strategies Index are discussed below.

The CSI counts the frequency and severity of behaviors in which people engage when they do not have enough food or enough money to buy food (Maxwell and Caldwell, 2008). Food security measurements here involve dietary diversity and food frequency. They include Food Consumption Score (FCS); Household Dietary Diversity Scale(HDDS); Spending on food and; Household Food Insecurity and Access Scale (HFIAS);The Household Hunger Scale (HHS). The Self-Assessed Measure of Food Security (SAFS) and CSI capture the element of quantity or sufficiency. HFIAS captures a mix of sufficiency and psychological factors.HHS captures the most extreme manifestations of insufficiency.FCS and HDDS capture quality and diversity(although FCS is calibrated to capture an element of quantity as well).

FAO (2014) defines dietary diversity and food frequency indicator - frequency weighted diet diversity score as a score calculated using the frequency of consumption of different food groups consumed by a household during the 7 days before the survey. It is an acceptable proxy indicator to measure caloric intake and diet quality at household level, giving an indication of food security status of the household if combined with other household access indicators. It is a composite score based on dietary diversity, food frequency and relative nutritional importance of different food groups used primarily by the World Food Programme. Food Consumption Score (FCS) Dietary diversity represents the number of different foods or food groups consumed over a given

reference period usually with a 24-hour recall period without frequency information or weighted categorical cut-offs. It is a proxy measure for HH food access. The number of food groups examined is usually between 7 and 16. This method is widely used by the FAO and USAID. The target are individuals (IDDS), household(HDDS), or women(WDDS).

Household Dietary Diversity Scale(HDDS) is based on a comparison of usual food consumption expressed in terms of dietary energy (kcal) with certain energy requirement norms. It considers mean dietary energy supply as a proxy for food energy consumption. The part of the population with food consumption below the energy requirement norm is considered undernourished ("underfed") (FAO, 2014). Estimating the proportion of expenditure on food of the total household income is another proxy of food security. There is a high propensity of people closer to the edge of poverty to spend greater and greater proportion of their income on food. This method can also look at the proportion spent on different food groups. Spending on food combine indicators for overall food security, Input indicators, domain summary indicators and consolidate to provide an outcome. The method is used by World Food Programme (WFP) on food insecurity to plan for food needs.

In this study, food security was measured using the Consumption Behavior as proxy for food security. In particular, the Household Hunger Scale was adopted. This is essentially a behavioral measure. It asks questions such as; was there ever no food to eat of any kind in your house because of lack of resources to get food? Did you or any household

member go to sleep at night hungry because there was not enough food? Did you or any household member go a whole day and night without eating anything because there was not enough food? In this study a household was considered food insecure if the answer to any of the above questions is yes.

Adoption of food security strategies is likely to increase sustainable food security. Food security strategies maybe categorized under: institutional support; Technology; producer characteristics and; socio-economic factors. The strategies are assumed to be implemented in an environment of appropriate policies and climatic conditions. Fertilizer use and certified seeds for example have the potential of improving sustainable food security due to their effects on agricultural production. Seaman *et al* (2014), in a study done in Lake Tahoe in North America, showed that to be most effective inputs such as fertilizers need to be applied in proper quantities.

Africa's use of certified seed and fertilizer in food production is relatively low compared to rest of the world. African countries represent 2% of global demand for fertilizers (Yara International, 2018). This means many countries have a huge potential for increasing crop yields if fertilizer use is extensively exploited. Population growth is expected to rise sharply in African countries by the year 2050 and to keep up with rising population, Tanzania for example needs to increase maize production from 4.65 million tons in 2010 to 18.6 million tons in 2050 in order to meet the expected demand (Yara International, 2018). Without use of enough fertilizer and certified maize seed, farmers will need to more than quadruple existing farmland area for maize production in order to reach the target. But with recommended levels of inputs it is estimated that production

increase can be done within existing farmland irrespective of existing problems of land scarcity and fragmentation.

Fertilizer and certified seed subsidy by the GoK is one of the institutional support emerging strategies employed in the recent past to address the challenge of food insecurity in Kenya. Before introduction of the subsidy, most farmers could not afford the high fertilizer and certified seed prices thus used suboptimal levels of fertilizer and uncertified seed. According to Baldos & Hertel (2014), application of inputs like fertilizer should not be seen as a goal in isolation. The broader goal is application of sufficient quantity of fertilizer.

Another strategy for food security is the development of physical infrastructure and market support in Kenya. Poorly developed and inadequate infrastructure and uncompetitive markets are responsible for driving up prices of food in remote rural areas. Improving on cost and reliability of access to food in rural areas is an important aspect of sustainable food security. This is achieved by infrastructural development of roads, railway line among others in order to improve on movement of food items from areas of surplus production to areas of scarce production thus food security. Poor roads raise transport costs, while trader collusion increases margins. Improving market efficiency is one powerful solution that the GoK and county governments are now engaging.

Increasing access to market information may greatly improve marketing efficiencies and contribute to increased reliability of accessing food. Use of mobile phones to access market information is one of the emerging strategies that are in use in Kenya. Mobile phones, Television (TV) and radio are also used to educate farmers on use of recommended agricultural technologies and on appropriate use of required inputs such as fertilizer, seed, pesticides and, pest, weed and disease control measures among other emerging issues that touch on crop and animal production. Use of phones, TV and radio however require farmers to be informed, well trained and educated enough to understand the information communicated to them. Mango *et al* (2014) noted that training is enhanced when various medium are used to promote easy understanding, this can be done using appropriate media which vary from workshops, seminars, on farm training and demonstrations. The role of extension officers determines sustainability of the promoted initiatives in the long run. Thus, the higher the level of education of a farmer the higher the farmer's agricultural productivity. Education mostly improves the managerial ability by helping the farmer to emulate and execute farm plans and acquire information on how to improve marketing of the products. A sound educational background can reinforce natural talent and provide a basis for informed decision making. The knowledge that the farmers gain from mobile phones, TV, radio and from extension officers among other trainings can greatly improve sustainable food security.

Use of agricultural machinery and irrigation are emerging strategies adopted to address the problem of food insecurity. Farm machinery is used to complement limited manual labor. Thornton & Lipper (2014) noted that availability of labor at household level, farming skill, irrigation facilities and support by the agriculture extension officer

influenced yield thus sustainable food security. In general, farmers who mobilized labor for early land preparation, planting and weeding received higher crop yields. Farmers who received lower yields attributed this to a scarcity of labor at household level. Weeding is essential for pest control and good crop health and yields, however, some farmers could not raise sufficient labor, as they had to divide their time between care roles and treatment requirements. Moreover, high maize production hampered by unproductive land.

A report by United Nations World Summit on Sustainable Development on food security established that poverty eradication, agriculture and food security have moved to the center stage of the global development agenda. These are the greatest global challenges facing the world today. They are indispensable requirements for

sustainable development, particularly for developing countries. At the World Summit on Sustainable Development (WSSD) held in Johannesburg in 2002, the international community reaffirmed its commitment to develop national and local programs for sustainable development, poverty eradication and food security (WSSD, 2002). As the Kenya government continues to operationalize the Agricultural Sector Development Strategy (ASDS), Vision 2030 and the National Accelerated Agricultural Input Programme (NAAIP) there is need to assess the influence of the intervention strategies on food security and its sustainability.

1.2The Problem Statement

Food security is one of the Big Four agenda issues implemented by the Jubilee Government in Kenya. Despite the substantial investments of public funds on the emerging food security enhancing strategies, the large number of farmers involved and the almost national coverage, it is difficult to find a comprehensive study on why Kenya continue to experience food deficits and sometimes forced to resort to imports under crises. According to CFSVA (2016), Homa Bay County is one the counties in Kenya identified as experiencing food insecurity.

Over the years, Kenya has experienced years of heightened food insecurity and dependence on imports and emergency humanitarian assistance. While several emerging food security strategies have been put in place to ensure Kenya attains national food availability and sustainability, deficits continue to recur especially in years of prolonged droughts. National food security programs have not guaranteed household food availability and accessibility. There seems to be no improvement in food security situation despite national and county government efforts to curb food insecurity. This calls for a study to determine food situation, to evaluate the adoption of emerging strategies and analyze the specific effects of the strategies on sustainable food security as well as determine the challenges to attaining sustainable food security in the study area.

Studies elsewhere show that when systems are modernized, there are bound to be improved outcomes. Emerging food security strategies are expected to modernize ways of attaining food security. However, the persistent food insecurity in the study area calls

for a study on the emerging strategies towards sustainable food security thus the undertaking of this study.

1.3 Objectives of the Study

The general objective of the study was to examine the emerging strategies aimed at improving food security sustainability in Homa Bay County. The specific objectives of the study were:

- (i) To assess food situation in Homa Bay County
- (ii) To evaluate emerging strategies employed in food security sustainability in the study area
- (iii) To analyze the effect of the emerging strategies on sustainable food security in Homa Bay County
- (iv) To determine challenges faced while improving sustainable food security in the study area.

1.4 Research Questions

This research was intended to answer the following questions:

- (i) How is the food situation in Homa Bay County?
- (ii) Which strategies are being applied towards sustainable food security in the study area?
- (iii) What are the challenges faced in attaining sustainable food security in Homa Bay County?

1.5 Research Hypothesis

H₀: There is no significant relationship between adopting emerging food security strategies and sustainable food security in the study area.

1.6 Justification of the Study

Kenya has for long pursued the goal of attaining self-sufficiency in food commodities that include maize, wheat, rice, beans, milk and meat. The government in collaboration with development partners has put in place projects and programs geared towards building smallholder farmers' capacity (MOA, 2008). The programs make use of group approaches to achieve economies of scale in extension services, input procurement and sale of farm produce. Several strategies that include the National Accelerated Agricultural Input Access Programme (NAAIAP) were initiated to address the problems of food security and poverty amongst the resource poor farmers. The ever changing societal dynamics calls for a study to analyze the emerging sustainable food security strategies employed to address food security in the study area. This study therefore sought to bridge this gap.

1.7 Significance of the study

Knowledge on the impact of food security efforts and programs and their success in achieving intended goals and objectives is important since it provides the empirical evidence on the programs' impact on welfare of households. The study findings add to the existing body of knowledge on the area of sustainable food security and factors that determine it. Information on effects of emerging strategies on sustainable food security

can act as guide to policy makers on future formulation and implementation of social programs on food security or improvements in existing programs through reviews. The research findings will be useful to development partners in formulating their strategies in the rural sector to strengthen their policy dialogue and their lending programs in Kenya. The documentation of results of this study adds to existing body of knowledge on food security and its sustainability in the study area.

1.8 The Scope and Limitations of the Study

The study was carried out in Homa Bay County. The choice of the study area was influenced by being a vast food insecure area (CFSVA, 2016). Homa Bay County has both urban and rural populace making it ideal for this study. Rural and urban people represented the views of Homa Bay people and Kenyans in general. The study population comprised households, National and County government officials as well as opinion leaders among others who reside in Homa Bay County. Among the qualitative responses, the logit regression models were selected to analyze the effect of the factors believed to affect sustainable food security in the study area.

Food security can either be determined at global level using Global Hunger Index (GHI) as measure or at household level. This study concentrated on food security sustainability at the household level. There are several measures of food security. This study adopted the Household Hunger Scale (Vhurumuku, 2014) as a measure of food security. Descriptive statistics were both qualitative and quantitative and were used to analyze the independent variables. The mode was used to analyze qualitative data while the mean was used to analyze the quantitative data.

This study did not determine types, levels and extent of food security as it was only concerned with emerging strategies that are believed to affect sustainable food security in the study area. Analyses of the emerging food security strategies affecting sustainable food security in this study were limited to descriptive statistics and inferential analyses.

CHAPTER TWO

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Overview

This chapter will provide a review of literature on the studies that have been undertaken on the subject of this study. It begins with the theoretical framework of the study and then provides studies that are related to the current study with the aim of identifying information gaps that the study attempted to fill. The conceptual framework of the study is also presented in this chapter. The conceptual framework enables to highlight variable relationships in the study.

2.2 The Food Situation in Kenya

The 2016 Kenya Comprehensive Food Security and Vulnerability Analysis (CFSVA) provide the first 47-county overview of food security and nutrition in Kenya since the onset of devolution in 2013. This data was collected and analyzed in the year 2014 and was designed to monitor and evaluate population and health situations in Kenya. The World Food Programme's (WFP, 2016) analysis of the Demographic and Health Survey (DHS) data for the CFSVA explored Food Consumption Score Coping Strategy Index (FCSCSI), as an indicator of households food security as well as discussing possible causes of food and nutrition insecurity.

The CFSVA (2016) report indicated that Kenya is a food deficit Country, meeting the needs of its growing population through formal and informal imports of maize as well as

rice and wheat. This makes the Country vulnerable to international price fluctuations as well as to trade barriers sometimes imposed by neighboring countries from which it imports. Growth in the agricultural sector rarely keeps pace with that of other sectors. It fell from 5.2 % in 2013 to 3.4 % in 2014 but rebounded to 5.6 % in 2015 (CFSVA, 2016). This was attributed to favorable rains which were received during that year. One of the reasons for food deficiency is that smallholder farmers who face multiple constraints that erode their production potential are dominant in the sector. These farmers find it hard to access credit needed to buy inputs such as fertilizers and pesticides whose costs are rising mainly because of transaction costs from source to destination, exploitation by middlemen and high demand occasioned by insufficient supplies. According to the CFSVA (2016) report on DHS data, smallholder farmers produce in small plots of less than 0.5 ha (1.23 acres) and only about 6–8 % of the land has been irrigated, leaving smallholder farmers highly vulnerable to unreliable rainfall and floods.

The arid and semi-arid lands (ASALs) which cover about 80 % of the Country's landmass are characterized by erratic, low rainfall and are prone to prolonged drought and flash floods. Some (8) counties namely; Turkana, Marsabit, Samburu, Isiolo, Wajir, Taita Taveta, Kajiado and parts of Kitui have experienced a high number of droughts in the past 15 years. These areas have experienced high number of poor growing seasons for both the short and long rains between February 2001 and February 2016 (CFSVA, 2016). Most households have no legal title to their land, which deters them from investing in land improvement and can lead to land grabbing conflicts and expropriation

by the State. Additionally, intensive maize cropping and unsustainable land management practices have continued to degrade soil fertility (KNBS, 2016).

Livestock production, most of which is concentrated in ASALs, plays a major role in food security. For subsistence pastoralists, livestock ownership is critical in times of stress because they survive on meat and milk alone when market prices rise. According to CFSVA (2016), the average number of Total Livestock Unit (TLU) owned by a rural household is three (equivalent of, for example, 14 goats) but in Marsabit, Garissa and Narok they own at least 10, followed by Wajir, Samburu, Isiolo, Baringo, Mandera and Tana River.

The major challenges pastoralists face are livestock diseases and lack of pasture and water especially during prolonged drought. Flash floods can also wash away weakened animals as well as the high cost of fodder during drought. Small and medium scale farmers produce about 75% of the main staple food (maize), while large-scale (above 25 acre-farms) produce the rest. During normal season, national maize production cover up to 98.5% of consumption but during drought season it may fall to 62% as was the case in the year 2009 (CFSVA, 2016).

The CFSVA (2016) estimated the total maize production in 2015, from both the long and short rains to be 3.1 million Metric Tons (MT), about 9% above the five-year average. This was due to the two successive favorable cropping seasons and continued cross-border imports, giving the Country a surplus of about 0.41 million MT. One of

the major challenges that dominate maize production is how to keep farm prices high enough to encourage farmers to grow it, but low enough to ensure poor consumers can afford to buy it. Maize price instability is a major impediment to smallholder productivity growth and food security.

Across the Country households were highly dependent on buying their food. Market integration and food prices are key determinants of household food security. Kenya National Bureau of Statistics (KNBS, 2016), indicated that rural households buy around 76% of their food consumption demands. The pastoralist communities in Kenya's poorest and most remote counties such as Turkana, Mandera, Garissa, Wajir, Isiolo and Samburu buy all commodities apart from livestock products like meat and milk. Most markets in these areas particularly those off main transport routes, are poorly linked both amongst themselves and with the main supply markets because of poor infrastructure and low population densities. It can take up to four days to reach remote markets during the dry season.

In the rainy season routes are sometimes impassable in these remote areas, hence longer days for supply to reach market, reducing availability of supply and pushing up prices. Prices increased by about 1.3% for every additional hour of delivery time from the hub market to the county headquarters of these remote counties and 1.8% for each hour between the county headquarters and the remote markets off the corridor (KNBS, 2016). Prices are often lower between November and May. The highest market prices are in the most remote counties of Turkana and Mandera, where they are more than 100% above

those of the base market (on average), followed by Garissa, Wajir, Marsabit, Samburu and Kajiado.

The KNBS (2016) reports that while most (88%) of Kenyan households have acceptable food consumption; around four million people (12% of households) have unacceptable consumption. This translated into a diet that consisted majorly of a staple, flavored with green vegetables and oil. Turkana stands out as being far more food insecure than any other county. Almost one in five (19% of the households) in Turkana County had poor consumption and a further 24%, borderline. No other county comes close to this level of food insecurity. The next most food insecure counties (by FCS indicator) were Samburu, Tana River, Baringo, West Pokot, Busia and Siaya. The four pastoralist counties that are relatively food secure by the Food Consumption Score (FCS) and have very low dietary diversity are Marsabit, Mandera, Garissa and Wajir. Nationally almost one in ten (10%) of the rural households have low food diversity, often consuming four groups or fewer (KNBS, 2016).

Lack of food was most extreme in Turkana (86% of people experienced shortages) followed by Busia, Homa Bay, Baringo, Siaya and Wajir where more than 60% experienced shortages (CFSVA, 2016). When faced with shortages, households have no choice but to cut the quality and/or quantity of what they eat. The Coping Strategy Index (CSI) is a reliable measure of short-term hunger. It seeks to identify alternative means employed by household when they have no food and income to acquire food. The report indicated that high levels of food related coping strategy were most prevalent in

Marsabit, Tharaka-Nithi, Samburu, Baringo and Siaya. In some counties more than 60% of households did not consume any iron-rich foods. These included Wajir, Kitui, Murang'a and West Pokot. Most Kenyans had a vitamin A-rich diet, with 83% of households consuming foods containing the vitamin every day. However, in Turkana County, 38% of households consumed no vitamin A rich foods during that time (CFSVA, 2016).

In Wajir, Mandera, Garissa and Marsabit household levels of adequate food consumption are average or even above average despite their poverty levels. The pastoralist counties are relatively food secure by the FCS indicator because of their high consumption of animal products, especially milk. Their high milk consumption (six days a week) inflates the FCS. However, these four counties have a high percentage of households with low dietary diversity. It is likely that these pastoralist communities are still managing to maintain 'acceptable' diets by migrating when pasture becomes poor so that their livestock can survive. But they have high levels of low dietary diversity. Food security levels would quickly drop in the likely event of a drought that would make their animals less productive (or kill them) and in the event food price rises. Climate change poses a serious threat to pastoralists' way of life. Each successive drought is likely to weaken pastoralists' animals more and further erode their traditional coping mechanisms. If their animals fail to produce milk their dietary diversity will be further compromised. The pastoralist counties are highly vulnerable to food insecurity.

According to African Development Bank (ADB, 2014) almost one in three Kenyans now lives in urban areas compared to 16% in 1994. They projected that by 2033, half of the population will be residing in urban areas. Urban residents often struggle to pay the high cost of city living or are unable to afford sufficient food to meet their minimum nutritional requirements, unhygienic, crowded living environments with poor access to food. The CFSVA (2016) finding on food insecurity prevalence is higher in rural Kenya. Nairobi however had the highest number of food insecure households. Some 96,356 households had unacceptable food consumption, which translated into more than 308,000 food insecure people in the capital out of over 3 million populations (KNBS, 2016). Of these almost 61,000 people were estimated to be severely food insecure. Public services exacerbate the effects of urban informal dwellers' food insecurity. The urban poor frequently have a less diverse range of coping strategies to employ in the face of food insecurity than do their counterparts in rural areas. They do not have access to land and inter-generational support networks tend to be weaker. Most face high levels of food shortages and have to resort to corrosive food-related coping mechanisms.

An interesting feature in the CFSVA (2016) report is the vulnerability of households in four counties bordering Lake Victoria such as Homa Bay, Migori, Siaya and Busia where many households did not have enough money to buy food. Homa Bay and Migori have particularly high levels of men working as agricultural laborers, employment that is more closely associated with poverty and food insecurity than any other. On average they earned Ksh 6,503 a month (CFSVA, 2016). Seasonal employment is common meaning they are likely working on someone else's land rather than tending to their own

during their most needed times. Along with agricultural workers, unemployed were over-represented in two poorer wealth quintiles and were significantly more likely to be food insecure by both indicators.

2.3 Food Security Strategies

In the recent past emerging strategies to improve agricultural production include shift from subsistence to commercialized agriculture, improved marketing of agricultural products and introduction of new technologies. A study by Jaleta and Hoekstra (2009), revealed that commercialization among smallholder farmers in Ethiopia had an impact on smallholder farmers' welfare, which included, income and consumption; nutrition and health. In addition, they noted that commercialization comprises both participation in input and output markets and the decision by smallholder farmer to use inputs.

In developing countries, market linkage plays a critical role in income improvement and food security (Sanginga *et al.*, 2004). Access to market by smallholder farmers is likely to provide incentives for specialization and agricultural production, which will lead to generation of employment and revenue enhancement thus food security (Chirwa, 2005). According to World Bank (2008) transformation of subsistence system of agriculture to market-oriented production system in rural areas will lead to an improvement of farmers' livelihood and welfare. Output market participation by rural farmers determines farmers' welfare gains (Otieno *et al.*, 2009), but access to market provide opportunities for improving their livelihood and sustainable food security (Minot and Ruth, 2007). For profitable farm activities, smallholder farmers ought to shift production from subsistence system to market oriented production; which necessitate

intensification of production and use of new technology (Omiti *et al.*, 2009). Shifts in priorities in rural areas; investment in commercialization of agriculture, will lead to poverty reduction and economic growth (Geda *et al.*, 2001).

A study by Swinnen and Vranken (2006), using data envelop model to determine causes of efficiency changes in transition agriculture, revealed that general institutional reforms focused on market institutions with the aim of reducing market imperfection in input and output markets, which had positive impacts on farm efficiency. Farm productivity is constrained by market imperfections, limited opportunities for off farm income and high transaction cost in accessing new technology. Study by Mosheim and Lovell (2009), using shadow cost efficiency model to examine efficiencies of dairy producers in America, revealed that smallholder farmers were more economical on average but exploited economies of scale to a much lesser degree than large-scale farms.

Use of new agricultural technologies improves efficiency of food production. A study by Penda and Asogwa (2011), using stochastic frontier model to analyze the correlation between individual farm efficiency and income among farms in Nigeria revealed that as a farm becomes more efficient, more output is likely to be produced and sold thus increasing farm income thus food security. Adoption of new crop and livestock varieties is an emerging trend strategy to improve food security in developing countries found to enhance food security.

The use of modern techniques of marketing is likely to increase income to rural smallholder farmers through increased productivity and indirectly decreasing the price of

input commodities (De Janvry and Sadoulet, 2002), alleviating poverty and encouraging smallholder farmer to produce for the market. However, most smallholder farmers have limited access to necessary production skills and lack market information. In addition, there is weak linkage between smallholder farmers and available markets; this has led to inappropriate use of inputs (Otieno *et al.*, 2012), thus leading to low agricultural productivity and growth; yet agricultural sector is expected to play an important role in national economic growth (Oluoch-Kosura, 2010).

Farm efficiency is useful in providing on input use efficiency, competitiveness of each farm and how to improve farm productivity (Abdulai and Tietje, 2007). Previous studies on efficiency focused mainly on crops (Daniel *et al.*, 2010) and dairy production efficiencies (Dana and James, 2010). According to Larsen *et al.* (2009), improvement of crop and livestock productivity is vital in enhancing rural economic growth, food security and reducing poverty.

Development of road transport affects food security in rural and urban centers. Those people living in urban centers will access affordable food while the rural producers' income will improve enabling them be food secure. A study by DeSilva (2011), assessing the influence of access to market on farm efficiency among rice farmers in Philippines noted that there was a negative relationship between farm productivity and distance from farm to market. However, this finding has weakened over time due to the development of markets in rural areas and urban markets facilitated by an increase in population in urban

areas, improved road transport and availability of extension programmes. Both the production and cost frontier models were used for the analysis.

Lemba *et al.* (2012), on their study comparing technical efficiency of smallholder farmers in dry lands of Kenya under different intervention and strategies to find out those interventions that significantly improved farm efficiency, noted that average technical efficiency was high for farms that participated in an irrigation intervention. They also noted that intervention strategies such as access to irrigation, input and output markets had the most significant effect on farm efficiency. Vendaplas *et al.*(2013) revealed that farmers in India supplying informal channels were less efficient and earned less profit than those supplying formal channels.

A study by DeSilva (2011), assessing the influence of access to market on farm efficiency among rice farmers in Philippines noted that there was a negative relationship between farm productivity and the distance from farm to the market. However, this finding has weakened over time due to the development of markets in rural areas and urban markets facilitated by an increase in population in urban areas, improved infrastructure and availability of extension programmes. In the study, both production and cost frontier model were used for the analysis.

Most governments have contemplated more direct action to come out of this food insecurity. One approach has been to overcome high costs of credit, insurance and inputs in markets by offering subsidies to make these items affordable to poor farmers. Several

governments in Africa have reintroduced subsidies on fertilizer. This is for a given period of time with comprehensive training and capacity building programs.

Large scale, also known as universal agricultural input subsidies were a common and major feature of agricultural development policies in poor rural economies from the 1960s to the 1980s. They were generally implemented as 'across the board' price subsidies accessible to all producers, or to all producers of a particular category (Dorward, 2009). These subsidies continued to a greater and lesser extent in a number of countries though conventional wisdom and dominant donor thinking in the 80s and 90s was that such subsidies had been ineffective and inefficient policy instruments in Africa and that had contributed to government over-spending and fiscal and macroeconomic problems. However, from mid 1990s, this conventional wisdom has increasingly been challenged with a resurgence of interest in agricultural input subsidies in Africa and complementary emergence of innovative subsidy delivery systems and instruments. There has also been considerable interest in development of new instruments and approaches in designing and delivering input subsidies, the so called 'smart subsidies' (Dorward, 2009).

The focus on subsidies has been the result of several factors including failures of liberalization policies, stagnation of agriculture, declining soil fertility, deteriorating livelihoods of poor rural households as well as rapidly increasing food and fertilizer prices (Tiba, 2009). The new generation 'smart subsidies' has gained importance. The fundamental principles behind these subsidies are to address failures of the market,

promote market development, boost sustainable development of agricultural input markets and enhance the welfare of the poor. They stimulate demand in private markets through lower prices of inputs and benefit private distributors by facilitating entry into input markets and by helping achieve economies of scale (Tiba, 2009). Market-smart agricultural input subsidies can play a significant role in raising productivity of the agricultural sector by facilitating farmers' access to technically and economically efficient inputs at reduced costs, thus increasing profitability. They are designed to target the poor and thus favor market-based solutions in input supply and aim to promote pro-poor economic growth through increasing competition, economic efficiency and empowerment of farmers (Morris, 2007).

2.4 Effects of Emerging Strategies on Sustainable Food Security

New technology adoption studies can be used to model adoption of emerging food security strategies. In this study the Logit regression model was used to analyse the effect of emerging strategies on food security in the study area. Toure *et al.* (2008) using the Logit regression model revealed that institutional factors did not significantly affect market participation by rice smallholder farmers in Burkina Faso, Mali and Nigeria. The major constraining factors were that of commercialization as evidenced by low level of rice output marketed in all the three countries, therefore rice farmers were unable to take advantage of market opportunities. Jari and Fraser (2009) assessed factors that influenced smallholder farmers marketing behavior in South Africa. They noted that contractual agreements, collective action and tradition among smallholder farmers mainly influenced output marketing behavior. They concluded that formation of farmer

groups likely increased bonding social capital hence smallholder farmers were easily linked to various market channel actors.

Panda and Sreekumar (2012), on their study determining factors influencing marketing channel choice by smallholder farmers in India, used multinomial logit model. The study revealed that access to market information, grading, value addition; infrastructure and access to steady output market were the major factors that influenced smallholder farmers' participation in informal market. Technical factors as well as institutional factors were the major factors that influenced the choice of marketing by smallholder farmers. At household level, choice of marketing was influenced by presence of extension services and transportation to the market.

A Logit regression analysis of factors influencing market channel access among horticultural crop farmers in Zimbabwe showed that informal markets were more accessible than formal markets. Market channel choice by smallholder farmers was influenced by output price and ownership of a mobile phone; enabled farmers to receive timely information on output price. A study by Blandon *et al.* (2009) determining marketing preference by farmers in Honduras using the Logit model revealed that smallholder horticultural farmers preferred new supply channels that has pre-arranged price and quantity with the buyers. However, some farmers preferred to sell at spot markets whereby they received cash payments upon the sale, lack produce grading and their ability to sell independently. Farmers' preference for traditional marketing channel is one of the major factors reducing commercialization in rural areas therefore hindering potential benefit that new supply chain would offer.

Amaya Urquieta (2009) study indicated that determinants that affected market channel choice by potato farmers in Bolivia included market attributes; time to the market and distance to tarmac road, production; total acres owned and household related variables; access to credit, cell phone ownership and age of household head. However, they noted that gender had no significant effects on the decision of marketing choice, which contradicted theories that gender has a major influence on choice of marketing by a household. A study by Reyes *et al.* (2012) using double hurdle model while estimating factors influencing marketing decision by potato farmers in Angola showed that potato producers, sellers and male-headed households were richer than their counterparts. They concluded that male-headed households were more likely to sell their potatoes, owning productive assets and have access to extension services. They noted that transaction costs had a negative effect on quantity sold and the choice of marketing.

Olale and Nazli (2010) used Tobit model to analyze effects of market barriers and non-farm income on farm income. Result showed that market barriers and farm income greatly influenced farm household marketing behavior and income diversification. Wainaina *et al.* (2012) studied the impact of contract farming on poultry farmers' income and found that farmers who participated in contract farming earned more income than those who marketed independently. Participation in contract farming thus likely improved farmers' welfare. Level of education and distance to the market influenced farmer's decision to produce and market under a contract.

A study by Omiti *et al.* (2009), using truncated regression model revealed that distance to the market, output price and market information access were the major factors influencing farmers extent of market participation when determining factors influencing the intensity of market participation by farmers in rural and semi-urban areas of Kenya. Farmers in semi-urban areas will tend to have higher market participation intensity than those in the rural areas, more retail outlet and increase market links in rural areas are likely to increase market integration and hence improve poor rural farmers' welfare.

2.5 Challenges to Food Security

In Kenya, food security is a matter of concern to the Government and is one of its agenda four items to be tackled in order to alleviate hunger in the country and numerous efforts have been put in place to ensure sustainable food security. In 2007 the Government decided to embark upon a National Accelerated Agricultural Input Access Program (NAAIAP) to promote food security, agricultural input use, input market development, and agricultural productivity. Initially planned to subsidize fertilizers and maize seed for a limited number of districts, it has subsequently been expanded to national coverage with plans to provide 2.5 million farmers with maize seed and fertilizers for 0.4 ha each, with vouchers issued to targeted farmers and subsequent redemption through private input sellers who would also be eligible for trade credit guarantees. Farmers also benefited from linked extension, cereal banks, warehouse receipts, and participation in farmer groups (Sikobe, 2008).

NAAIAP sought to address the problem of food security and poverty by the very resource poor farmers. The primary objective of the program was to improve farm inputs (fertilizer and seeds) access and affordability for smallholder farmers to enhance food security and availability at the household level and generate incomes from sales of surplus produce. The research examined the influence of this large scale input subsidy program on targeted households' food security through enhanced maize production as well as their advancement to the next level of the program. Kenya for a long period has pursued the goal of attaining self-sufficiency in food commodities that included maize, wheat, rice, beans, milk and meat. The government in collaboration with development partners has put in place projects and programs geared towards building smallholder farmers' capacity (MOA, 2008). The programs make use of group approaches to achieve economies of scale in extension services, input procurement and sale of farm produce. The implementation of NAAIAP program started in July 2007. The program targeted an outreach of approximately 2.5 million smallholder farmers throughout the Country (MOA, 2010). The government has spent Ksh.3.7billion to enable vulnerable farmers' access inputs in the last four years (MOA, 2008). The government has disbursed ksh1billion, while the rest was donated by development partners that include the World Bank, Food and Agriculture Organization, European Union and African Development Bank. Despite substantial investments of public funds in this program, the large number of farmers involved and the almost national coverage, it is difficult to find a comprehensive review on it.

Maize is a staple food to a large proportion of people in Kenya. About 3.5 million small-scale farmers are involved in maize production and produce about 75 percent of the total maize crop (MOA, 2010). Therefore, more knowledge on how to increase maize farm productivity and income for these farmers is a great necessity. Performance of policy strategies have to be reviewed in order to find ways of further improving their implementations, hence, the need for this research. FAO (2016) reported that limited storage leads to 20–30 percent of maize being lost postharvest from insect pests, rodents and pathogens, which affect not only food availability, but also household income and their ability to buy food. Lack of drying facilities means the highly toxic aflatoxin fungus linked to liver disease, cancer, associated with immune-system suppression and growth retardation continue to grow in contaminated maize post-harvest.

2.6 Theoretical Framework of the Study

2.6.1 Theories of Food Security

There are a number of theories that has been advanced to explain food security. In this study the theories were discussed as a basis to understand how they explain food security. These theories include the Neo-Malthusian theory, the world systems and dependency theory, food and livelihood theory, social theory of food security and modernization theory. Modernization theory was considered relevant to this study and thus was adopted for the study and qualitative response model used in analysis. Qualitative response model, the Logit regression model was used to analyze the effect of emerging sustainable food security strategies on food security. The dependent variable was assumed to be either food secure or food insecure (qualitative) and the selected

emerging sustainable food security strategies were considered to be independent variables.

Neo-Malthusian theory argues that food security and sustainable developments are intrinsically linked (Scanlon, 2003). According to the theory, food security exists if a household has supply available and means to get adequate food to maintain nutritional needs of its members (Neffet *al.*, 2011). Other considerations may become relevant when investigating lower income areas with different challenges, mainly nutritional value. According to Scanlon (2003), food security can be eroded through inadequate production, which can result from a variety of social and climatic problems. Food security as a characteristic of community resilience requires availability, access, and ability to gain nutrition from supply (Scanlon, 2003). Neo-Malthusian theory is not applicable in this study because this is a basic theory that assumes that the conditions for improved food security are available and are fully embraced by household with low population. This was not the case in this study. This study explored the emerging strategies towards food security.

The world-systems and dependency theory is a theory that explains food security. Political economists employing world-systems and dependency interpretations (Frank, 1969; Wallerstein, 1974) argue that domestic dynamics including food deprivation are consequences of a global division of labor in which core capitalist accumulation results from exploitation of semi periphery and periphery (McMichael, 2004; Wallerstein, 1974; Wimberley and Bello, 1992). Populations in the developing world, the South, are left vulnerable due to limited food supplies coupled with barriers to food access (Craig

and Scanlan, 2001). Thus, while capitalist development-via modernizing processes-increases well-being in the USA, Japan and the North Atlantic 'core' nations of the world system, it is temporarily, spatially and causally coterminous with the relative under-development of the rest of the system. This theory is not applicable to this study as it assumes existence of developed and underdeveloped economies living side by side with developed exploiting and creating food insecurity to the developing economies. This study was undertaken to identify and evaluate the effect of nationally introduced emerging strategies on food security.

Food and livelihood theory of change postulate that rural livelihoods are characterized by a high degree of vulnerability to climate change, market volatility and political unrest (Pelletier *et al.*, 2016). Resilience is used to inform development initiatives aimed at building the capacity of rural households and communities to cope, adapt, and transform in the face of diverse shocks and stressors. There remain however, significant challenges to mainstreaming resilience thinking into food and nutrition security policy and programming, primarily because the concept is best understood as being embedded within dynamic and highly contextual processes that can be interpreted differently by various parties. It highlights the key roles played by broader social, institutional and governance contexts in affecting food and nutrition security. Although households are characterized by vulnerability to climate change among other challenges that this study aimed at identifying through the objective on challenges affecting food security in the study area, the model was not used to model food security in this study because household are known to have inherent coping strategies that inform county government and national government development initiatives.

Social theory of food security advanced by Craig and Scanlan (2001) argue that food security in less developed countries can be explained by development that border on domestic investment, urban bias, foreign capital penetration, population pressure, tapped by increased age dependency, undermining both supply of food and population access to it, and cultural dualism that magnifies the effect of population pressure on food insecurity. This theory also argues that political actions that arm imports, cause internal violence and political democratization also affect food security. The theory of social change is assumed to explain the county and national government investments and programmes put in place as emerging strategies to address food insecurity. The current study however did not adopt the model in that the theory is premised on dualism that relate to differential investments arising from urban bias, foreign capital penetration, population pressure and fueled by population pressure and increased dependency. It cannot be used to analyze the emerging strategies towards food security put in place by the county and national governments in the study area.

This study adopted modernization theory. According to, Munk (2018) the theory is based on ideas of Max Weber (1864–1920) which provided the basis for the modernization paradigm developed by Harvard sociologist Talcott Parsons (1902–1979). The theory postulates that modern systems lead to better or improved outcomes. Modernization theory identifies the social variables that contribute to social progress and development of societies and seeks to explain the process of social evolution. This study chose the theory to explain introduced emerging strategies towards sustainable food security in the study area because the theory stresses not only the process of change but

also the responses to that change. It also looks at internal dynamics while referring to social and cultural structures and the adaptation of new technologies.

Modernization is a theory of a progressive transition from a traditional to a modern society (Munk, 2018). The theory postulates that traditional societies will develop as they adopt modern practices. Modern developments such as irrigation technologies, improved infrastructure and adoption of mobile technology to provide agricultural information are assumed to make things better than the status quo. The theory is related to the current study in that emerging strategies are assumed to be modern introductions to the traditional production systems and are expected to result in improved food security. The fact that the emerging strategies have not resulted in expected improved food security situation in the study area calls for a study to evaluate the emerging strategies and their relationship to food security. The study also attempts to determine challenges to attainment of food security despite the presence of emerging food security strategies introduced by the national and county governments.

The Logit Model was used to obtain the inferential statistics that tested the hypothesis postulated in the study. Hypothesis testing requires inferential statistics. In this study the test hypothesis was that there was no significant relationship between adopting emerging food security strategies (modern technologies) and sustainable food security in the study area. The Logit Model is based on randomness and assumes existence of a theoretical continuous index derived from explanatory variables. The dependent variable in Logit is log odds of a chosen household is food secure given the household and other

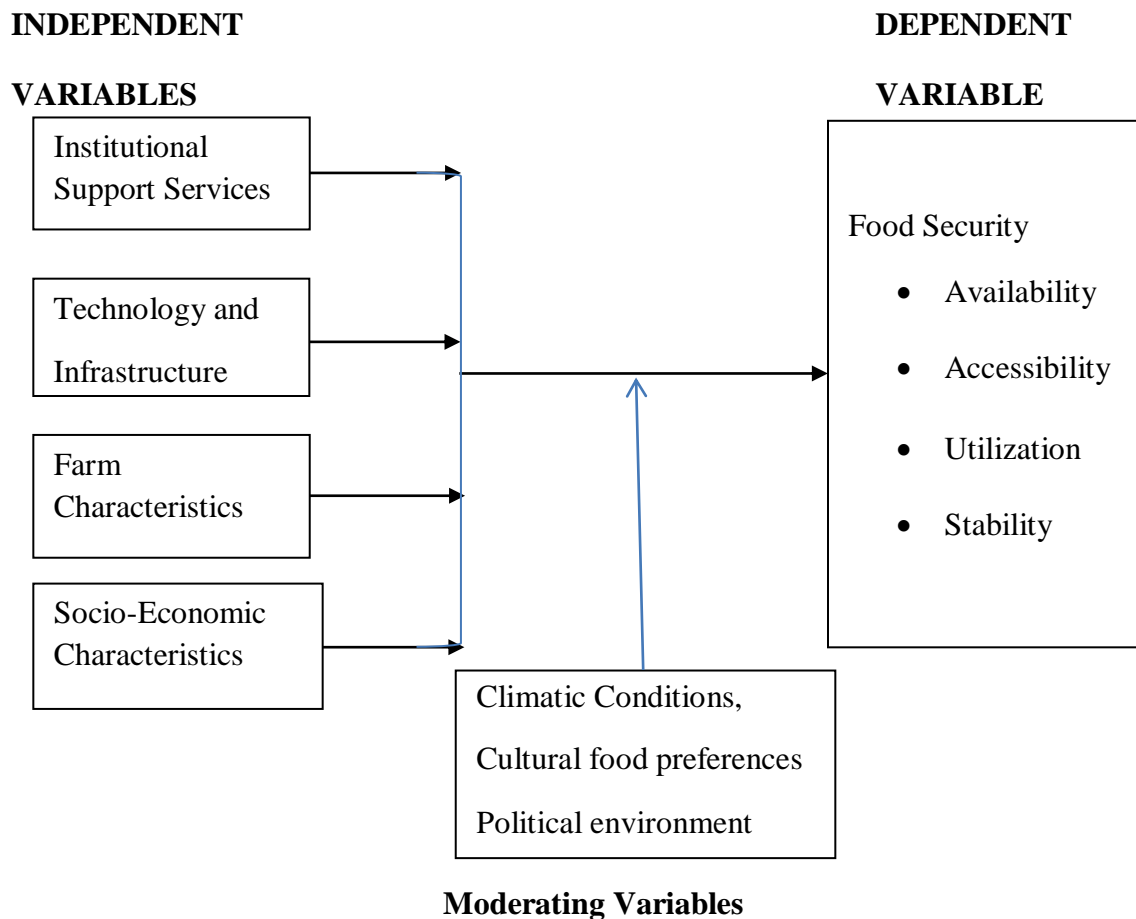
characteristics. The estimation procedure is the Maximum Likelihood Estimation (MLE). MLE of a parameter (a) is the value of estimate (\hat{a}) for which observed probability of the sample data (Y_i) takes its greatest value (Ghosh, 1991). For a particular sampling model data is substituted into a probability function and the probability is considered a function of the unknown parameter value a . The probability is defined for all the potential values of a , namely the values between 0 and 1 and probability first case-food secure household is selected is equal to one minus probability food insecure- second case (Amemiya, 1981; Chow, 1983; Pindyck and Rubinfeld, 2008). The likelihood function is specified as: $L = \text{Prob.}(Y_1) \text{Prob.}(Y_2) \text{Prob.}(Y_3) \dots \text{Prob.}(Y_n)$. Y is a dummy variable indicating critical cut off value that translates underlying index into a case equal to 1 when one category is chosen and 0 when other category is chosen. Variance of logistic distribution is given as $\pi^2/3$ (Ghosh, 1991).

The maximum likelihood estimators of the Logit model are asymptotically consistent and are efficient. This enables the statistical t-tests to be done on the parameter estimates (Green and Ng'ong'ola, 2008; Pindyck and Rubinfeld, 2008). Logit model assumes a cumulative logistic function. The variables in this study justified an assumption of a cumulative logistic distribution. The logit model has the advantage of being able to transform the least squares estimators to be homoscedastic. Heteroscedasticity renders the estimators inefficient, although unbiased. It also makes the coefficients useless in making predictions on value of the dependent variable (Green and Ng'ong'ola, 2008). The odds ratio is the ratio of probability that a farmer is food secure to the ratio of

probability that the farmer is not, given the independent variables postulated to affect food security (X_i).

2.7 Conceptual Framework of the Study

The model on conceptual framework of this Study shows that food security is a dependent variable. Food security in this study was looked at in terms of food availability, accessibility, utilization and stability. Food availability is believed to be related to household production while food accessibility is related to household income and the proximity to food markets. Utilization is a function of composition of the food and how the body makes use of the food to meet dietary needs. Stability concerns the continuous supply of food in terms of quality and quantity. Stability in this study will be used as a measure of food sustainability. Figure 2.1 is the conceptual framework of the study.



Source: Researcher(2019)

Figure 2.1: Conceptual Framework of the Study

From the conceptual framework, food security in this study was postulated to be affected by independent variables such as institutional support services (input and food price subsidy, cash transfer, post-harvest food processing), Infrastructure (road, water and air transport, market facilities) and new technologies (irrigation, machinery, improved crop and livestock varieties, mobile phone technology), household socio-economic characteristics (age, education level, gender, family income, membership to producer groups), farm characteristics (asset endowment, total land size, proximity to the Lake),

among others that are believed to affect food security. The study also assumed that the effect of external factors such as variations in climatic conditions, political environment prevailing and cultural food preferences on food security and consumption behavior (moderating variables) do not vary significantly.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Overview

This chapter presents the methodology that was employed in the study. In particular it highlights the research design used, study population, sampling procedure, sample size determination, types and sources of data collected and tools that were used to collect data. This chapter also provides information on how data collected was analyzed. The research questions/ hypothesis held and objectives of the study guided the selection of data analysis tools.

3.2 Research Design

This study adopted mixed method research design. According to Aramo-Immonen (2013), this is an approach to inquiry that combines or associates both qualitative and quantitative forms. It involves both collecting and analyzing quantitative and qualitative data. The specific approach used was a concurrent mixed method design that compares findings from qualitative and quantitative data sources (Creswell, 2011). This involved collecting both types of data and assessing the information using parallel constructs. Data was then separately analyzed and results were compared through a discussion and transformation of the qualitative data set into quantitative scores in some cases and jointly displaying both forms of data in other cases.

3.3 Study Area

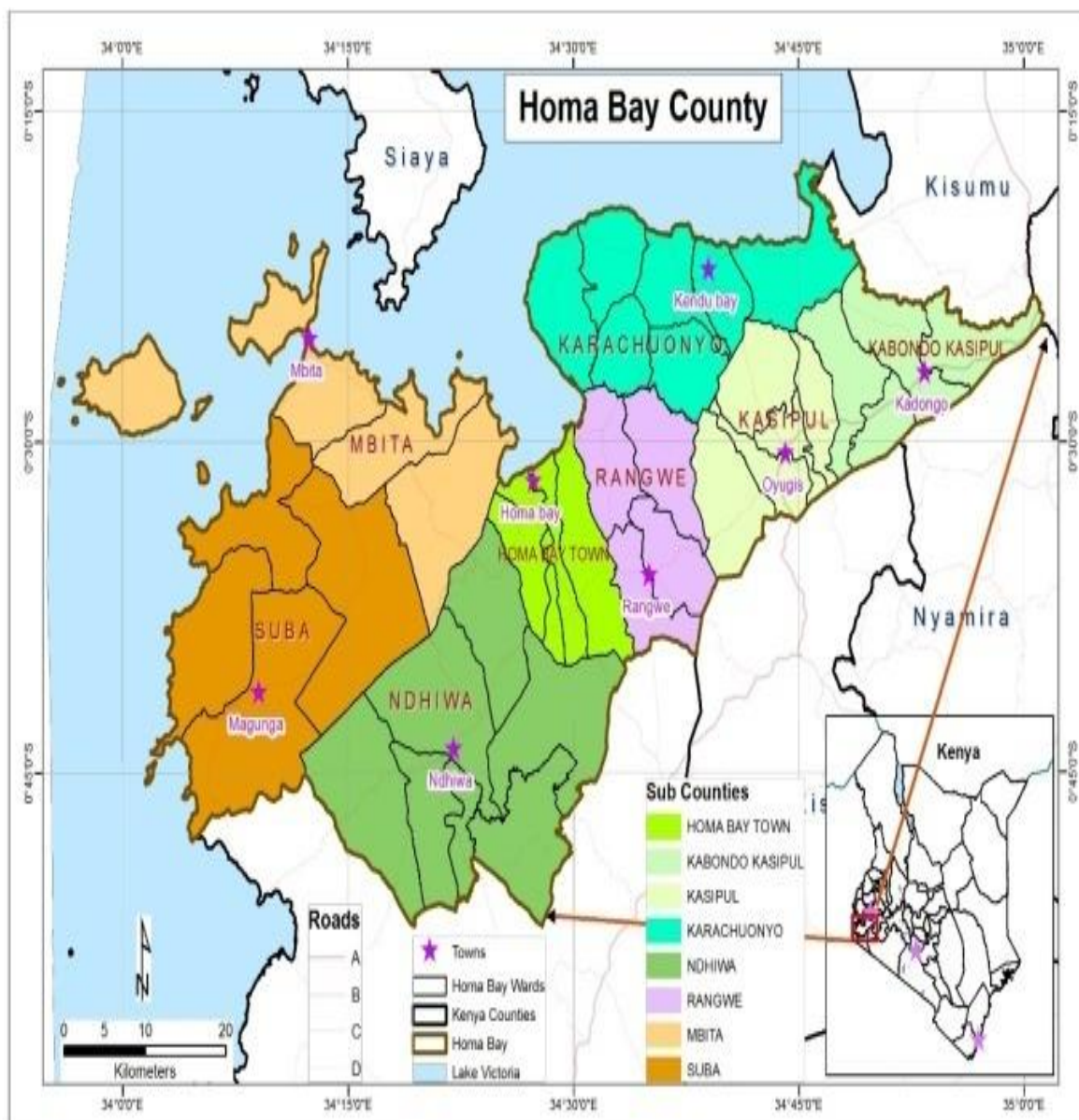
Homa Bay County is a county in the former Nyanza Province of Kenya. Its capital and largest town is Homa Bay. The county has a population of 1,131,950 persons, of which 539,560 are males, 592,367 females and 23 intersex persons. It has 262, 036 households with an average of 4.3 people per household. The county has a population density of 359 people per square kilometer (KNBS, 2019). Lake Victoria is a major source of livelihood for Homa Bay County. Homa Bay County has two rainy seasons (March to June-long rains season and August to November-short rains season). The total annual rainfall received ranges from 700 to 800mm. The rainfall received in the long rainy season is 60% reliable and ranges from 250–1000mm while 500–700 mm is received in the short rainy season (KMD, 2015). Many parts of the County especially the Lake Victoria region however, experience frequent and prolonged dry spells. The sub counties most affected by the dry spells and droughts are Karachuonyo, Mbita, Homa Bay Town and Rangwe(KMD, 2015).

According to Ministry of Agriculture (MoA, 2015),Homa Bay County has seven agro-ecological zones namely: Upper Midland (UM1), coffee-tea-zone which occupies southern parts of Kasipul and Kabondo-Kasipul sub-counties; Upper Midland (UM3), marginal coffee zone covering Gwassi hills of Suba sub-county supporting maize, millet, pineapples, sorghum, sunflower and tomatoes; Upper Midland (UM4), sunflower-maize zone covering Gwassi hills of Suba and Nyarongi areas of Ndhiwa sub-county. This zone supports maize, soya beans and pineapples; Lower Midland (LM2), marginal sugar zone occupies parts of Ndhiwa, Homa Bay Town, Rangwe, Kasipul and north of Kabondo-Kasipul sub-counties. The zone supports green grams, millet, sorghum,

tobacco, sunflower, sugarcane, beans, pineapples, sisal and groundnuts; Lower midland (LM3), cotton zone occupies parts of Homa Bay Town and Rangwe sub-counties, supporting maize, sorghum, cow peas, ground nuts, beans, soya, sweet potatoes, sunflower, simsim, green grams, rice and vegetables; Lower Midland (LM4), marginal cotton zone occupies west of Karachuonyo, central Mbita and Gwasssi areas.

According to KNBS (2013), Homa Bay County has eight parliamentary constituencies or sub counties and 40 electoral wards distributed to sub counties as follows Kabondo Kasipul 4, Kasipul 5, Karachuonyo 7, Homa Bay Town 4, Ndhiwa 7, Rangwe 4, Mbita 5 and Suba4. The study was carried out in Homa Bay County in Kenya.

Appendix 1 shows the location of the County in Kenya while figure 3.1(appendix 2) is the map of Homa Bay County.



Source: GoK (2013), https://www.researchgate.net/figure/Map-of-Homa-Bay-County-Source-GoK-2013_fig1_319644498

Source-GoK-2013_fig1_319644498

Figure 3.1: The Map of Homa Bay County

3.4 Study Population

The study population consisted of households in Homa Bay County. According to Friedman *et al.* (2015), study population is the subset of population with the characteristics of interest defined by the eligibility criteria. The County had about 262,036 households with an average of 4.3 people per household (KNBS, 2019). The sample was made up of selected households and key informants in Homa Bay County. Key informants included County officials such as Director of Agriculture, Director of Fisheries, Director of Livestock, agricultural extension officers, progressive farmers, political leaders and area administrators within the study area. Key informants were interviewed to provide information that complemented that which was collected from selected households. According to Stephanie (2014), a sampling frame is a list of all the items in the population. It is a complete list of everyone or everything needed for the study.

3.5 Sampling Procedure

Stratified random sampling and purposive sampling were used in selecting households in this study. According to Hunt and Tyrrell (2001), stratified random sampling procedure involves categorizing the members of the population into mutually exclusive and collectively exhaustive groups. Stratified random sampling procedure was considered the most effective method of sampling as it ensured that the selected sample was representative of the population thus eliminating selection bias and ensured that the data obtained was credible. The assumption was that the target population was uniform hence informing the choice of the sampling procedure. The sub counties formed the strata in

the study and respondents were proportionally chosen as guided by the number of wards in each sub-county of Homa Bay County.

Purposive sampling procedure was used to select key informants. The study enquired and identified key informants from the target population. Key informants included County officials, progressive farmers, political leaders and area administrators. Purposive sampling is a non-probability sampling method and it occurs when elements selected for the sample are chosen by the judgment of the researcher. Researchers often believe that they can obtain a representative sample by using a sound judgment, which will result in saving time and money (Black, 2010). Purposive sampling in this study was necessitated by the need to obtain valuable and expert information that would complement data collected from the randomly selected respondents. Table 3.1 provides data on number of respondents selected using the two sampling procedures.

Table 3:1 Selection Procedure of the Respondents

Stratum	Stratified sampling	Purposive sampling
Kabondo Kasipul	48	6
Kasipul	39	6
Karachuomyo	67	6
Rangwe	38	6
Homa Bay Town	49	6
Mbita	38	6
Ndhiwa	67	6
Suba	38	6
County office	0	4
Total	384	52

Source: Field Survey (2019)

3.6 Sample Size

A total sample size of 436 respondents was used in this study. Questionnaires were administered to 384 selected household respondents. An additional 52 key informants were interviewed using interview schedules. Homa Bay County has approximately 262,036 households (KNBS, 2019). Since the target population was over 10,000 households, the following formula was used to determine the sample size for respondents interviewed using questionnaire administration.

$$n = Z^2 pq / d^2$$

Where, n = desired sample size, Z = the standard normal deviation at the required confidence level, p = the proportion in the target population estimated to have characteristics being measured, $q = 1 - p$ and d = level of statistical significance set.

The value of p was assumed to be 50% since there is no estimate available proportion in the target population assumed to have the characteristics of interest (Mugenda and Mugenda, 1999). The level of significance (d) is taken to be 0.05; the Z statistic is taken as 1.96 (95%).

$$n = (1.96)^2 (0.5) (0.5) / (0.05)^2 = 384.16 = 384.$$

The 52 respondents that were interviewed using interview schedule were purposively selected by the researcher from the eight sub counties in this study.

3.7 Data Types and Sources

Primary and secondary data were used in this study. Primary data refer to data that was sought from the respondents that were administered questionnaires to and interviewed in this study. Secondary data was collected from published materials that are available in sub and /or County offices and libraries in the region. The data included those on proxies of food security, household income, household food production, institutional support services (credit facilities, National and County government fishing and agriculture input and output prices support services, extension services, output handling services), household head socio-economic factors (age, education level, gender, membership to producer associations or groups), producer characteristics (asset endowment, total land size, proximity to the Lake, farming experience), infrastructure (land, water and air transport, markets) and new technologies (irrigation, machinery, improved crop and livestock varieties, mobile phone technology) and any other factor that was identified and considered to affect food security in the study area. Household food security was determined by assessing the ability of the household to produce food for subsistence use and/or the ability of the household to acquire food through purchase. Food security was a qualitative variable. In data recording a food secure household was given value 1 and 0 otherwise.

3.8 Data Collection Techniques

This study used structured questionnaire, interview schedule and observation guide as data collection tool to collect primary data. Secondary data was obtained from published materials. Data was collected from the respondents through face to face interview using

a structured questionnaire. The questionnaire was pre-tested in Karachuonyo Sub County with a sample of 38 respondents before the actual data collection began. This helped to check on areas of weaknesses and ensured that any errors and editorial mistakes that may elicit unintended responses were corrected before actual data collection exercise. Interview schedules were more helpful in collecting more, correct and accurate information. Observation guide was used to collect data on observables such as development of infrastructure like roads, storage facilities among others.

3.9 Validity and Reliability of Research Instruments

The validity of the content was determined through judgment whereas reliability was ascertained through test-retest method. The data collection instruments were subjected to experts, supervisors, academicians and consultants opinion. This was done in order to comment on the relevance of questions in the instruments using Content validity. The questionnaire and interview schedule were pretested to ascertain if there were inconsistencies and ambiguities using a sample of respondents in Karachuonyo sub-county in Homa Bay County among household that were not interviewed during the data collection exercise. Questionnaires were pre-tested with a sample size of 38 respondents (representing the required 10% of sample size for pre-test) as this study interviewed 384 respondents. Data collected was checked for completeness and accuracy before being subjected to analysis. Results of the validity indicated that contents of the questionnaires were relevant, reasonable, unambiguous and clear. Expert opinion analysis of the questionnaires/interview schedules confirmed that construct validity and criterion validity were reasonable.

3.10 Data Analysis

Data processing and analysis commenced as soon as the execution of the research study was completed. Descriptive and inferential statistics were used in data analysis. Descriptive data collected using questionnaires were computed using SPSS software to generate frequencies, percentages and means of the descriptive analysis as per the research objectives.

Key informants responses were analyzed qualitatively using the thematic analysis approach. Thematic analysis is used in qualitative research and focuses on examining themes or patterns of meaning within data (Braun *et al.*, 2019). The interview responses were read several times by the researcher until he was able to familiarize with the content. Interviews were transcribed verbatim by the researcher. The researcher assigned codes to statement to denote meaningful unit, group codes together and form themes. The themes were applied to index systematically in textual form by use of code. The researcher then grouped statements with the same content into sub themes and organized codes within each theme together. The explanation to findings was derived from categories that were associated with themes.

To assess the food situation in the study area, descriptive statistics on food availability, accessibility, utilization and stability were used. Proportion in (%), frequencies) were used to analyze households that lacked food most times to analyze food availability. Food accessibility was determined using income levels of households as well as food production levels by households. Food utilization was done through analysis nutrient

sources of households. The stable of supply of food was used to evaluate the stability of the food sources.

To identify emerging food security strategies, data collected from key informant was thematically analyzed using descriptive statistics. The strategies were ranked in order of importance based on the number of household that had adopted the emerging strategies.

To determine the variable relationships in this study, inferential statistics was used. The Logit regression analysis was carried out to show the effect the emerging food security strategies had on sustainable food security in the study area. The logit model is used to model the probability of a certain class or event existing such as pass/fail (Howell,1992), or food secure/ insecure in this study. Each dependent variable was assigned a probability between 0 and 1, with a sum of one. When the household was food secure, it was assigned a value of 1 and 0 when otherwise.

Correlation analysis was done in order to determine the extent of multicollinearity (relationship between the independent variables)(<https://support.minitab.com>, 2019). Econometricians have not come up with a universally acceptable critical value below which statistically insignificant multicollinearity of multivariate econometric models is assumed to exist. In this study multicollinearity was considered serious when the Pearson correlation coefficient was at 0.5 and above. The choice of 0.5 was based on the fact that most researchers (Wilcox, 2005; Moriya, 2008) have adopted the Pearson correlation value of 0.5 in their researches. When the Pearson correlation coefficient was at least 0.5, one of the variables in the pair of variables being analyzed was dropped.

High correlation coefficients indicate statistically significant relationship between the variables. A backward stepwise elimination procedure was used to determine variables to be dropped due to the high levels of correlation thus variables to be retained in the logit analysis of emerging strategies affecting food security.

3.11 Data Presentation

Data was presented in textual and tabular forms. Textual consisted of use of paragraphs or sentences. This involved enumeration of important characteristics, emphasizing significant figures and identifying important features of data. Cross sectional data collected in this study was analyzed and presented in tables. Qualitative and quantitative data was analyzed in tabular form. Qualitative data was analyzed using the mode while qualitative data was analyzed using the mean. Textual presentation was used to complement tabular presentation.

3.12 Ethical Considerations

Permission to carry out the study was sought from Moi University, School of Graduate Studies. The researcher obtained permit from National Commission for Science, Technology and Innovation (NACOSTI). The questionnaire and interview schedule contained a write up meant to assure the respondent that the information that they provided was to be treated with necessary confidentiality and was for only research purposes. Ethical considerations that included informed consent, freedom of respondents to voluntarily participate or withdraw from study and maintenance of anonymity of respondents was ensured. In this study, only relevant components of the questionnaires and interview schedules were assessed.

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSIONS

4.1 Overview

This chapter contains results of data analyses and discussions in relation to the study objectives namely: evaluation of food situation in Homa Bay County; assessment of strategies being employed in food security sustainability in the study area; the effects of the emerging strategies on sustainable food security in Homa Bay County and; challenges to improving sustainable food security in the study area. It begins with the socio-economic characteristics of the respondents.

4.2 Socio-Economic Characteristics of the Respondents

The study sought to determine the social and economic characteristics of the respondents in the study area. This is important in the understanding of the characteristics of the study population under consideration. This is useful in the analysis of emerging strategies believed to affect food security in the study area. The social and economic characteristics of the respondents are also likely to play an important role in access to institutional support services and in the adoption of new technologies aimed at improving sustainable food security in the study area. The demographic characteristics considered were gender, age and economic activities of respondents. The results on gender of the respondents are provided in table 4.1.

Table 4.1: Gender of the Respondents in the Study Area

Gender	Frequency (N=384)	Percentage (%)
Male	256	66.7
Female	128	33.3

Source: Field Survey (2019)

The study findings revealed that most households were headed by male. The table 4.1 indicates that majority (66.7%) of respondents were male while 33.3% were female. This may have an impact on food security because it is believed that there is a link between food security and gender. Culturally, women are not empowered to make serious decisions unless it is in consultation with their men. Audit reports reveal that even in women groups, women still prefer men in leadership positions (County, 2013).

Out of the 384 respondents, 24.1% of them were aged between 18-35 years, 26.8% were between 36-49 years and 48.4 % were above 50 years. The youth (between 18-35 years) who are believed to be energetic were not the majority in this study. This could be attributed to the fact that most of them have migrated to urban settings in search of wage employment. The old (over 50 years) were the majority (48.4 %) in this study probably because they were the main decision-makers in most households.

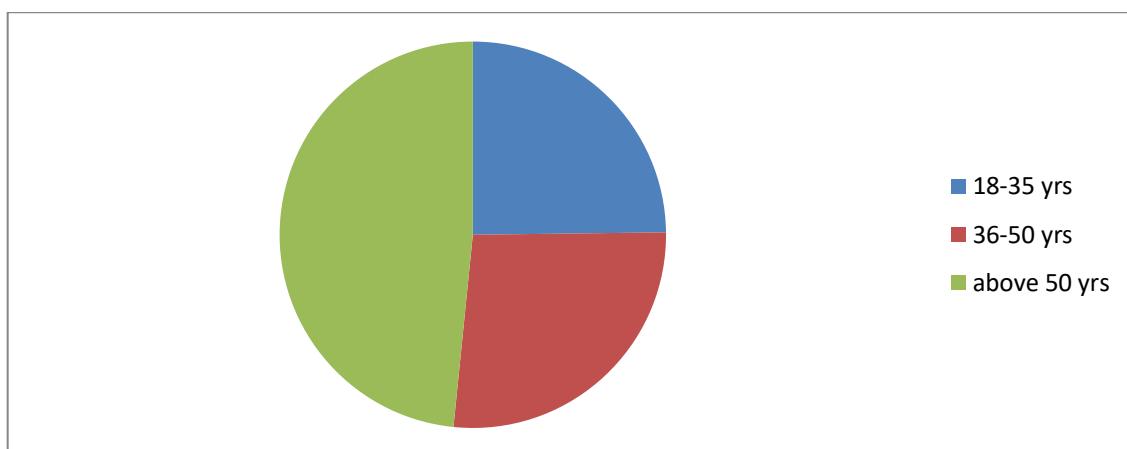


Figure 4.1: Age Distribution of Respondents

Source: Field Survey (2019)

Household engaged in many economic activities both formal and informal. However this study considered four main primary activities namely farming, fishing, business and formal employment that most respondents engaged in. The findings revealed that 83.3% of respondents engaged in farming as the primary activity, 9.4% in fishing while 5.7 % had business as their primary economic activity. The least number (1.6%) of the respondents had formal employment as tabulated in table 4.2. This finding is in line with County (2013) findings that reported that agriculture was the leading income generator besides being a contributor to household food security.

Table 4.2 provides findings of study on the economic activities and proportion of households engaged in them among the selected households.

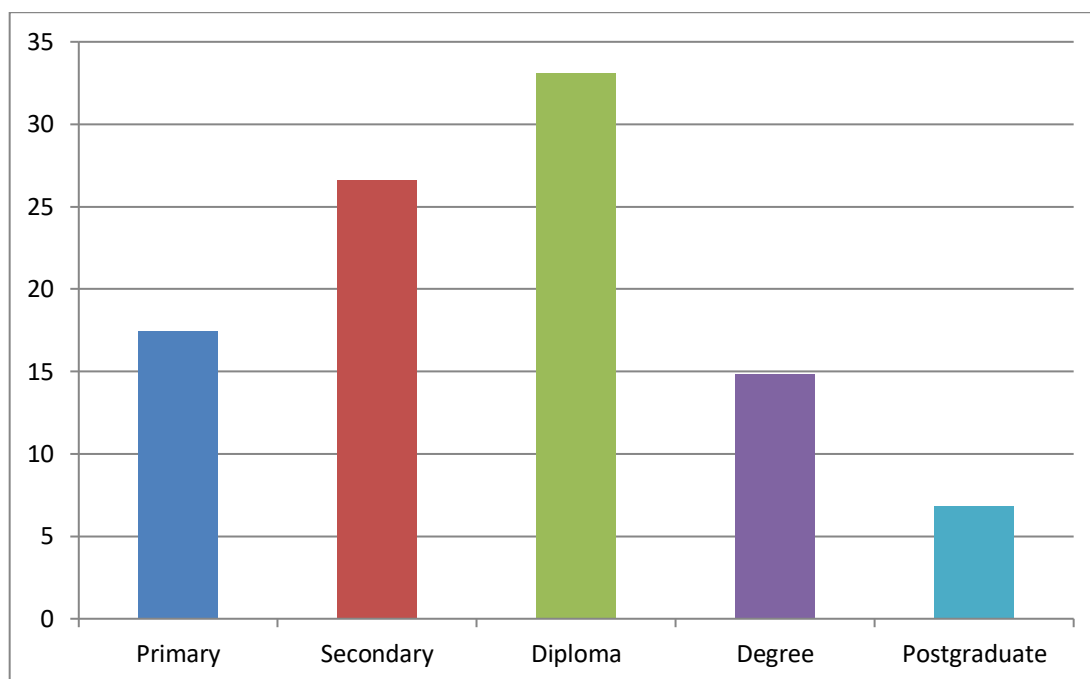
Table 4.2 *Economic Activities of Respondents*

Primary Activity	Numbers	Proportion (%)
Farming	320	83.3
Fishing	36	9.4
Business	22	5.7
Formal Employment	6	1.6
Total	384	100

Source: Field Survey (2019)

This study also analyzed data on level of education of respondents and the findings (figure 4.2) showed that a majority (33.1%) was diploma holders, 27.6% were secondary school leavers, 17.4% of the respondents were primary school leavers, 14.8% were degree holders and 6.8% were postgraduate degree holders.

According to County (2013), the literacy rate in Homa Bay County stood at 64 % with males accounting for 66 % and females at 54 %. The highest literacy rates were recorded in Homa Bay Town sub-County and the lowest rates recorded in Suba. The highest literacy rate was observed within the age range 15-24 whereby in 2011, about 74.3% of the populations were found to be literate (County, 2013).



Source: Field Survey (2019)

Figure 4.2: *Proportion (%) of Respondents and their Level of Education*

4.3 Results and Discussions

This section provides findings of the analysis of the data collected in this study in relation to the stated specific study objectives namely to: evaluate food situation in Homa Bay County; assess emerging strategies employed in food security sustainability in the study area; analyze the effect of the emerging strategies on sustainable food security in Homa Bay County and determine challenges faced while improving sustainable food security in the study area.

4.3.1 An Evaluation of Food Security Situation in Homa Bay County

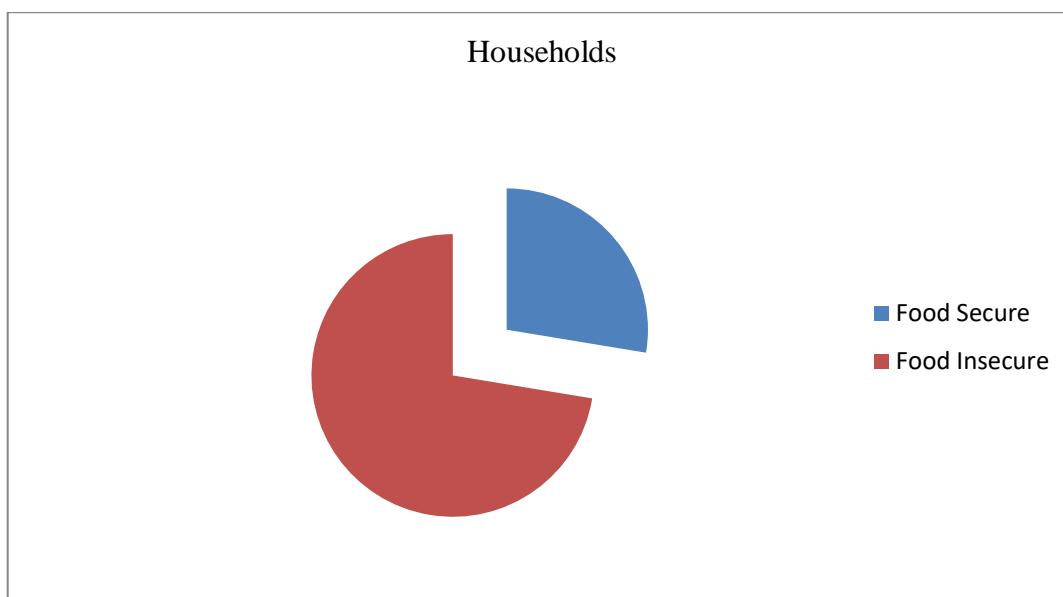
Food security was evaluated in terms of availability, access, utilization and stability. From the discussion it can be seen that the four pillars of food security are interrelated. Access depends on availability of food while utilization depends on both availability and access to food. Stability is related to access, availability and utilization of food in the long run.

4.3.1.1 Household Food Availability

In this study the evaluation of Food Consumption Behavior was used as a measure of food availability and accessibility. The findings of the study are presented in figure 4.3. The study findings indicated that majority (72.4%) of the respondents had lacked food in most times thus food insecure. while a few (27.6%) were food secure. From the interview conducted, the respondent in an interview stated that:

“Homa Bay County is food insecure as most families often reported sleeping hungry most of the times due to lack of enough food” (P1-A1, Oral Interview, Homa Bay County, 2019).

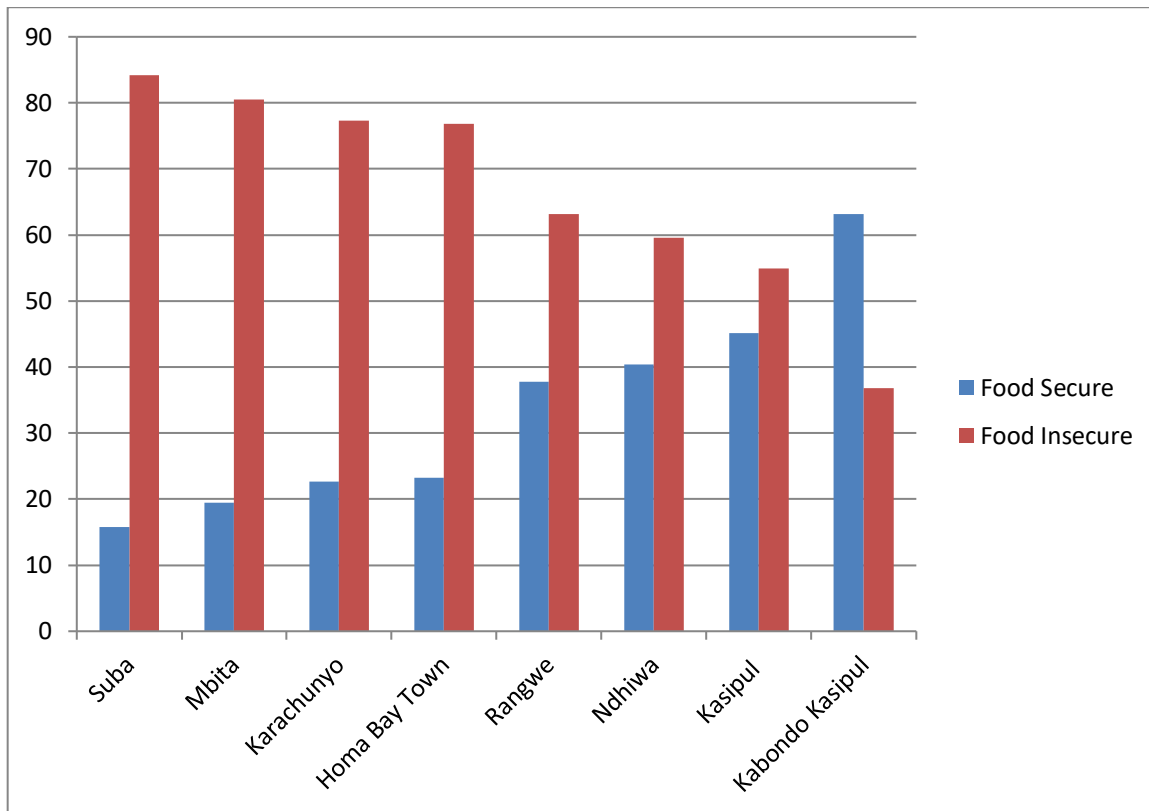
This was attributed to low food production in the region that was insufficient to meet food needs of the population despite the County having two rainy seasons (March to June-long rains season and August to November-short rains season). The total annual rainfall received ranges from 700 to 800mm. The rainfall received in the long rainy season is 60% reliable and ranges from 250–1000mm while 500–700 mm is received in the short rainy season (KMD, 2015).



Source: Field Survey (2019)

Figure 4.3: Food Security Situation in Homa Bay County

Data analysis in this study indicated that food security situation varied across the County. From the findings (figure 4.4),Suba sub county ranked highest in terms of food insecurity at 84.2 % of household experiencing food shortages during most parts of the year, Mbita sub County was second at 80% and so forth while Kabondo Kasipul sub county was ranked 8th at 36.8%. From the food situation analysis it can be seen that food availability and accessibility remain a challenge in Homa Bay County despite the County covering two main agro-ecological zones; upper midland (UM)and lower midland(LM), which are suitable for production of different agricultural commodities ranging from tea and coffee in the UM to livestock, millet and cotton in the LM (Endalew *et al.*, 2015).Figure 4.4 provides the proportion (%) of households' food security situation in the various sub-counties of Homa Bay County.



Source: Field Survey (2019)

Figure 4.4: Food Security Situation per sub counties in Homa Bay County

The County was not food secure as many households reported consuming insufficient food quantities due to crop failure arising from unreliable rainfall especially in sub counties such as Suba, Mbita, Karachuonyo, Homa Bay Town, Rangwe and Ndhiwa. Berti (2015), points that rainfall amount received in an area had a great effect on the crop yields in a given year of production. The study found out that the low annual rainfall amount in specific years contributed immensely to the low production of food crops and farming in general. Previous study by Ifeoma and Agwu (2014) noted that

climate change was expected to increasingly impact on crop and livestock production in Busia and Homa Bay counties.

Homa Bay County like many ASAL areas in Kenya, are prone to rainfall variability but droughts have increased in frequency and are the major constraints to rain-fed agricultural production (Ifeoma and Agwu (2014). Study by Onchiri *et al.*, (2016) noted frequent occurrence of drought in Mbita between the years 1983 – 2012. The most adversely affected by the extreme climatic conditions like prolonged dry spells was the agricultural sector and mostly crop production which had obvious implications on food security (Wambua *et al.*, 2015).

Previous studies on drought occurrences in the Lake Victoria region by Awange (2007) and that of Onchiri *et al.*, (2016) in Mbita sub County revealed that Homa Bay County experienced drought conditions in the years 1991/92, 1995/96, 1999/2000, 2004/05 and 2008 with extreme drought in 2009/10, which experienced much lower crop production. Between July 2011 and mid-2012, a severe drought affected the whole of East Africa causing severe food crisis in Kenya (UN, 2012). Mateche (2011) reported that in 2015, prolonged dry spell affected over 1.6 million people in Kenya with marginal agricultural livelihoods subjecting them to famine. However, these findings have not informed decision makers in planning for appropriate strategies that would ensure sustainable food security in Homa Bay County.

4.3.1.2 Household Food Accessibility

Food accessibility is a function of household resources and food prices. The study sought to evaluate household's ability to access food with prevailing food prices based on their incomes. The study findings on estimated income from all the sources (appendix 5) indicated that 53.4% of the households earned less than Ksh5,000, 24.7% earned between Ksh5,000 and 20,000, 13.3% earned between Ksh20,001 and 40,000, 5.2% earned KShs 40,001-60,000 and 3.4% (13) respondents earned above Ksh60,000. Given the prevailing food prices, household incomes from all sources were considered insufficient for most households to access food.

Table 4.3 presents summary statistics of per capita household income levels of respondents.

Table 4.3: Income Levels of Households

Monthly Per Capita Household Income (in KShs.)	Frequency	Proportion (%)
Below 5,000	205	53.4
5,000- 20,000	95	24.7
20,001-40,000	51	13.3
40,001-60,000	20	5.2
Above 60,000	13	3.4
Total	384	100

Source: Field Survey (2019)

According to the GoK(2013), Homa Bay County is identified as the poorest county of all the other counties in the former Nyanza region. Over 70% of people in the County were classified as absolute poor in 2012 (GoK, 2013). The distribution of the poor in the region varies from one constituency to another. Statistics estimated from the 2015Welfare Monitoring Survey and Population Housing Census released by the GoK showed that Asego and Rangwe divisions had the highest number of poor persons, followed by Nyarongi, Riana and Ndhiwa (GoK, 2015).Respondent in an interview stated that:

“Most households in Homa Bay County lack enough income that can sustain them in accessing enough food. This is because of high dependency on income from farming activities characterized by price fluctuations. Some households are food vulnerable due to high number of dependents occasioned by impacts of HIV/ AIDS”(P1-A3, Oral Interview, Homa Bay County, 2019).

These findings are in agreement with Kaiser *et al.*, (2015) who in his study categorized households according to incomes into vulnerable and non-vulnerable ones. The level of total income was used as a proxy indicator of food vulnerability. After estimating the total income and ordering the households from the highest to the lowest income earners, proportions of poor households gathered from the Commission of Revenue Authority’s fact data (CRA, 2013)on counties were used to establish the border line between the vulnerable and non-vulnerable. For Homa Bay County, the poverty rate was 44% implying that the same proportion of the households, counted from the one with the lowest income, was treated as vulnerable.

The above statistics revealed that Homa Bay County is characterized by low per capita monthly incomes. This means that they had low purchasing power of goods and services that include food items. The available incomes were likely to be used to abridge shortages experienced during periods of low food production. Total household income considers on-farm income (from agricultural related activities within the farm), non-farm income (agricultural related activities done outside the farm) and off farm income (from non-agricultural related activities). The main sources of household income included on-farm (crop and livestock sales, woodlot) and off-farm (salaried employment, businesses, remittances among others). The findings indicated that most of the income was derived from crop and livestock activities. The purchasing power of individual households was mostly through income acquired from farm production. This implied that food situation in Homa Bay County relied heavily on the success of agricultural sector.

This finding is in line with a report by MoALF which showed that on-farm income earned the households an average of KShs. 98,496/ year with crop sources contributing the largest portion. The study also indicated that on money value basis at household level, crop income represented 40% of all on-farm income compared to livestock contribution of 21%. Woodlot activities earned male headed households of KShs. 19,050/ year compared to earnings by female and youth headed households of KShs. 7,600 and KShs. 3,733 per year, respectively (Profile, 2016).

4.3.1.3 Household Food Utilization

Results obtained from evaluation of information from interview schedules and observation guide indicated that food utilization was a function of what households produced and what was acquired from other counties through purchase. Ndhwa, Rangwe, Kasipul and Kabondo Kasipulsub counties had reliable rainfall and high agricultural potential to produce foods that were consumed in the region. The main foods produced were maize, sweet potatoes, cassava, beans, sorghum, green grams and groundnuts. Rice, sugarcane, cotton, sorghum and sweet potatoes were produced for sale. Sweet potato dough made from sweet potatoes used in making bread was mainly exported to Nairobi.

Maize as a staple food determined food security in Homa Bay County. Maize production was so important in the region that families considered themselves food insecure if they did not produce enough to meet household food needs, even if they produced other foods in adequate amounts. Most households had no surplus maize production thus produced maize for subsistence needs.

In terms of food utilization it can be said that Homa Bay County was not food secure. This is because it relied mainly on carbohydrates such as maize and to small extent sorghum. Groundnuts, tomatoes, water melon, green grams and beans were produced in small quantities and for sale thus most households were unable to consume and gain nutritional value from them. Watermelons and tomatoes were mainly exported to other counties like Kisii and Kiambu that had high demand.

Few households were able to meet protein needs as few were able to access protein sources such as green grams, beans, groundnuts, milk, fish and chicken, cow, sheep and goat meat. According to the County Fisheries Department, Nile perch was exported to countries such as Netherlands, Italy, Hong Kong, Spain and Israel. The type of fish breeds exported to other counties included tilapia, *clarias* (local is *omena*), Nile perch, catfish and mudfish. At household level, majority of people did not meet their protein needs as the demand for the protein foods such as fish and livestock products was very high making the prices prohibitive. Prices of fish were high despite the fact that Homa Bay County is next to Lake Victoria due to the high demand. The key informants indicated that Suba Sub County was known for low livestock production thus high meat prices. This was because of high mortality rate of livestock arising from prolonged drought. Zebu breed characterized by low milk production was found in all sub counties. Exotic breeds were mainly found in Kasipul, Kabondo-Kasipul, Rangwe, Ndhiwa and Mbita and were kept for milk production.

4.3.1.4 Household Food Stability

This study sought to evaluate food stability situation in the study area. Food stability is about constant supply of food throughout the year and in the long run. Food stability is a function of sustainable availability, accessibility and utilization of food by household. As earlier discussed food can either be produced or purchased. Food production was also shown to be limited in the study area because of unfavorable climatic conditions among other factors. To evaluate food stability it was necessary to know the sustainability of household income sources.

The study findings indicated that 83.3% of the respondents had farming as their primary activity and source of income while 9.4% from fishing. Another 5.7% of households engaged in business activities as primary source of income while 1.6% derived most of their income from formal employment. Sources of income from the main cash crops like sugar cane in Ndhiwa, sun flower in Suba, pineapples in Rangwe and sweet potatoes in Kasipul and Kabondo Kasipul were unreliable and unsustainable. Sugar cane farmers complained of delayed payments while sweet potato farmers in Kasipul and Kabondo Kasipul sub counties were exploited by middlemen. From the above findings it can be concluded that food stability in the study area was poor. This is because households over relied on agricultural production which was unable to sustain food needs of the family. Any emerging strategies targeting improved agricultural production will thus go a long way in ensuring sustainable household food security.

There exists huge potential for cotton in Mbita, Homabay Town, Rangwe and Karachuonyo sub-counties which had not been fully exploited. Sustainable food security can thus be achieved if the potential can be exploited. Large-scale farmers were found mainly in less densely populated areas where large stocks of livestock were kept. The main livestock kept in the County included zebu cattle, the red Maasai sheep, the small East African goat, and indigenous chicken. Most of these livestock were bred for their sentimental value and were used only in emergencies to cover medical and transport costs, pay school fees, entertain guests and pay dowry. This makes livestock production a cultural activity and not a major contributor to sustainable food security.

The findings also indicated that most of the households had a high number of members involved in farming activities hence providing cheap labor. This translates to low household income arising from low pay which cannot sustain most household food needs. However, the farming practices remain largely traditional with little or no use of hybrid seeds, modern fertilizer or updated planting methods. The results are poor yields year in year out, making the community food poor.

Mango (2014) in his study noted that family farms have the potential to capture the strengths and the contributions that fathers, mothers and the youth can bring to creating a dynamic yet sustainable farm. Men, at times, are overconfident risk takers, more interested in publicly presenting what their farm is or can be, rather than sweating to realize their vision. Mothers, on the other hand, have shown to be more interested in getting things done and taken care of. Women, however, can have the tendency to be too modest to see and seize their potential. The combination of these family members a true joint venture will bring the best of both worlds. Youth should be involved in the family farm, not only because they are tech-savvy, but as part of succession planning. Family farms should groom one successor to take over the business, when parents retire. It is a tragedy nowadays that farms are ripped apart in inheritances. This means that gender dynamics should be given enough consideration in sustainable food security.

The findings from study indicated that 9.4% of households had fishing as the main source of income. According to Fisheries Development Department, fishing was the most important activity in Homa Bay County with over 18,300 people and 3,600 families engaged in it. The main types of fish harvested included Nile perch, tilapia and

clarias (local is *omena*). The County had 151 landing beaches managed by 133 beach management units (BMUs). However, the County faced a challenge of declining stock of fish in Lake Victoria due to the drying up of waterways arising from poor rains in the Lake water catchment areas. This explains why only 9.4% of the household interviewed considered fishing as the primary source of income.

The least proportion of households 5.7% and 1.6% considered business and formal employment respectively as primary sources of income. Business activities and formal employment are sustainable sources of income as they are more reliable than farming and fishing. This means that only 7.3% of households in the study area were able to meet food stability.

4.4 Strategies Employed to Ensure Sustainable Food Security in Homa Bay County

The second objective of this study was to assess strategies adopted in the study area to achieve sustainable food security. This section provides findings of the assessment in terms of household awareness of food security strategies and prevalence of the strategies among selected households. The study also identified emerging strategies for sustainable food security and carried out a correlation analysis of the strategies.

4.4.1 Awareness of Food Security Strategies in Homa Bay County

The study sought to assess the respondents' awareness of the different strategies that were being implemented to achieve sustainable food security. The study findings indicated that majority (63%) of the respondents were aware of the emerging sustainable food security promotion strategies while the rest (37%) were not aware.

Among the majority households most of them mentioned strategies such as agricultural extension services, input and output price subsidy, formation of cooperatives, artificial insemination (AI), pest and disease control, provision of cooler boxes, fodder production as the emerging strategies in place. The study also noted that there were several organizations in the region operating to curb the food insecurity challenge. Off-farm services, such as early-warning systems, extension, capacity building and training, postharvest handling and storage facilities and market information, is believed to increase food security adaptive capacity. The findings are presented in table 4.4.

Table 4.4: Awareness of Sustainable Food Security Strategies

Awareness of Strategies	Frequency	Proportion (%)
Those who are aware of food security strategies	242	63
Those who are not aware of food security strategies	142	37
Total	384	100

Source: Field Survey(2019)

Among the 37% of the respondents who were not aware of the promoted emerging sustainable food security strategies, it was necessary to assess how they were able to cope with food insecurity challenges common in the study area. This study determined the strategies they adopted to cope with the problem of food insecurity and the findings are presented in table 4.5. The results showed that households had adopted one or more food insecurity coping strategies. A majority (43%) of the respondents preferred diversification to improve food security. Diversification involved dietary change like

resorting to wild vegetables, preparing porridge for the family instead of *ugali*. Diversification facilitates increased food security among households by increasing the available range of food products. When households diversify, it leads to decrease in the period of food shortages and an increase in the diversity of foods accessed (Kline *et al.*, 2017). Studies have shown that most households rely on less preferred and less expensive foods as a way of addressing food insecurity. This include consumption of low grades (or cheaper quality) of wheat, broken rice, and cheap cuts of meat like feet, intestines or upper part of skin (Hendricks, 2016). Hendricks (2016) also showed that 17% of households reduced numbers of meals eaten in a day as a way of coping with food insecurity.

Another 26% of respondents resorted to borrowing to acquire food while 20%, had adopted mixed crop farming. Opiyoet *al.*, (2015) found that household coping mechanisms to ensure food security had results that range from diversification, practicing mixed farming, good storage facility, early or timely planting, leasing of land, dietary change, selling assets to proper farming practices. In this study, some households sold assets such as furniture, jewelry or utensils when they needed to buy food, however, such cases were very rare (11%).

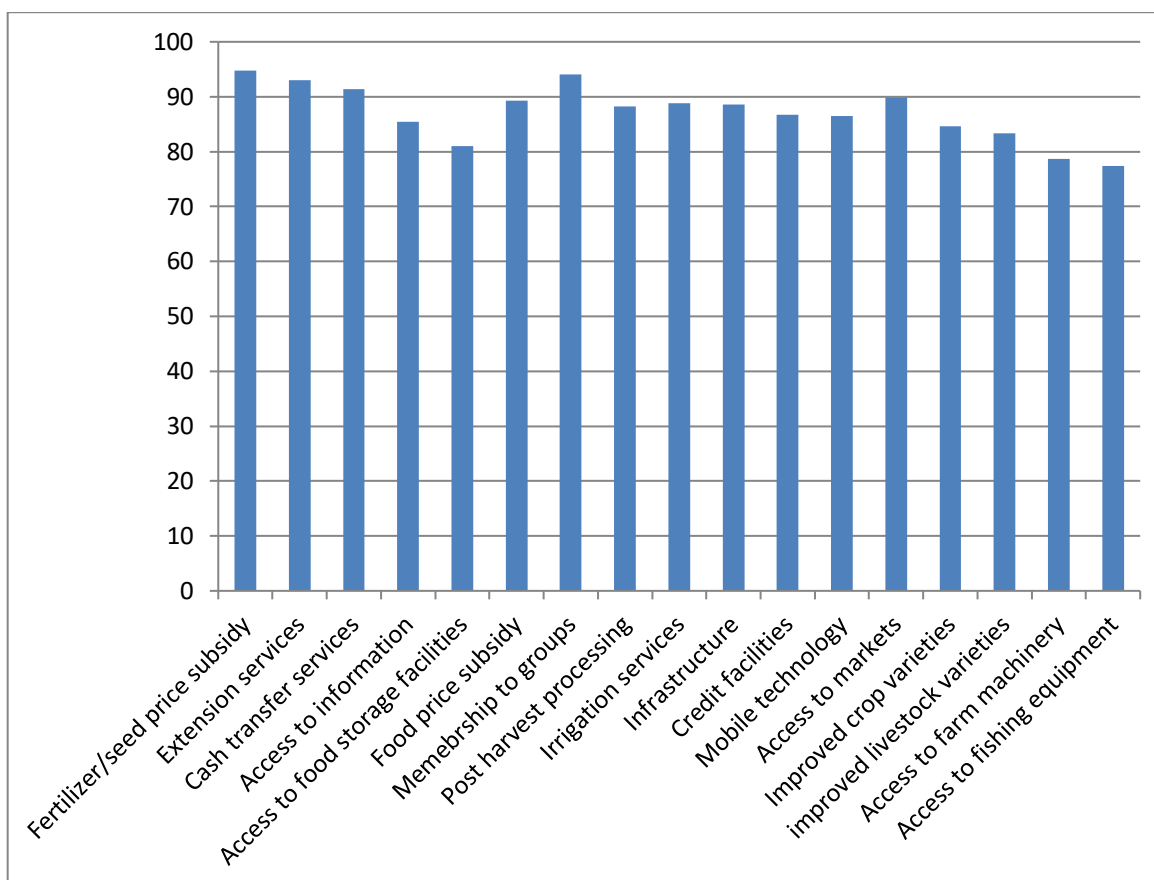
Table 4.5: Household Coping Mechanisms to Food Insecurity in the Study Area

Coping Strategy	Frequency	Proportion (%)
Diversification	165	43
Borrowing	99	26
Mixed Crop Farming	77	20
Selling of assets	43	11
Total	384	100

Source: Field Survey (2019)

4.4.2 Analysis of Food Security Strategies implemented in Homa Bay County

The study sought to assess the prevalence of food security strategies in the study area. It also evaluated the emerging strategies promoted in Homa Bay County to achieve sustainable food security. A correlation analysis of the emerging strategies was carried out and results are also presented in this section.



Source: Field Survey (2019)

Figure 4.5: Proportion (%) of the Prevalence of Food Security Strategies among Selected Households

The findings indicated that food security strategies in Homa Bay County adopted by most households (94.79%) was fertilizer and certified seed price subsidy followed by membership to groups/ associations (94.01%). Governments' support service through provision of subsidized fertilizer and certified seeds was a strategy that enabled many households to engage in food production activities. Agricultural extension services

(92.9%) and cash transfers to vulnerable groups (91.4%) were also strategies that were adopted by most households in the study area.

Access to markets had assisted 89.84% of households to address food security needs. Food price subsidy (89.32%), irrigation services (88.80%), development of infrastructure such as road, water and air transport (88.54%) also played a big role in food security. Infrastructure enabled movements of food items to market places where they were sold. Others included post-harvest food processing (88.28%), credit facilities (86.72%), mobile technology (86.46%), access to information (85.42%), improved crop (84.64) and livestock varieties (83.33%). The least adopted strategy was use of fishing equipment (78.65%) and farm machinery (77.34%) as strategies to improve food security.

Most household adopted fertilizer and seed price subsidy highest because of the government of Kenya provided the subsidy that has enabled most households to benefit from it. Fishing equipment was least adopted as a food security strategy mainly because most people do not live near the lake and lacked fishing skills. The only people that had fishing skills most lived near the lake and those who had interest in fishing. Farm machinery was expensive to own or hire thus was also not widely adopted. Furthermore, most household tilled small parcels of fragmented land making it uneconomical to use farm machinery such as tractor and planters.

Figure 4.5 presents findings of the assessment of the prevalence of the existing food security strategies among the selected households in the study area.

According to interviewed respondent,

“Subsidized fertilizer and other farm inputs like seeds, pesticides that are offered by the government at a friendly cost, were able to improve on food security in Homa Bay County”(P1-A4, Oral Interview, Homa Bay County, 2019).

The farm input price subsidy offered by national and county governments as well as other development partners within the County enabled households to increase food production activities thus increased output. Studies have supported the important role input price subsidies play in food security. Odendo (2000) noted that subsidies in big world economies have risen reversing a long-term declining agricultural production trend as governments pour more funding into agriculture despite strained budgets and high food prices. Barnely (2016) noted that the US price and income support grew out of acute farm income and financial crises, which led to widespread beliefs that the market system was not adequately rewarding farmers for their agricultural commodities. Modern agricultural subsidy programs in the US began with the New Deal and the Agricultural adjustment Act of 1933 which gave the government power to set minimum prices and included government stock acquisition, land schemes to cut supplies by destroying livestock. In 2006, China launched an altered agricultural production subsidy program in which subsidies were a function of fluctuating market prices of agricultural equipment and grain, as well as cultivated land area thus providing an incentive for farmers to grow grain (Sonnino, 2016).

In Homa Bay County, the government embarked on provision of food production support services with the aim of improving sustainable food security. These interventions were beneficial and attracted a large number of households (94.79%). However according to the respondents there was lack of proper coordination and regulations to guide who to benefit. The decision on who to benefit was entirely in the hands of authorities who sometimes were unfair. In other times the subsidized fertilizer and certified seed would only be available long after planting season is over. According to Ford *et al.*,(2014) African countries such as Kenya, Tanzania, Malawi, Zimbabwe and Zambia pursued large scale subsidy programs from the 1960's up through 1980's. The programs were characterized by a government-controlled input (and output) marketing system, in which farmers were supplied with agricultural inputs at controlled and subsidized prices, and often on heavily subsidized credit. Some of the programs succeeded albeit being extremely expensive and tending to benefit relatively well-off and better connected farmers. Further, the fertilizer subsidy programs were prone to inefficiencies arising from high administrative costs, government monopolies and political manipulation.

Proper implementation of government policies and programs on subsidies is believed to drastically enhance sustainable food security. Dorward (2009) believed that Malawian Government pioneered the return to large- scale subsidies in 1998, when it began distributing free fertilizers. Implementation of a large-scale agricultural input subsidy program in Malawi in 2005/6 and subsequent years attracted major international interest resulting in increased grain production. This enabled Malawi to attain food security and to export the surplus. Fertilizer Support Program in Zambia (ZFSP) launched at the start

of 2002/3 agricultural season sought to break from earlier programs that focused less on direct subsidies and more on controlling input prices and making sure that inputs were available to smallholders through state-managed production and distribution (World Bank, 2010).

Food security strategies such as agricultural extension services, cash transfers to the vulnerable groups as well as improved infrastructure were identified as critical in improving food security in the study area. Interview response in this study indicated that the County Government of Homa Bay had prioritized on interventions that would improve and accelerate agricultural production to ensure food security. Previous studies show that agricultural sector is critical to food security in general. In Tanzania for example, agriculture is the backbone of the economy and a significant contributor to overall national growth sharing more than 45% in the GDP and employing over 80% of the population. In 2008/9, Tanzanian government embarked on an initiative to revive agricultural input subsidy to stimulate growth (Vervoot *et al.*, 2016). The Accelerated Food Security Project contributed to higher food production and productivity in targeted areas by improving farmers' access to critical inputs. Heavy subsidy on agricultural sector improved livelihoods of the poor, generated demand for goods and services, reduced poverty and inequality and supported social and political stability (Sonnino, 2015).

4.4.3 Emerging Strategies for Sustainable Food Security

The study determined the emerging strategies promoted for sustainable food security in the study area and carried out a correlation analysis of the strategies. Sixteen strategies known to improve food security were identified as the emerging food security strategies promoted in the study. These were fertilizer/seed price subsidy, extension services, cash transfer services, access to information on food production, access to food storage facilities, food price subsidy, membership to groups, post-harvest food processing, irrigation services, improved road network, mobile phone technology, access to markets, improved crop varieties, improved livestock varieties, subsidized farm machinery and fish cage farming. Respondents were asked to state their preferences for the strategies based on their perception on the effectiveness of the strategies. Majority (91%) identified membership to groups as the most effective emerging food security strategy. The least number(43%) of households identified subsidized farm machinery as the most preferred emerging strategy (table 4.6).

Table 4.6: Preferences for Emerging Food Security Strategies

Food Security Strategy	Proportion (%) of Households	Rank
Membership to groups	91	1
Access to information	87	2
Extension services	85	3
Fertilizer/seed price subsidy	81	4
Cash transfer services	78	5
Food price subsidy	77	6
Access to markets	73	7
Improved road network	69	8
Improved crop varieties	65	9
improved livestock varieties	61	10
Mobile phone technology	58	11
Fish cage farming	55	12
Post-harvest food processing	53	13
Irrigation services	47	14
Access to food storage facilities	46	15
Subsidized farm machinery	43	16

Source: Field Survey (2019)

Membership to Groups

Perception on effectiveness of membership to groups such as merry-go-rounds, associations and cooperative SACCOs in addressing food security in the study was very high in this study (91%). In this study, it was observed that support groups and

cooperatives were key household strategies to deal with food insecurity. The national and county governments supported food security by formation of cooperatives and producer SACCOs. These groups or cooperatives provided incentives to members by enabling access to loans, trainings, provision of relief food, as well as provision of food preservation equipment such as milk cooling plants like the one in Oyugis Town, catchment reinforcement and value addition such as that of making yoghurt and other dairy products. This reduced postharvest losses thereby enhancing sustainable food security.

The study observed that cooperatives in Homa Bay County vary in size and influence. Some of the cooperatives in the agricultural sector included Aquaculture Multipurpose Cooperative Society (AMCS), Local Poultry Value Chain Cooperative Society (LPVCCS), Rangwe Dairy Cooperative Society (RDCCS), and Peanut Value Chain Cooperative Society (PVCCS). The cooperatives and the farmer groups such as Ogongo Development Group were engaged in promotion, pricing and linking farmers to buyers. However, the cooperatives and farmer groups were not well structured and coordinated, limiting their activities. Johnson *et al.*, (2016) argued that the existence of farmer groups (associations and cooperatives) constitutes the social capital that is needed in adoption of agricultural innovation. The social capital is defined as “networks together with shared norms, values and understandings that facilitate co-operation within or among groups”. The value and use of social capital depends on the institutional environment. Alston & Bowles (2008) noted that policies, markets and other institutions influenced motivations, values and trust thus the social capital.

With support of cooperatives, farmers can pool production from their individual farms in order to better meet market demand, reduce risks, access better financing, acquire and share farm machinery and other assets, negotiate better prices, and jointly market their produce. Formation of farmer organizations enabled farmers to discuss and share their various experiences which enhance group dynamics. Respondent in this study stated that:

“Membership to various groups was beneficial in accessing information on market trends as well as accessing agricultural production information and trainings. Membership to groups also increases access to loans that could be used to acquire farm input needed for production of food or will lead to direct access to food from the market”(P1-A2, Oral Interview, Homa Bay County, 2019).

Amaya (2009), showed that those in private sector had key actors in food marketing. Agro-veterinary companies engaged in distribution and sale of agrochemicals and other farm inputs and often trained farmers on the safe utilization of pesticides, fertilizers and other input supplies. Financial institutions such as banks provided loans to farmer cooperatives that were not necessarily agricultural loans but loans that farmers could use to purchase farm inputs. The extent to which such formal financial institutions were accessible and were used by farmers however, was not clear.

Access to Information on Food Production and Market Trends

The findings indicated that 87% of households identified access to information as the most preferred strategy to address food security. Access to information played an important role in creating awareness through provision of knowledge on products and services to the households, and thus an essential component for sustainable food security and development. Information has power only when applied and practiced effectively.

This study found that information access was a basic resource for households to improve their food security levels and living conditions. Information access facilitated awareness and empowerment on supply of inputs and new technologies. Availability of inputs and access to new technologies are necessary for improved crop and livestock production which are important in food security in rural areas. Respondent in an interview stated that:

“Information on early warning systems that include news on drought, pests and diseases enable households plan for the challenges and also ensure that they store food to make up for the impediments. Market prices for inputs and output are very essential in food security as it enabled households to make informed farm planning and budgeting decisions”(P1-A2, Oral Interview, Homa Bay County, 2019).

In Rwanda, Shiferaw *et al.*, (2014) showed that since information is power, then enough information should be given to individuals, repackaged in the language they understand and given to them at the appropriate time. People are able to make informed choices based on available information, thus the importance of efforts to create suitable awareness for accessing information. Shiferaw *et al.*, (2014) argued that information given to rice farmers in Sri Lanka should be according to their needs. Their needs could be on use of fertilizers, planting, pests and disease control. In a study carried out in Nigeria (Domenech, 2014), information on existence of subsidies and other agricultural production strategies was found to be important. It was noted that effective subsidy Program promoting policy is successful when it creates awareness among the farmers on the existence of subsidies. The policy should analyze the extent to which farmers are exposed to valuable information regarding the subsidy program.

Agricultural Extension Services

Preference of agricultural extension services was ranked third with 85% of households identifying it as the most effective in addressing food security. This study found that extension officers were the main information providers, and were in charge of information centers, hence had a great role to play in providing information to farmers in different forms such as talks, posters, pamphlets and brochures. There were organized radio discussions in the local Luo dialect where households participated and benefited from agricultural and other improving food security related information.

According to the key informants that participated in this study, the FM radio sessions formed the basis of agricultural information content delivery to rural farmers. Extension agents and selected farmers in the study area participated in radio discussions which were broadcasted in local FM stations. TV stations such as Citizen was also rated highly in terms of provision of useful agricultural information. According to Amaya (2009) recordings of radio broadcast are dubbed on audiocassettes for replay by farmer groups during their meeting days. The participation of extension agents and farmers in agricultural radio programs has brought access to information closer to the rural small holder farmers thereby demystifying the activities of programs. Respondent in an interview stated that:

“Agricultural trainings were carried out by agricultural extension officers as well as different development agencies such as world Vision, Farm Africa, FAO among others through organizing seminars and workshops. From the trainings, farmers were equipped with new strategies to enhance sustainable food security within the region. When farmers had been prepared to be at ease, they were thoroughly explained to why the skill to be learned was important.

Demonstrations were made on how the tasks or skills were to be utilized by the farmers”(P1-A6, Oral Interview, Homa Bay County, 2019).

The study found that training was effective in improving the farmers’ abilities to emulate and execute farm plans and to acquire information on how to improve marketing of their products. It thus reinforced natural talents and provided a basis for decision making. Training was effective in improving food security in the study area because farmers were appraised on crop management techniques, fertilizers requirements and application strategies for maximum benefit. Training enabled farmers to come into contact with various sources of relevant information and knowledge necessary in improving farming efficiency thus food security. The key informants were of the view that training provided information back up that improved agricultural productivity in the study area. In a case study in Bangladesh, Wekerle and Classens (2015) noted that regular and repeated training and education play a vital role in improving households’ awareness, making them act as subjects in the development process.

Schreinemachers *et al.*, (2016) noted that the more a farmer has been trained effectively and continuously the more successful the farmer becomes. According to a case study by Odingo (2014) on effective extension methods for increased food production in Vihiga County in Kenya, it was noted that training should continue through extension support during the project implementation. The study found that regular training of farmers on subsidies like fertilizers enhanced their adoption. Mehar *et al.*,(2016) noted that a knowledgeable population is an asset to the agricultural sector as it provides personnel and opportunities for development.

According to Nompozolo (2000), a knowledge-based economy creates, adopts and adapts information on production and distribution of goods and services, making it the focal point and engine for rapid agricultural growth. To become an entrepreneur with parameters that determines the scope of an enterprise in rural areas, smallholder farmers must be familiarized with the principles of business and economics, record keeping and should become proficient with managerial skills. Nompozolo recommended that extension officers should be trained on indigenous knowledge relevant to the farming activities carried out in their areas of operation.

Sonnino *et al.*, (2015) recommended that extension officers must be trained to carry out their work since their role determines sustainability of food security development initiatives in the long run. The knowledge that farmers gain from the extension officers enable them to be sustainable and successful in the future. Therefore there is need for extension officers to be trained in indigenous knowledge relevant to the farming activities to fully and more clearly disseminate information to the smallholder farmers. For example, Atshushi (2015) in his study reported that banana farmers in Uganda are trained using farmer to farmer approach, where model farmers are selected based on education level, leadership position, success at the enterprises and personality traits. The model farmers are trained and given inputs, other farmers are encouraged to learn from the model farmers who are required to encourage and train their peers by generously sharing knowledge.

4.4.4 Correlation Analysis of the Emerging Strategies for Sustainable Food Security

The computation of Pearson correlation coefficient test done on the 16 identified emerging food security strategy variables (membership to groups, access to information, extension services, fertilizer/seed price subsidy, cash transfer services, food price subsidy, access to markets, distance to access roads, number of improved crop varieties, number of improved livestock varieties, mobile technology, fish cage farming, post-harvest food processing, irrigation services, access to food storage facilities and subsidized farm machinery) showed that out of the 16 variables, only 12 variables (membership to groups, extension services, fertilizer/seed price subsidy, cash transfer services, access to markets, access roads, mobile technology, fish cage farming, post-harvest food processing and irrigation services) had Pearson correlation coefficient test values below the critical value of 0.5 adopted in this study for inclusion in logit model.

Pairwise correlation of variables indicated that membership to groups and access to information had a high positive correlation (0.71) and membership to groups and improved crop varieties had a positive correlation of 0.57. Access to information and improved livestock varieties were not included in the logit model analysis. The choice of which of the variables to include was based on the researchers opinion on the variable's role in contributing to sustainable food security. Fertilizer/seed price subsidy and improved crop varieties had high positive correlation (0.81). This led to exclusion of improved crop varieties from the list of variables included in logit model analysis.

Post-harvest food processing and access to food storage facilities had a positive correlation as indicated by the Pearson coefficient correlation test value of 0.66. Access to food storage facilities was thus dropped. Extension services and subsidized farm machinery had a high positive correlation of 0.59 (appendix 7). Subsidized farm machinery was thus dropped and was not included in the logit analysis. Agricultural extension services and food price subsidy had a high negative correlation (Pearson coefficient test value of -0.64). Food price subsidy was thus not included as a variable in the logit regression model.

4.5 Analysis of Effects of Emerging Strategies on Sustainable Food Security

This section addressed the hypothesis that postulated that the analyzed emerging food security strategies have no statistically significant effects on food security in the study area. Findings on the effects of emerging strategies on food security are useful in designing policies aimed at improving food security. In this study a positive sign of coefficient of a variable indicates a direct positive relationship between the variable and food security. A negative sign of coefficient of a variable indicates a direct negative relationship between the variable and food security. The cause-effect relationships were analyzed at both 99% and 95% confidence level. The results of the logit regression analysis are presented in table 4.7.

Table 4.7: Summary Results of the Logit Regression Analysis

Variable	Coefficient	Standard Error	Significance
Fertilizer/Seed Price Subsidy	2.70***	0.67	0.01
Extension Services	3.26	0.60	0.70
Cash Transfers	1.72*	0.98	0.08
Asset Endowment	2.28***	0.91	0.01
Fish Cage Farming	0.03	0.03	0.36
Household Income	2.27***	0.69	0.00
Membership to Groups	1.87**	0.87	0.03
Irrigation Facilities	0.18	0.90	0.84
Mobile technology	1.11	0.89	0.21
Post-harvest Food Processing	1.42*	0.74	0.06
Access to markets	2.37**	1.11	0.03
Access to Roads	0.04	0.03	0.17
Constant	2.29	1.67	0.19

Source: Field Survey (2019)

* indicates the variable is significant at 90%, **means the variable is significant at 95% while *** shows that variable is significant at 99% levels of significance, The $R^2 = 0.875$,

Table 4.7 shows that sustainable food security was positively affected by all analyzed variables. The coefficient of input (fertilizer/certified seed) and price subsidy was positive (2.70) and statistically significant at 99% confidence level. Asset endowments had a positive coefficient of 2.28) while coefficient for household income was 2.27 and the effects were significant at 99% confidence level. The effect of membership to groups

(coefficient of 2.27) and access to markets (variable coefficient of 2.37) was positive and statistically significant at 95% level. The effects of the rest of the variable on food security were not statistically significant. In this study the included variable explained 87.5% of food security ($R^2=0.875$) while the rest 12.5% could not be explained by the model and could be explained by variable that were not included in the model, measurement errors or other unexplained reasons. The fairly high R^2 value enabled making reasonable conclusions from variable relationships in the presented model.

4.5.1 Effect of Input Price Subsidy on sustainable Food Security

Price subsidy consisted of subsidy on prices of food, fertilizer, certified maize seed and farm implements such as tractors. This strategy was shown to have a number of benefits to the farmers and to the residents of Homa Bay County as a whole. The households benefited on input subsidy programs offered by the government of Kenya such as introduction of fertilizer. Use of fertilizer increased crop yields thus the availability of high food output for consumption and sale.

Gok responded to the food crises through three major policy interventions: Supply, prices and income related policies with subsidy on farm inputs, especially fertilizers, through involvement of the National Cereals and Produce Board (NCPB) in importing and distributing the inputs being the major undertaking on supply related policies. Agricultural subsidies have been provided by the Government to farmers since 2004 in order to increase their outputs, reduce post-harvest losses, adopt better technologies and production practices and enhance market links to promote farmers income thereby

improving the economic viability of small scale farmers and improving food security (GoK, 2010).

4.5.2 Effect of Asset Endowment on Sustainable Food Security

The effect of asset endowment on food security was positive and statistically significant at 99% confidence level. Asset endowment included farm machinery, land, vehicles, fishing gears, buildings and business stock. Farm machinery play an important role in food production in that it enables farmers to make timely land preparation especially for large scale farmers. This is particularly important since the study area is characterized by limited manual labor. Land is an important factor of production and its ownership is critical to sustainable agricultural production. Those who owned commercial vehicles were better able to earn additional income to complement food production in the study area. Vehicles were used for transport businesses and for transporting farm produce to the market or to storage and processing facilities. For those who owned fishing gears, buildings and business stock it was noted that they were also able to generate additional income to acquire basic needs including food.

Resource endowment as a determinant of food security was statistically significant since most households were resource poor. This study found that ownership of resources contributed to access of food by households. Economic constraints or factor endowment model assumes that distribution of resources among potential users in an area determines the pattern of adoption of any technology including agricultural production technologies.

Poorly resource endowed households had a tendency to neglect food production practices as they lacked the capital to establish and maintain the practices.

Resource endowed households were also likely to be advanced credit for crop and livestock improvements. Some studies have shown a positive relationship between land size and access to credit. According to NTF and ICRAFT (1988) farmers that grew subsistence crops such as maize had to have more than 2 ha (5 acres) of land to qualify for access to credit. This excluded most smallholder farmers from accessing credit.

In a study on effect of socioeconomic and institutional factors on adoption in Punjab (Pakistan), Salam (1985) showed a negative relationship between farm size and adoption of fertilizers. Holloway *et al.* (2002) showed that adoption of High Yielding Varieties (HYV) of rice in Bangladesh was negatively correlated with farm size. Farmers with small farms tended to adopt HYV of rice. According to Clay and Reardon (1997) farmers with large farms adopted fewer technologies per unit area than those with small farms. These have implications to sustainable food security.

4.5.3 Effect of Household Income on Sustainable Food Security

The effect of household income on food security was positive and statistically significant at 99% confidence level. Households with relatively higher incomes were more likely to afford food. Income tends to increase farmer's ability to acquire inputs, hire land, employ labor and even purchase food during period of low agricultural productions. This explains why income had a significant effect on food security. The positive coefficients of income variable indicated that income increased the households'

ability to secure food through production or purchase. People with higher incomes tended to have better knowledge of new practices and thus were better placed when it came to food production abilities.

The positive coefficient of income variable indicated that income increased ability of the households to improve the quality of labor. People with higher incomes were also more likely to have better knowledge of new technologies and thus were better placed when it came to adopting the technologies. Poverty induced households to opt for current consumption at the expense of investing in sustainable food security. High incomes enabled households to use capital inputs like fertilizer and seed and to hire labor thus enhancing food security. Households with high incomes tend to have low discount rates thus make long-term investments like buying land. High incomes are linked with profit maximizing farmers who have high discount rates, hence less likely to invest in long term ventures (Oluoch-Kosura, 2010). At very low income, investment in sustainable food security ventures was not easy as households was only concerned with household immediate need for food, clothing, shelter and for educating children. Family income of some households had been improved through activities of some organizations such as World Vision, USAID, FAO, IFAD, One-Acre Fund among others that were operation in the region with the aim of improving households' livelihoods in the study area.

4.5.4 Effect of Membership to Groups on Sustainable Food Security

Membership to groups by members of the household positively affected household food security. The effect was statistically significant at 95% level. This positive effect could

be explained by the fact that membership to groups improved household social capital and access to credit facilities. Access to credit has the potential of increasing household liquidity, freeing up some resources for investment in income and food production ventures thus food security. Since credit markets are not efficient in the area, group membership enabled farmers to acquire loans or benefit from merry go round needed to spur up investment in income generating activities. Membership to groups also influenced adoption of new agricultural technologies such as making of yoghurt production that was seen in Oyugis Town. The study also established that membership to environmental conservation groups enabled soil and water conservation which are necessary in sustainable agricultural production. Farmer groups exposed farmers to technology, provided them with intra-group support for individual experimentation, facilitated farmer-farmer interactions in technology testing and management, reduced demonstration costs and increased economies of scale for broad based technology dissemination to group members.

Adoption of alley cropping in Cameroon (Adesina *et al.*, 2000) and that of agroforestry in Senegal (Caveness and Kurtz, 1991) positively correlated with membership to farmer groups. Falusi (1974) in a study in Nigeria showed that membership to cooperatives/ farmer associations, frequency of extension visits, farmers' exposure and credit capital supply were more important than economic factors (land, labor, crop prices) in small scale farmers' fertilizer adoption.

4.5.5 Effect of Access to Markets on Food Security in the Study Area

The effect of access to markets on food security was positive and statistically significant at 95% confidence level. Poorly developed road network make food prices high due to transaction costs such as cost of reaching market from rural households that were far from market centers. Most residents relied on purchased food during periods of short supply.

In a study by Jansen *et al.*, (2006) in Honduras and Trifinio Region in Central America, households had to contend with poor roads and high transportation costs when making production decisions. Farmers select crop activities based on costs, revenue and profit but are constrained by labor, cash and food security concerns and output and output market access. Market access is directly related to distance to market. Distance to market increases the cost of inputs, transportation costs and reduces the effective price farmers receive for output.

4.5.6 Effect of other Analyzed Variables on Food Security in the Study Area

The study also analyzed the following variables that were found not to be statistically significant in determining food security: extension services, access to cash transfer, fish cage farming, access to irrigation, mobile phone technology, storage facilities and distance to access roads. The effect of extension services positively affected sustainable food security in the study area. Extension services though usually associated with positive effect on food security for the fact that it assists farmers in learning new production technologies and production practices did not have a statistically significant

effect on food security. This could be explained by the fact that household to extension officer ratio was too high making their presence not to be felt. According to MoA (2010) the extension agent to farmer ratio was 1:1000 in the area. This was too low to ensure adequate number of farm visits. The positive correlation between extension services and food security was expected because agricultural extension is known to be a traditional way of transmitting new information and technology to relevant users, especially in agriculture.

The effect of cash transfer on food security was positive and significant at 90% confidence level. Cash transfer is a strategy used to support vulnerable in society and has been widely used in developed countries. This strategy is new in Kenya and aims at transferring cash to the old and persons living with disabilities. The study established that cash transfers enabled households that benefited from the transfer to acquire food. Although cash transfer has the potential of significantly contributing food security, it was not significant in this study possibly because a small proportion of households benefitted from the strategy.

Furthermore, the amount of cash transferred was not only insufficient to address household food demands but also unreliable as it was not released on a regular basis making it hard to plan for household food needs. The study also found that there was high dependency ratio and the elderly supported many orphaned children. The average household size in the study area was 6 with a range of 4to11. Household size affected the ability of the household to meet her food needs.

The effect of age of household decision-maker on food security in the study area was positive. The positive effect could be explained by the fact that most factors of production such as land and capital were held by older farmers. From this study a majority of household heads were above 50 years. The lack of significant contribution of age of decision-maker to food security could be because agricultural production is labor intensive making the old not significant contributors to agriculture as they are less energetic.

The study findings indicated that effect of irrigation on food security was positive. The effect was not statistically significant possibly due to the fact that irrigation farms were few and were practiced on small scale to produce rice and vegetables which are not staple foods. To ensure that irrigation benefits rural households there is need to expand the existing irrigation coverage. This will enable households to improve food production and household income generation.

The study found that the effect of mobile technology on food security was positive but not significant. This could be explained by the fact that majority of them did not use phones to access information on new agricultural technologies that could lead to increased food production. It was also found out that the effect of access to storage facilities on food security was positive and significant at 90% confidence level. The positive effect can be explained by the important role that storage facilities played in preserving perishable food products for use in periods of low supply. The effect of distance to access roads was negative but not statistically significant. The negative effect

was expected because the longer the distance from access roads, the more difficult it was for households to access food and input markets.

4.6 Challenges faced in Improving Sustainable Food Security in Homa Bay County

This section addresses the research question “what are the challenges faced in attaining sustainable food security? The identified challenges included: low resource endowment; limited and poorly development infrastructure; labor and; limited agricultural extension support services.

4.6.1 Low Resource Endowments

Resource endowments considered ownership of assets (movable and immovable) held by the household. Resource endowment is believed to affect households’ capacity to secure food. The study findings indicated that majority (94.79%) of the respondents owned mobile phones. However, most of these households owned mobile phones that were analog. The analog phones could not be used to access digital platforms that provided information on modern agricultural practices. It was also noted that for the farmers that had digital phones, they rarely Google to access agricultural information because of reasons that range from lack of bundles needed for surfing the internet to limited knowledge on how to access agricultural information. Table 4.8 contains information on types of the identified assets owned by households.

Table 4.8: Descriptive Statistics on Assets Owned by Households in Study Area

Assets	Proportion (%)	Rank
Mobile phones	94.79	1
Land	92.45	2
Radios	91.15	3
Hoes/ <i>jembes</i>	90.16	4
Bicycles and motor cycles	88.89	5
Carts	88.54	6
Ox-Ploughs	56.20	7
Wheelbarrows	45.42	8
Fishing gears	41.51	9
Television	28.12	10
Farm machinery (Tractor)	17.08	11
Computers	6.56	12

Source: Field Survey (2019)

Thornton and Lipper (2014) in their study showed that means of communication is very crucial in agricultural innovations. He observed that communication through radio and mobile phones that are accessible by small farmers is essential for promoting adoption of innovative farming practices. In integrated agricultural innovation systems, communication enables participatory processes through a two-way flow of information and knowledge. Mobile technology and communication has been found to be important for sustainable food security. However, this was found to be limited in the study area.

An interesting finding in the study was that a very small proportion of the households (17.08%) owned farm machinery. Ownership of farm machinery such as tractors, planters, weed/ pest control sprayers among others are considered very important in improving timely and large scale farm operations leading to sustainable food security. Farmers used ox ploughs and hoes/*jembes* to till land making large scale farming difficult and uneconomical to run. There was over supply of motorcycles and bicycles (88.89%) leading low income earnings from the business thus making their contribution to food security low. Although majority of households owned land (92.45%), the size of land was small and fragmented limiting production of sufficient food for the household. Furthermore, some of those who owned land indicated there were associated land disputes that hindered long term developments on the land. Tendall *et al.*, (2015) noted that the most serious challenges faced by farmers in improving food security through diversification were small pieces of land as a result of customary rights leaving the land inadequate for food production.

Homa Bay County is located next to Lake Victoria. However this study established that a small proportion of households (41.51%) owned fishing gears. This has negative implications on food security as the household either hired fishing gears or relied on fish purchased to meet their dietary needs. It was also observed that most household lacked computers that are considered important for communication in advanced agricultural production systems. Only a small proportion of households (6.56%) owned computers. Computers are also useful in keeping farm records.

4.6.2 Limited and Poorly Developed Infrastructure

The study sought to determine distance covered by households to reach various infrastructural facilities such road networks, markets, airstrips and water transport points. The study findings are shown in table 4.9.

Table 4.9: Estimated Distance Households Covered to Access Selected Facilities

Facility	Average Distance (Km)
Homa Bay Airstrip	33
Nearest Tarmac Road	6
Market	2

Source: Field Survey (2019)

The study findings indicated that households covered a distance of average 33km to reach Homa Bay Airstrip. To reach the nearest tarmac road and market households covered on average a distance of 6 km and 2 km respectively. These distances were noted to be relatively long. Long distances pose a challenge as they may lead to perishable foods getting spoiled before reaching the markets or processing facilities. Further the study observed that although the average distances to tarmac roads was only 6kms the rural access roads were mostly impassable during the rainy seasons making it difficult for household to access food and/ or produce for markets. This negatively impacted on food security in the study area. From the observation, it was noted that there

was need for increased public investment in transportation and communication sectors in order to strengthen rural economy for sustainable food security. Rural access roads needed to be graded and well murramed to facilitate easy movements of people, goods and services even during rainy seasons.

Clapp (2014) noted that household distance from main road significantly affected household food security. Infrastructure, such as roads, is important in quick transportation of agricultural products from the farms and to the markets, thereby facilitating market integration among regions. This will help to move the products from surplus areas to deficit areas to reduce the impact of food shocks on households. Curtis and Halford (2014) showed that poor road networks and the high cost of transportation discourage farmers from taking surplus produce to the market. This makes them sell their surplus at farm gate reducing their profit margins.

Orsini *et al.*, (2016) noted that infrastructure such as roads plays significant role in improving agricultural productivity in developing economies. Improved infrastructure lead to increase in agricultural productivity, which consequently drives economic growth and reduce poverty.

4.6.3 Limited Agricultural Extension Support Services

The study found that there was limited number of extension visits by agricultural extension staff. This was attributed to the low farmer to extension staff ration characteristic of the study area. Most household claimed that they had rare meetings with extension officers/ agents. This negatively affected food security as extension play a critical role in educating farmers of farming practices that would improve their agricultural productivity thus access to food. The few extension offices cited lack of facilitation to reach rural households as their cause for not maximizing farm visits.

Kemore (2015) noted that agricultural extension workers have a significant role to play in raining and mentoring farmers and introducing better farming techniques. He noted that in Kenya, there was very limited number of extension workers and were not properly facilitated to enable them to deliver services effectively to farmers. According to Kemore there was only one extension officer in Homa Bay County, and it was not possible for him to provide proper support to all farmers. Inadequate facilitation for movement within the County was the biggest challenge in reaching farmers especially those living in the remotest areas of the County.

4.6.4 Unfavorable Climatic Condition

According to respondent in an Oral interview conducted in Homa Bay (2019), it was noted that the County had experienced droughts and unpredictable rainfall patterns in the recent past. The study also observed that Homa Bay County lacked sufficient irrigation facilities to fully exploit irrigation agriculture to improve the agricultural potential of the County. With irrigation, Homa Bay County is capable of producing enough food for all

her households and even extra for export to other counties for trade. However, the region's limited number of irrigation schemes makes this a mirage. Households therefore depended on rain fed agriculture which was unpredictable. The respondent in an interview in the study stated that:

“The major challenge to food security in Homa Bay County is unpredicted rainfall patterns in most parts of the County thereby affecting crop and livestock production. The County has been experiencing unfavorable climate for agricultural production in the recent past. This has led to low agricultural production activities hence food insecurity”(P1-A3, Oral Interview, Homa Bay County, 2019).

Oduor (2015) noted that lack of irrigation facilities led to farmers depending solely on rain fed agriculture leading to limited production. Significant public investment is required in improving access to water such as borehole sinking, collecting rain water and generally developing irrigation systems in order to expand irrigation for high productivity.

4.6.5 Limited Labor

High population densities characterizing most rural counties are associated with availability of cheap labor. However in this study labor was a real problem to sustainable food security. The cost of labor was high making it unaffordable to most households. A key informant in this study said that;

“The problem of agricultural production in Homa Bay County is the high cost of labor. For example to plough an acre of land you need KShs. 3500, weeding the same land may cost you KShs. 2000-2500 and sometimes you need to weed twice. This high cost in labor discourages agricultural production, leading to food shortage” (P1-A2, Oral Interview, Homa Bay County, 2019).

The high cost of food arising from unfavorable climate translated to high cost of living thus high cost of labor. Household depended on own labor in agricultural production.

However family labor consisted of the elderly as majority (48.4%) were above 50 years of age. The young people had migrated to urban settings in search for wage employment. The challenge of labor was worsened by individualism that had eroded the traditional spirit of communal work.

The respondent in an interview stated:

“The problem of limited labor was worsened by the low social capital arising from the progressive breakdown of African self-reliance and social concern for others. In the traditional African society, there was self-reliance and social concern for others through a socio cultural provision to incorporate the young, old, poor and sick into the society to achieve an inbuilt provision of self-reliance for the individual and for the society”(P1-A5, Oral Interview, Homa Bay County, 2019).

Social capital is a function of a community’s ability to co-operate, learn and copy from each other the social norms about good farming. In this study it was observed that modernization has destroyed the African traditional set up making it difficult for household that were constrained with labor to meet household food production needs. Lipper (2014), noted that one of the factors that influenced the crop yields was availability of labor at household level. In general, farmers who mobilized labor for early preparation, planting and weeding received a higher crop yield.

The challenges affecting food security in Homa Bay County are categorized into low resource endowment, limited agricultural extension services, poorly developed infrastructure, limited labor among others. These challenges are mainly institutional and policy related making it possible to undertake affirmative action to mitigate their effects on sustainable food security in the study area.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of the Findings

On food situation, the study revealed that most households in Homa Bay County were not food secure due to low food production and low income level. This was attributed to low, unreliable rainfall, limited land size, and high levels of poverty. Land was mostly fragmented into smaller units that could not support large scale farming.

The study identified the following emerging sustainable food security strategies; fertilizer/ seeds price subsidy, agricultural extension services, national and county government support (cash transfers), post-harvest food processing, formation and membership to groups, new agricultural technologies like improved crop and livestock varieties, irrigation facilities and infrastructural development. Diversification was mostly practiced as a coping strategy alongside borrowing, mixed crop farming and selling of household assets. Most of the households believed that most of the strategies were effective in addressing food security. However not all households had embraced the sustainable food security strategies.

On the third objective this study found that some of the variables analyzed had positive effects on food security while a few negatively affected sustainable food security. The effects of input price subsidy, asset endowments and household income on food security were positive and statistically significant at 99% confidence level. The effect of

membership to groups and access to markets affected sustainable food security and were significant at 95% level. On testing the hypothesis, the study revealed that the emerging food security strategies had significant effect on sustainable food security in the study area.

The study findings revealed that the challenges affecting sustainable food security in Homa Bay County can be summarized into: low resource endowment; limited and poorly developed infrastructure; limited and inefficient agricultural extension services; unfavorable climatic conditions and; limited labor.

5.2 Conclusions

Based on the above discussed findings, the following conclusions can be made. The study concluded that Homa Bay County was not food secure. Most of the households in Homa Bay region slept on hungry stomachs at night due to lack of food. Inadequate resources due to low income have also led to cases of food shortage in the area. Monthly income is mainly earned from farm production and is insufficient for most households to enable them acquire enough and stable food.

The emerging food security strategies that households embraced to address sustainable food security in Homa Bay County were not new. Most of these strategies have been adopted elsewhere. These strategies included input price subsidy, agricultural extension services, national and county government support such as cash transfers, post-harvest food processing, formation of groups, new agricultural technologies like improved crop

and livestock varieties, irrigation facilities and infrastructural development. Different food security strategies employed in different regions of Homa Bay County had varying effects on food security. Fertilizer/ certified seeds price subsidy program is shown to have the greatest effect on food security. Some of the effects of the food security strategies include increased production activities, reduced post-harvest losses, increased outputs, adoption of better technology and production practices and it also enhanced the links that promoted farmers to earn more income.

The study concluded that the emerging strategies significantly affected sustainable food security in the study area. Some of the analyzed variables were statistically significant in determining sustainable food security in Homa Bay County thus this study rejected the null hypothesis that the analyzed emerging food security strategies had no significant effects on sustainable food security in the study area. Fertilizer/ seed price subsidy, asset endowments and household income were statistically significant at 99% confidence level. Membership to groups and access to markets were significant at 95% level.

The study findings revealed a number of challenges that farmers in the region encountered in curbing the food insecurity challenge. For example, the distance to major transport infrastructure like roads and markets is long leading to post harvest losses. Other challenges include limited extension services, limited land for cultivation, inadequate capital, and lack of skills, pests and diseases, lack of irrigation schemes and high cost of inputs. The study concluded that Homa Bay County can be food secure if these challenges are eliminated or minimized.

5.3 Recommendation

Based on above findings and discussions on the emerging strategies towards sustainable food security, this study recommends the following:

- i. The study area being highly food insecure requires urgent action to improve food security. Majority (72.4%) of households were found to be food insecure. The County and national governments should address the causes of food insecurity through promotion of strategies such as improved access to credit, use of irrigation, crop and livestock diversification known to positively improve agricultural production. Food security can also be improved through improved incomes. Improved household can be achieved through cash transfer to vulnerable groups but there is need to review the amounts and reliability of the cash transfer system.
- ii. The County Government should promote strategies identified and preferred by households in optimizing sustainable food security. The preferred strategies include membership to groups, access to information, extension services, fertilizer/seed prices subsidy that were ranked high.
- iii. There is need for National and County governments as well as development agencies to lobby and promote emerging strategies found to statistically affect sustainable food security in this study. Institutional support is needed to help farmers in order to avoid cases of food shortage. This can be achieved through subsidized fertilizer and certified seeds prices, and through improved access to markets. Job creation activities through industrial development will go a long way in improving farmer's incomes and resource endowments which were found to be significant in determining sustainable food security in this study.

- iv. On challenges affecting food security there is need for households to practice mixed crop farming to address the problem of limited land. Returns to agricultural production should be addressed through input subsidy and improved agricultural produce prices in order to release labor into farming. The County's infrastructure needs urgent improvement to enhance movement of goods and services from different parts of Homa Bay County and to increase access to markets. Proper and more storage facilities need to be established in order to ensure households remain food secure by reducing on post-harvest losses and to reduce exploitation by middlemen.

5.4 Areas of Further Research

Further research should be done to analyze the effectiveness of the identified emerging strategies towards sustainable food security in the study area.

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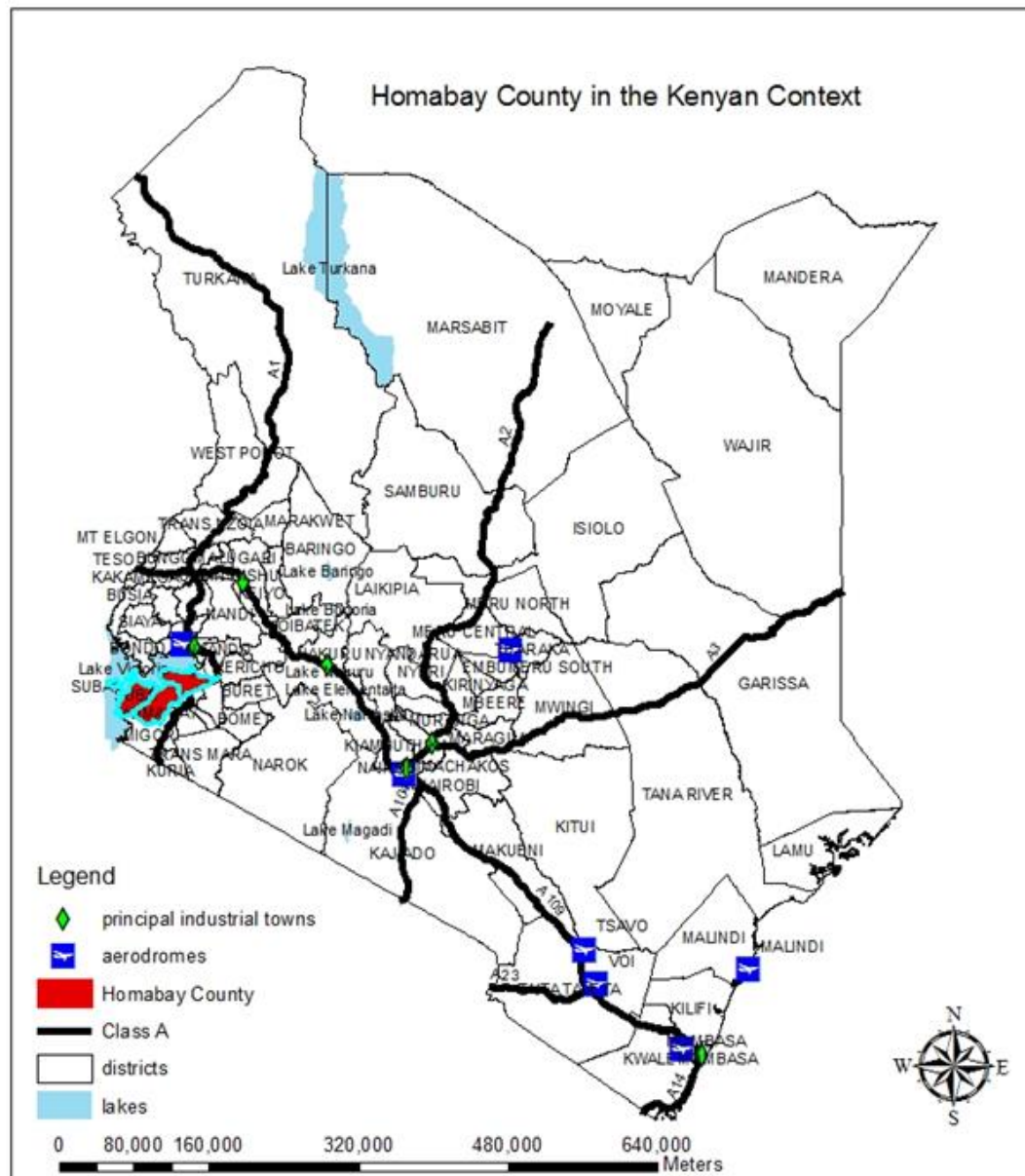
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APPENDICES

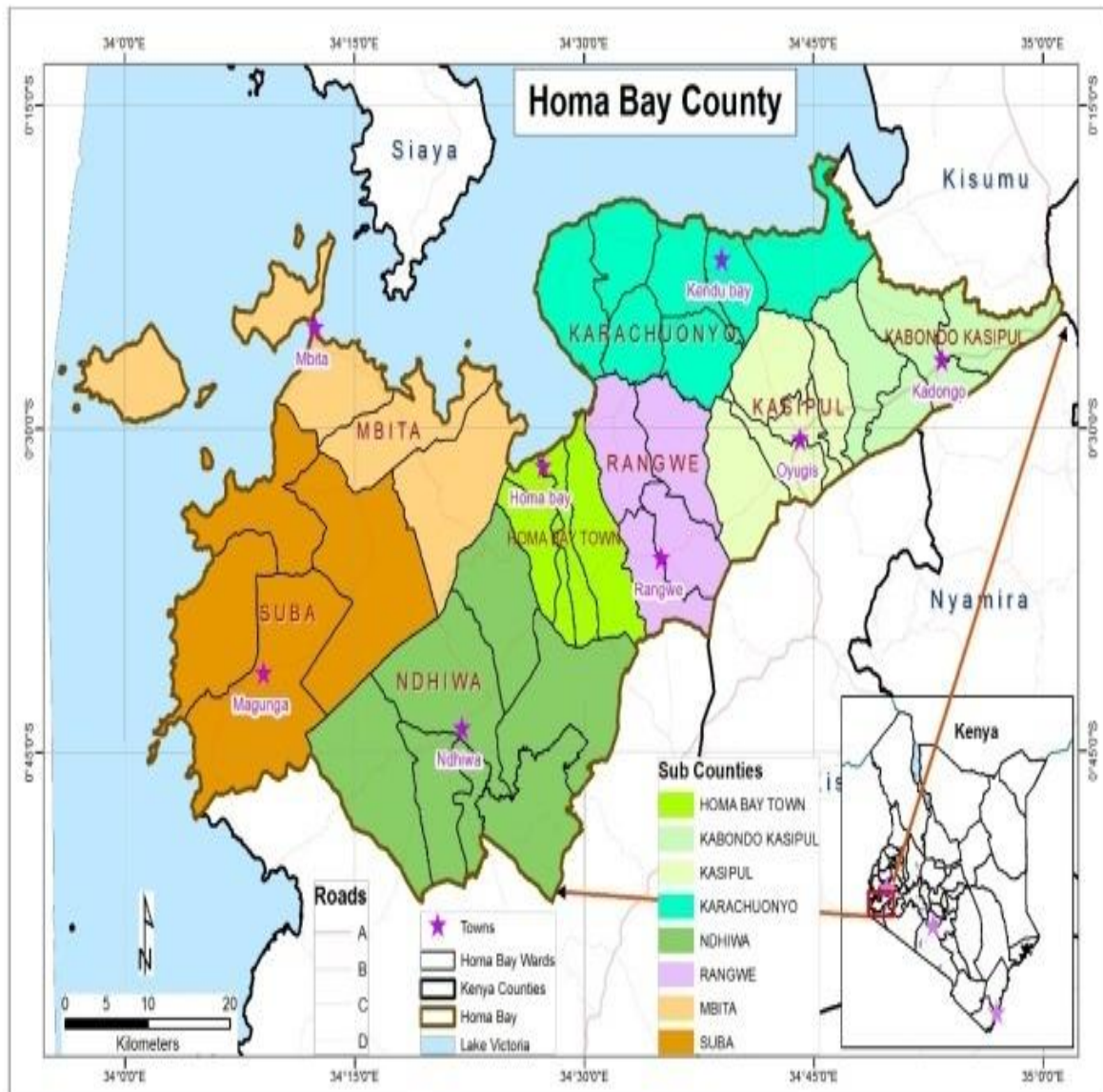
Appendix I: Location of Homa Bay County in the Map of Kenya



Source: Homa-Bay County Integrated Development Plan 2013-2017

https://www.homabay.go.ke/wp-content/uploads/2016/01/CIDP-DOCUMENT-HOMABAY-COUNTY-GOVERNMENT.OCT_.2013.pdf

Appendix II: The Map of Homa Bay County



Source: GoK(2013), [https://www.researchgate.net/figure/Map-of-Homa-Bay-County-](https://www.researchgate.net/figure/Map-of-Homa-Bay-County-Source-GoK-2013_fig1_319644498)

Source-GoK-2013_fig1_319644498

Appendix III: Data Collection Questionnaire

Dear Respondent,

Introductory Information about Researcher

My name is Thomas Odhiambo Bonyo, Registration number SHRD/PGD/02/14. I am a student pursuing a Master's Degree programme in Development Studies in the School of Arts and Social Sciences, Moi University. The research is titled: **Emerging Strategies towards Sustainable Food Security in Homa Bay County, Kenya**. This study is conducted to find out the emerging strategies affecting food security in Homa Bay County. You are requested to be my informant. The information provided will be specifically used for research purposes. The information will be treated with strict confidentiality. The study will fulfill part of the requirements for the award of the master's degree. I would really appreciate if you spare your precious time to respond to this questionnaire. I assure you that the information collected in this study will be used only for purposes of addressing the study objectives. Personal information provided will be treated confidential and will not be divulged for use for unintended purpose. It is hoped that information that come out of this study will contribute to the body of knowledge on food security in Homa Bay County, Kenya.

SECTION A: GENERAL INFORMATION

1. Name of respondent (optional)	
2. Ward	
3. Location	
4. Sub-Location	
5. Sub county	

6. Provide the following detail about the household head

Gender 1=Male, 2=Female	Age (years)	Primary activity	Farming/Fishing experience (years)	Education (Level)

SECTION B: TO EVALUATE FOOD SITUATION IN HOMA BAY COUNTY

- (i) Have you occasionally experienced food shortage in recent past? Yes [] No []
- ii) If no to above question, indicate how you have managed to ensure that your family is food secure _____
- iii) If yes to (i) please tick appropriately below if it applies to your household.
 -Was there ever no food to eat of any kind in your house because of lack of resources to get food? Yes [] No []
 Did you or any household member go to sleep at night hungry because there was not enough food? Yes [] No []
- iv) What do you normally do to at least provide some little food to the family in case of lack _____
- v) Are you engaged in formal employment or in business? Employment []
 Business []
- If formal employment, name the employment and your job group below
 Name of employment _____
- a) If business, what kind of business _____
- b) how many businesses do you handle _____
- c) What is your estimated income per month? (tick)
 Less than Kshs. 5,000 []
 Kshs. 5,000-10,000 [] Kshs. 10,001-30,000 []
 Kshs 30,000-50,000 [] Above 50,000
- d) What is your estimated monthly household income from all sources?
 1. Less than Kshs. 5,000 [] 2. Kshs. 5,000- 20,000 [] Kshs.
 20,001- 40,000 [] 3. Kshs. 40,001- 60,000 [] 4. More than Kshs.
 60,000 []

vi) Indicate the number of household members in the following age groups living with you

Age categories in Years	Males	Females	Total	Number actually working on the farm at least once a week
Less than 20 years				
20 – 50				
51- 70				
Over 70 years				
No. of children in school				

vi) Indicate your income sources and what proportion of total income from each source accounts

Type of earning	Please tick	What is the proportion of total income (%)
Income from farm production (crop produce, milk)		
Employment income		
Income from business		
Income from sale of livestock and other assets e.g. land, vehicle		
Transfer earnings from relatives, sons, daughters etc		
Land rented out income		
Buildings rented out income		
Other structures rented out income		
Motor vehicle rented out income		
Other income		

(vii) Do you practice farming or fishing? Yes [] No [].

If yes, what is your main purpose of farming/ fishing? List main purpose in any or

both a) Farming _____

b) Fishing _____

SECTION C: TO ASSESS STRATEGIES BEING EMPLOYED TOWARDS FOOD SUSTAINABILITY IN THE STUDY AREA.

8 (a) Are you aware of some of the emerging food security strategies? (Tick)

Yes [] No [] do not know [] If yes list them below

(b) What is your opinion of the food security strategies listed above

Food security strategy	Opinion about the food security strategy

(c) Are you aware of the following food security strategies?

(i) Institutional support services including credit facilities, National and County government fishing and agriculture input and output prices support services, extension services, postharvest food processing, cash transfer services Yes [] No [].

(ii) Household head socio-economic factors including age, education level, gender, membership to producer associations or groups Yes [] No [].

(iii) Producer characteristics asset endowment, total land size, proximity to the Lake, farming experience Yes [] No [].

(iv) Infrastructure including road, water and air transport, market infrastructures

(v) New technologies irrigation, machinery, improved crop and livestock varieties, mobile phone technology agricultural advice? Yes [] No [].

If yes to any of the above please indicate on the table on the back page how each of them has benefited the community to address food security in the spaces provided.

d) Are you or any member of your household a member of any group/association or merry go rounds?

If yes, which one? Name the group _____

e) Does membership affect food security? Yes [] No [].

If yes how? _____

SECTION C: TO EXAMINE EFFECTS OF THE EMERGING STRATEGIES ON SUSTAINABLE FOOD SECURITY IN HOMA BAY COUNTY

9) In spaces below indicate the food security strategy that you have benefited from or adopted in your household by ticking in the box

Food Security Strategies	Tick if it applies to you
Credit facilities	
Food price subsidy	
Fertilizer price subsidy	
Extension services	
Postharvest food processing	
National cash transfer to the old (above 70 years) services	
Membership to producer associations or groups	
Asset endowment/ wealth	
Road transport	
Water transport	
Air transport	
Available market infrastructures	
Introduction of irrigation	
Machinery for farming and fishing	
Improved crop	
improved livestock varieties	
Mobile phone technology	

10a. List down four strategies that you have benefited from and has been more effective_____

b. State the outcomes of such strategies that you have experienced as a beneficiary

SECTION D: TO DETERMINE CHALLENGES THAT FACED IN TRYING TO IMPROVE SUSTAINABLE FOOD SECURITY IN THE STUDY AREA

11 a) Do you own any of the following assets?

Asset	Yes	No	Number
Cart			
Vehicle			
Tractor			
Plough			
Wheel barrow			
Hoes/ <i>Jembes</i>			
Machetes/ Pangas/ Slashers			
TV			
Radio			
Bicycle			
Computer			
Mobile phone			
Fishing gear			

bi) Do you experience food shortage or any challenge(s) arising from lacking any of the above asset(s) thereby affecting sustainable food security in your household?

Yes [] No []

ii) If yes, list the challenges

c) Are there challenge(s) associated to owning any of the above assets that contribute to limited food supply for your household members? Yes [] No []

If yes, indicate

12 a) kindly indicate approximate distance to the following in kilometers:

i) Airport.....

ii) Nearest Tarmac road.....

ii) Market.....

b i) Are there challenges that you can associate to distance you travel to the above facilities that affects food security? Yes [] No []

ii) If yes list them

13. Rate the extent to which you consider the following contributing to challenges affecting food security in Homa Bay County

	SA	A	UD	D	SD
Extension services					
Size of land					
Inadequate capital					
Lack of skills					
Pest and diseases					
Lack of irrigation schemes					
High cost of inputs					

Where SA=strongly Agreed, A=Agreed, UD=Undecided, D=Disagreed, SD=Strongly Disagree

14. Please list other food security strategies that you believe has been adopted but failed due to other challenges

15. What measures do you propose that are likely to mitigate on the above challenges affecting sustainable food security in Homa Bay County?_____

Appendix IV: Interview Schedule

Research title: Emerging Strategies towards Sustainable Food Security In Homa Bay County, Kenya.

An interview Schedule used in conducting an interview with Key Informants in Homa Bay County.

- (i) How is the food situation in Homa Bay County?
 - a. Is the region food secure? How available and accessible is food in Homa Bay County
 - b. What are the foods grown in the region for subsistence and commercial purposes?
 - c. Which crops are produced in surplus for export to other counties/countries if any
- (ii) Which strategies are being applied towards sustainable food security in the study area?
 - a. Which among the strategies listed is mostly employed and why?
 - b. What can you comment about national and county government support towards sustainable food security in the region
 - c. How do farmers in the region learn about new food sustainability strategies
 - d. Who are the key partners in strategy formulation and implementation to manage food security in the area?
- (iii) How effective are these strategies towards sustainable food security in the study area?
 - a. Do the strategies employed achieve the desired results?
 - b. Point out instances of the same above

- c. What efforts are in place to ensure strategies employed are effective?
 - d. What are some of the reasons why some strategies may not be effective?
- (iv) What are the challenges faced towards attaining sustainable food security in Homa Bay County?
- a. Which are the common barriers to attainment of food security in the region
 - b. What organizations in the region are in place to assist farmers deal with challenges affecting food security
 - c. Which are the enabler factors to dealing with challenges of attainment of food security
 - d. Comment on overall national and county government efforts to specifically help farmers deal with challenges of attainment of food security

Appendix V: Pearson Correlation Test Coefficient


	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	X ₁₀	X ₁₁	X ₁₂	X ₁₃	X ₁₄	X ₁₅	X ₁₆	X ₁₇	X ₁₈
X ₁	1.00	0.71	0.04	0.02	0.03	0.05	0.12	0.01	0.20	0.30	0.06	0.57	0.53	0.18	0.23	0.41	0.08	0.12
X ₂	0.71	1.00	0.21	0.16	0.04	0.08	0.34	0.01	0.00	0.07	0.28	0.02	0.09	0.45	0.32	0.34	0.47	0.08
X ₃	0.04	0.21	1.00	-0.18	-0.07	0.02	-0.19	-	0.05	0.06	0.05	0.19	0.02	0.07	0.30	0.09	0.11	0.09
X ₄	0.02	0.16	-0.18	1.00	0.02	0.04	0.00	0.04	0.03	0.05	0.20	0.20	0.06	0.30	0.06	0.18	0.07	0.59
X ₅	0.03	0.04	-0.07	0.02	1.00	0.04	0.10	0.06	0.21	0.05	0.81	0.04	0.00	0.05	0.05	0.02	0.06	0.25
X ₆	0.05	0.08	0.02	0.04	0.04	1.00	0.01	0.04	0.05	0.08	0.06	0.09	0.13	0.06	0.06	0.06	0.07	0.30
X ₇	0.12	0.34	-0.19	0.00	0.10	0.01	1.00	0.12	0.05	0.01	0.13	0.09	0.00	0.04	0.08	0.03	0.05	0.06
X ₈	0.01	0.01	-	0.04	0.06	0.04	0.12	1.00	0.41	0.03	0.06	0.08	0.10	0.02	0.34	0.16	0.35	0.02
X ₉	0.20	0.00	0.05	0.03	0.21	0.05	0.05	0.41	1.00	0.12	0.05	0.44	0.04	0.37	0.06	0.03	0.16	0.09
X ₁₀	0.30	0.07	0.06	0.05	0.05	0.08	0.01	0.03	0.12	1.00	0.01	0.03	0.00	0.08	0.05	0.02	0.10	0.16
X ₁₁	0.06	0.28	0.05	0.20	0.81	0.06	0.13	0.06	0.05	0.01	1.00	0.05	0.29	0.12	0.04	0.06	0.08	0.06
X ₁₂	0.57	0.02	0.19	0.20	0.04	0.09	0.09	0.08	0.44	0.03	0.05	1.00	0.12	0.05	0.09	0.12	0.10	0.06
X ₁₃	0.53	0.09	0.02	0.06	0.00	0.13	0.00	0.10	0.04	0.00	0.29	0.12	1.00	0.35	0.01	0.20	0.06	0.09
X ₁₄	0.18	0.45	0.07	0.30	0.05	0.06	0.04	0.02	0.37	0.08	0.12	0.05	0.35	1.00	0.25	0.41	0.03	0.04
X ₁₅	0.23	0.32	0.30	0.06	0.05	0.06	0.08	0.34	0.06	0.05	0.04	0.09	0.01	0.25	1.00	0.16	0.66	0.08
X ₁₆	0.41	0.34	0.09	0.18	0.02	0.06	0.03	0.16	0.03	0.02	0.06	0.12	0.20	0.41	0.16	1.00	0.10	0.19
X ₁₇	0.08	0.47	0.11	0.07	0.06	0.07	0.05	0.35	0.16	0.10	0.08	0.10	0.06	0.03	0.66	0.10	1.00	0.39
X ₁₈	0.12	0.08	0.09	0.59	0.25	0.30	0.06	0.02	0.09	0.16	0.06	0.06	0.09	0.04	0.08	0.19	0.39	1.00


Source: Researcher (2019)

The variables in the paired Pearson correlation test table above are specified as:

X₁= Membership to groups, X₂= Access to information, X₃=Household income, X₄=Extension services, X₅=Fertilizer/seed price subsidy, X₆=Asset endowment, X₇=Cash transfer services, X₈=Food price subsidy, X₉=Access to markets, X₁₀=Improved road network, X₁₁=Improved crop varieties, X₁₂=Improved livestock varieties, X₁₃=Mobile phone technology, X₁₄=Fish cage farming, X₁₅=Post-harvest food processing, X₁₆=Irrigation services, X₁₇=Access to food storage facilities, X₁₈=Subsidized farm machinery

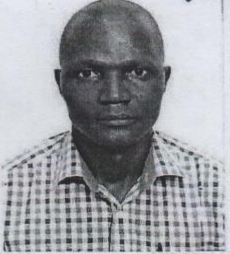
Appendix VI: NACOSTI Research Permit


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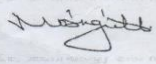
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