DETERMINANTS OF THE IMPLEMENTATION OF SUSTAINABLE FOOD SECURITY PROGRAMMES IN ARID AND SEMI-ARID REGIONS OF KENYA; A CASE OF TANA TIVER COUNTY

BY

ABDIKADIR ADHAN MOHAMMED

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DECLARATION

Student Declaration:

This research report is my original work and has not been presented for an award of masters degree in any other university or institution of higher learning.

Signature…… Date: …….

ABDIKADIR ADAHN MOHAMMED

L50/84612/2016

Approval by Supervisor

This research report has been submitted for examination with my approval as the University supervisor

Signature……. Date: ……

MR JOHNBOSCO KISIMBII

LECTURER; SCHOOL OF OPEN AND DISTANCE LEARNING

UNIVERSITY OF NAIROBI

DEDICATION

This work is a special dedication to my mother Fatuma Nur and my late father Adhan Mohamed who are my motivation towards this study.

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ACRONYMS AND ABBREVIATIONS

AFDB:	African Development Bank.
NGOs:	Non-Governmental Organizations
NDMA	National Drought Management Authority
OECD:	Organization for Economic Cooperation and Development.
SFSP:	Sustainable Food Security Programme
SPSS:	Statistical Package for Social Scientists
UNDP:	United Nations Development programme
USDA:	United States Department of Agriculture
WHO:	World Health Organization
FAO:	Food and Agriculture Organisation
KFSSG:	Kenya Food Security Steering Group
ASALs:	Arid and Semi-arid Lands

ABSTRACT

This study was carried out in order to examine the determinants of the implementation of sustainable food security programmes in arid and semi-arid regions of Kenya. The study was guided by the following four research objectives: to examine the extent to which peace building influences the implementation of sustainable food security programmes in arid and semi-arid regions Kenya; to determine the influence of Education on the implementation of sustainable food security programmes in arid and semi-arid regions of Kenya; to establish the extent to which crop diversification influences the implementation of sustainable food security programmes in arid and semi-arid regions of Kenya; and to assess the extent to which integrated water management influences the implementation of sustainable food security programmes in arid and semi-arid regions of Kenya. This study was guided by two theories i.e the development theory and the post development theory. This study adopted a descriptive survey design. The target population was 46, 123 farmers and 11 employees in the department of agriculture at the county level. In this study, the sample size was calculated by use of the Krejcie and Morgan table of 1970. A sample of 391 was used. The primary data from the field was obtained by use of a questionnaire. Data was analyzed using Statistical Package for Social Sciences (SPSS). The data was analyzed and presented using descriptive statistics such as means and percentages, frequency counts, and standard deviations. The hypothesis (relationship between the various variables) was obtained by use of the Chi-Square. Based on the findings, the research concluded that peace building significantly influences the availability, distribution and production of food thus enhancing food security. When there is peace, communities are engaged in productive activities that can lead to food production thus sustainability of the food security programme. Education is another major factor influencing food security in the county. Well educated individuals are able to use modern methods of food production, add value and use technology which in turn leads to sustainable food security. Crop diversification influences the sustainability of food security programme in the county significantly. This includes growing a variety of crops, intercropping, adoption of hybrid crops and moving to horticultural agriculture. Finally, integrated water management influences the sustainability of food security programme. This includes harvesting water during the rain seasons, using modern technology in irrigation, exploring underground waters and preservation of water catchment areas.

Key words: sustainability, food security, peace building, education, crop diversification, integrated water management

CHAPTER ONE:
INTRODUCTION

1.1 Background of the Study

Programmes that are aimed at ensuring the human race survives on earth have been implemented over a long time; with the Food Security Programme tracing itself to the land of Eden where the first man was compelled to work and produce agriculture related products for his use (Dawson, 2017). According to Paulina (2017), Food Security Programmes are among the first programmes that liberated the world as traced to the agrarian revolution. Paulina (2017) explains that the Agricultural Revolution Programme was a period of technological improvement and increased crop productivity that occurred during the 18th and early 19th centuries in Europe and it is considered as the greatest economic growth and development of today's European countries and its neighbors.

Food and Agriculture Organization (2017) has indicated the importance of food security in the world over almost century ago. According to FAO (2017), food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life. Household food security is the application of this concept to the family level, with individuals within households as the focus of concern. On the other hand, food insecurity exists when people do not have adequate physical, social or economic access to food etc. World Bank (2016) has shown the importance of FSP in the 21st century by indicating that food security is a central indicator of economic development in developing countries in Asia, Africa and South America. In its study that focused on poverty and hunger (issues and options for food security in developing countries), developing countries are performing poorly since most of its population is malnourished, is lacking enough nutrition, is lacking better access to water and other accompaniments that will make it healthy.

USDA (2017) has indicated that, growth in the agriculture sector has been found, on average, to be at least twice as effective in reducing poverty as growth in other sectors. Access to quality, nutritious food is fundamental to human existence. Secure access to

food can produce wide ranging positive impacts, including: economic growth and job creation; poverty reduction; trade opportunities; increased global security and stability; and improved health and healthcare. Therefore USDA (2017) has always emphasized that food security programmes are not only drivers of economic development but drivers of social stability and human health-other drivers of economic development.

In their study that focused on influencing factors of food security in China, Tang, Bai and Tang, (2015) has shown that there are a number of determinants influencing the implementation of food security in the country and these factors have placed the country in a better position of managing its food production for over decades. These factors include: agricultural mechanization, chemical fertilizer, efficient irrigation and food policy. Besides, the agricultural labor force, national financial allocation for agricultural science and technology, rural electricity consumption among others influence the performance of food security in the country. In their study they have indicated that, China's past success in grain self-sufficiency doesn't reflect its future vulnerability to food insecurity since the demand for crops for nonfood use is rising enormously. China is likely to remain self-sufficient in rice and wheat but will continue to be dependent on other countries for soybeans and corn to meet its growing appetite for meat and dairy products. Food and nutrition security scenario can worsen due to demographic pressures coupled with climate change, extreme pollution, diminishing arable land, and depleting aquifers.

FAO (2018) has shown that despite the fact that most African countries are food insecure, there are a number of these countries that have made some progress in achieving food security. For example, Tunisia leads in terms of being food secure in Africa at a rating of 68.2%, followed by Mauritius (67.33%), Morocco (64.38%), Algeria (63.86%), Egypt (60.03%), Gabon (58.81%), South Africa (57.88%), Ghana (53.57%), Senegal (52.16%) and Namibia (51.42%). The above trend is tied to a number of factors that include: political will by governments to prioritize food security, use of new crop and food production technologies. In addition, other factors like crop diversification, use of modern technology in both irrigation and pests and diseases control, use of modern

methods of water management, education and training to the farmers and many more have increased food security in Mauritius and Tunisia.

In east Africa, FAO (2018) has shown that it is one region that rates high in terms of food insecurity. According to the report, factors such as climate change, droughts and frequent floods, diversion of food products for production of bio fuels, piracy, and increasing demand for food products from emerging countrieshave led to sharp increases in the prices of food products in the region; making them uniquely vulnerable to food insecurity. According to Global Action Programme on Food Security (2017), in Uganda for example, a number of factors have posed a lot of threats to this country becoming food insecure. These factors include: limited land mass and population; fragile natural environments and lack of arable land; high vulnerability to climate change, external economic shocks, and natural disasters; typically high dependence on food imports; dependence on only one or two economic pillars; and distance from global markets.

Studies in Kenya have indicated that the country has a very big index of food insecurity despite the fact that there are a number of strategies and advances that have been made to address this issue (FAO, 2018 and KARI, 2017). Kenya Agricultural Research Institute (2017) for example has shown that in the recent decade, and especially starting from 2008, the country has been facing severe food insecurity problems. These are depicted by a high proportion of the population having no access to food in the right amounts and quality. Official estimates indicate over 10 million people are food insecure with majority of them living on food relief. Households are also incurring huge food bills due to the high food prices. Maize being staple food due to the food preferences is in short supply and most households have limited choices of other food stuffs; calling for urgent measures of tackling this problem.

In the marginalized regions like the Kenyan coastal counties and the northeastern part, the situation of food insecurity is worse with over 2.6 million people facing acute food insecurity (NDMA, 2017). According to NDMA (2017), reflecting the substantial decline in food security, the KFSSG short rains assessment that was conducted in 23 counties in January 2017 estimated that a total of 2.6 million people are acutely food insecure and

require urgent humanitarian assistance, mainly in Kenya's pastoral and marginal agricultural areas. This represents an increase in needs by about 100 percent from the last long rains assessment in July 2016.

According to SAID (2017) besides the drought, there are numerous factors leading to food insecurity in Kenya and this has not only started recently but has been a rooted problem in Kenya. The report indicates that the current food insecurity problems are attributed to several factors, including the frequent droughts in most parts of the country, high costs of domestic food production due to high costs of inputs especially fertilizer, displacement of a large number of farmers in the high potential agricultural areas following the post-election violence which occurred in almost election periods, high global food prices and low purchasing power for large proportion of the population due to high level of poverty.

Due to the state of food insecurity in the country, various bodies and government agencies have come up with sustainability strategies to address the issue of food security in the country (NDMA, 2017). A number of these strategies were proposed in the early 2008 when the national drought management authority was formed and placed under the ministry of agriculture. Some of these strategies include: Education strategy; Crop diversification; Tackling climate change; integrated water management strategy; integrated nutrient management strategy; improved varieties and many more. However, despite the fact the government and other agencies have come up with a number of strategies; there still exists challenges since food insecurity is persistent and increases each day in Kenya.

1.2 Statement of the Problem

Studies across the globe have indicated that food security is among the global disasters besides epidemic diseases, terrorism, drug and substances and civil wars (UNDP, 2017).According to WFP (2018), the food strength in the world for over one century now has been on the shrinking trend due to population pressure and climate change. WHO (2017) has shown that food security is not only vital for economic development and stability but also best for the health of a nation. UNDP (2017) has shown that a country

that is food secure achieves better nutrition for its citizens, eliminates unnecessary conflicts like scramble for food production for its individuals, eliminates basic diseases, achieves better manpower for economic development and enjoys more of innovation for economic growth and lifespan lives. Indeed this makes the concept of food security very important in both developed and developing countries.

NDMA (2017) has indicated that despite the fact the Kenyan government through its constitution established the body in 2008 through an act of parliament and allocated it resources, there still exists a downward trend in food security in the country. In fact, the trend of food security in the country is declining each day calling for urgent measures to address the situation. WFP (2017) notes that Kenya has been pumping numerous funds towards drought management, food providence and food security check but its population is getting much more hungry each day than expected. Surely, this calls for an in-depth examination on the strategies employed to curb food insecurity in the country and whether there are other factors that are influencing the poor results achieved in relation to the implementation of food security programmes.

A number of studies that have focused on the topic of food security have shown that there are a number of factors influencing food security. For example, Micheni (2015) did a study on the factors influencing household food security among the pastoral communities: the case of Pokot North District in Kenya and found out that factors like: drought, insecurity, illiteracy; poverty, cultural beliefs and poor market structures influence food security. However, this study focused on food security at household levels and did not tackle the concept of sustainability of the whole process. Furthermore, Pokot north has a very different socio-economic constitution from that of Tana River where the current study is going to be carried out. On the other hand, Kubai (2014) did a study that focused on the factors influencing food security in East Africa; a case of Eastern Africa Farmers Federation and found out that that there is relationship between food security and agricultural resource allocation, agricultural inputs, agricultural credit as well as the agricultural policy implementation. However, he has failed to explain further whether these factors have a direct link to sustainable food security programmes implemented in

East Africa. Secondly, the study addressed areas in east Africa region that have double maxima rainfalls and ranges of rainfall being over 1500mm per annum. The current study shall address some gaps left out by looking at the sustainable food security programmes and the sustainability of the programme in ASALs. It is also worth noting that there is no similar study as this one to be carried out by this researcher that has been carried in this region. The study therefore was carried out to examine the determinants of sustainable food security programme implementation in arid and semi-arid Kenya; a case of Tana River County.

1.3 Purpose of the Study

The purpose of this study was to examine the determinants of the implementation of sustainable food security programmes in arid and semi-arid Regions of Kenya; a case of Tana River County.

1.4 Objectives of the Study

The study was guided by the following four research objectives:

i. To examine the extent to which peace building influences the implementation of sustainable food security programmes in arid and semi-arid Regions of Kenya.
ii. To determine the influence of Education on the implementation of sustainable food security programmes in arid and semi-arid Regions of Kenya.
iii. To establish the extent to which crop diversification influences the implementation of sustainable food security programmes in arid and semi-arid Regions of Kenya.
iv. To assess the extent to which integrated water management influences the implementation of sustainable food security programmes in arid and semi-arid Regions of Kenya.

1.5 Research Questions

The study was guided by the following research questions:

i. What is the extent to which peace building influences the implementation of sustainable food security programmes in arid and semi-arid Regions of Kenya?
ii. What is the influence of Education on the implementation of sustainable food security programmes in arid and semi-arid Regions of Kenya?
iii. What is the extent to which crop diversification influences the implementation of sustainable food security programmes in arid and semi-arid Regions of Kenya?
iv. What is the extent to which integrated water management influences the implementation of sustainable food security programmes in arid and semi-arid Regions of Kenya?

1.6 Research Hypotheses

The study tested the four hypotheses at the 95% level of significance.

i. Ha: Peace building has a significant influence on the implementation of sustainable food security programmes in arid and semi-arid regions of Kenya.
   H_0: Peace building has no significant influence on the implementation of sustainable food security programmes in arid and semi-arid regions of Kenya.
ii. Ha: Education has a significant influence on the implementation of sustainable food security programme in arid and semi-arid regions of Kenya.
   H_0: Education has no significant influence on the implementation of sustainable food security programme in arid and semi-arid regions of Kenya.
iii. Ha: Crop diversification influences the implementation of sustainable food security programmes in arid and semi-arid regions of Kenya significantly.
   H_0: Crop diversification doesn't influence the implementation of sustainable food security programmes in arid and semi-arid regions of Kenya significantly.
iv. Ha: Integrated water management has a significant influence on the implementation of sustainable food security programmes in arid and semi-arid regions of Kenya.
   H_0: Integrated water management has no significant influence on the implementation of sustainable food security programmes in arid and semi-arid regions of Kenya.

1.7 Significance of the Study

This study is expected to benefit the national government by allowing it have the first hand information of the various factors that influence the performance of the food security programmes in the country. The study will specifically give the required information of what needs to be done to ensure food security currently and in the future without interfering with the environment negatively. The Ministry of Agriculture and the NDMA will be able to understand why the food security issue has been deteriorating over time and what needs to be done to address the situation currently without having bad future effects.

The county government can get firsthand information in relation to sustainable food security programme. This information can help the department in charge of Agriculture and Natural Resources Management to come up with measures of addressing food insecurity in the county. Also, the department in charge of Special Programmes can use the report to come up with measures that can address the current situation of food insecurity in the county while taking care of the future situation.

The study will be of beneficial to various NGOs and other bodies that struggle to feed the hungry people in Tana River through relief food to understand some issues that they can address to ensure sustainability of the food security in the county.

Finally the study shall be very important to the farmers and various households since they will get relevant information on some factors they need to consider in food production so that they can achieve sustainability.

1.8 Limitation of the Study

The study faced three limitations. One, the security situation in Tana River County was not all that good and the state of roads was at times impassable. This some extent hindered the movement of the researcher from one point to another to gather information. However the researcher used the local authorities and at times requested protection from the security organs besides using flexible means of transport like the motor bikes and bicycles. The study also faced the challenge of limited time for both research work and

linking with the university supervisor. However, the researcher used the holidays, weekends and any other free time to work on the thesis and reach the supervisor. Finally the researcher was constrained financially. However, this was addressed by requesting for family and friends support.

1.9 Delimitation of the Study

The research delimited itself by concentrating on food security programmes implemented in Tana River County only. The study also delimited itself to the four variables as the basis of questions preparation for data collection. The four variables that appeared in the questionnaires were: peace building, education, crop diversification and integrated water management.

1.10 Basic Assumption of the Study

The study was carried out with an assumption that the four variables outlined in the research objectives influenced the implementation of sustainable food security programmes in the county. This is fact that was proven by the hypotheses tested. It was also carried out with an assumption that there was a well-known food security programme implemented in the county. An assumption that was found to be correct or rather held in the study. Finally the study was carried out with the assumption that the respondents could answer the questions without bias and prejudice; an assumption that held throughout the study.

1.11 Definition of Terms

Crop diversification refers to the concept of cultivating a variety of crops that withstand various given conditions for better food yields currently and the future.

Education refers to the ability of the farmers to be literate in relation to modern technology use, farming methods application and betters trends of value addition to the whole food production process.

Integrated water management refers to wise and controlled use of both underground water and surface water while taking care of its future availability

Peace building refers to brining warring communities or conflict communities or individuals together for a stable environment that is associated with better food production.

Food security refers to the situation that exist when all people at all times have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for active and healthy life.

1.12 Organization of the Study

The study is organized into three chapters. Chapter one is the introduction and consist of background of the study, problem statement, purpose of the study,objectives of the study, research questions, significance of the study, study limitation, delimitation of the study, assumptions of the study and definition of key terms in the study. Chapter two consists of the concept of sustainability of programmes, literature review and theories used in the study. Also it gives the knowledge gap and literature summary. Chapter three stipulates research methodology. This includes the introduction, research design, target population, sampling size and sampling procedure, data collection instrument, reliability and validity, the ethical considerations and data analysis procedure. Chapter four contains the data analysis, interpretation and presentation while chapter five contains the summary of the findings, discussions, conclusions, recommendations and the areas of future study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The chapter outlines the introduction part, the concept of sustainable food security programmes implementation, the literature review, the theories used in the study, the conceptual framework, literature gap and literature summary.

2.2 Sustainable Food Security Programmes Implementation

According to FAO (2017), food security exists when all people at all times have physical, social and economic access to sufficient, safe and nutritious food. Food security is built on four pillars: availability, access, utilization and stability. Food and nutrition security embraces meeting energy, protein and nutrient needs for healthy life. In this case, stability means that the food is available in the right quantities, right qualities, right time and an assurance of it being available in the future without interfering with the biodiversity in what is known as sustainable food production.

OXFAM (2017) defines sustainability in the food area as a food system that supports food security, makes optimal use of natural and human resources and respects biodiversity and ecosystems for present and future generations. Further, sustainable food security is culturally acceptable and accessible, environmentally sound and economically fair and viable, and provides the consumer with nutritionally adequate, safe, healthy and affordable food.

In detailed explanation, World Bank (2017) has indicated that sustainability in relation to food security refers to the concept of implementing food production programmes that ensure the natural resources are utilized to the maximum to produce food that satisfies its population. This food production programmes should ensure that the amount of food produced, the times of production and the qualities are right and they must not interfere with the current natural environment. Besides, they must ensure that this production takes care of the future production and consumption.

According to WHO (2017) for sustainable food security programmes to be implemented in the world effectively, they should embrace the concept of sustainable agriculture. According to FAO (2017) sustainable agriculture is the production of food, fiber, or other plant or animal products using farming techniques that protect the environment, public health, human communities, and animal welfare. The AfDB (2017) adds that most African states have failed to come up with various projects that can feed their growing population due to failure in identifying the gaps that intertwine the concepts of environmental protection, food production, health, socio-economic stability and cultural changes.

According to WFP (2014) due to uncertainties in climate changes, population pressure patterns, urbanisation, technology change and changes in lifestyles across the globe, countries have resorted to food strategies that can address this issue. The strategies have not only been founded on grounds of meeting the current demands but also taking care of the future demands without destroying any of the available channels of production; in what is referred to as sustainability in agriculture. Roberto (2014) notes that, to meet the global food human needs by 2050, the world's agricultural system must simultaneously produce far more food for a growing population provide economic opportunities for the rural poor who depend on agriculture for their livelihoods, and reduce environmental impacts. The concept here thus calls for the knowledge, understanding and integration of sustainability idea in food production.

2.2.1 Peace Building and implementation of Sustainable Food Security Programmes

Studies by various bodies and scholars have documented substantial evidence that conflicts, wars and misunderstands between countries, individual communities and regional blocks has a very sphere negative effects on food security (AfDB, 2017). According to WFP (2015), the effects may be minor, as when spontaneous protest demonstrations over rising food prices take place in or around food markets and disrupt or close down vendors' operations. At the other extreme, there are food wars—"a concept which includes the use of hunger as a weapon in active conflict and the food insecurity

that accompanies and follows as a consequence," according to Ellen Messer et al. (2000), such wars affected nearly 24 million people in 28 countries in 2000.

Emmy (2017) has shown that peace and stability is a cornerstone of sustainable food security. In this study that was carried out in 3 countries (Syria, Somalia and Southern Sudan), food availability and distribution greatly depend on the availability of peace. She has indicated further that, conflict negatively affects all four dimensions of food security: availability, access, utilization, and stability. This is echoed by UNICEF (2016) report which noted that Southern Sudan's conflict, which broke out in 2014, presents an enduring case of a food war, with estimates that over 7.7 million people are currently experiencing direct effects of the conflict. Sudan political analyst Alex de Waal (2004) describes the approach used by the government of Sudan in responding to the demands of rebellious groups as counter-insurgency on the cheap-famine and scorched earth their weapons of choice

USAID (2017) on its study that focused on conflict assessment framework and food security in developing countries in Asia and Middle East, peace, reconciliation and understanding influences the sustainability of food security programmes. According to the regression analysis that was carried out in this study, there was noted a very strong correlation between the peace and reconciliation indicators influencing food security and the whole process of sustainable food security. The study found out that conflict reduces the availability of food (Food availability, one of the four dimensions of food security, is affected by conflict, even when the duration of conflict is relatively short);conflict impairs the effective utilization of food (The effective utilization of food is a measure of how well food supplies accessible to consumers are used to promote their health and productivity); and Conflict Increases Uncertainty Regarding Food Availability, Access, and Utilization (Conflict by definition involves social, economic, and political instability. The impact of such instability on households varies, but there is evidence that the fourth dimension of food security-predictability, stability, certainty is strongly affected by conflict. Conflict-related uncertainty affects the decisions made by farming and rural populations about whether to invest resources in future agricultural production and risk its loss or to flee with no assurance of future supplies).

In Ethiopia, USAID Ethiopia (2015) did a study and found out that; first, conflict disrupts production. Hostilities, especially armed hostilities, prevent normal farming, fishing, and herding operations from being carried out. For the millions of poor households whose principal source of income and much of their food supply is derived from agricultural production, conflict can inflict significant damage to livelihoods and food security. Second, conflict disrupts flow of food. Conflict reduces physical security, even for people not directly engaged as combatants or victims of violence. This insecurity disrupts normal commerce, directly reducing flow of food through market channels, as marketing agents face high risks of loss through theft and high cost if they try to protect their stocks. Further, international humanitarian organizations are only too aware that, since food is a valuable commodity in a resource-constrained environment, supplies of food readily become targets for competing parties, and food assistance pipelines are adjusted accordingly.

Similarly, Micheni (2015) did a study that focused on factors influencing household food security among the pastoral communities: the case of Pokot North District in Kenya and found out that peace, security and stable society influences food security programmes sustainability significantly. According to him, some of the negative effects of wars and instabilities in communities in relation to sustainable food security include: the pipeline of public and private investments in food production and marketing activities dries up. Governments, either intentionally or because conflict is threatened, divert funds from agricultural development to conflict-related expenditures (e.g., acquiring armaments and financing military operations); and conflict results in outright loss through the destruction of food and food-producing assets. Production equipment, animals, seed supplies, and food stocks are often casualties of conflict, deliberately destroyed by competing factions. Such destruction reduces food availability in the short term, but it also prevents a resumption of productive activities and recovery of livelihoods in post-conflict periods.

2.2.2The Influence of Education on the implementation of Sustainable Food Security Programmes

Role of education in improving farm efficiency and technology adoption has been well established. As agriculture transformed from subsistence to commercial level, farmers seek information on a wide range of issues to acquire knowledge or upgrade their skills and entrepreneurial ability. Literacy emerges as an important source of growth in adoption of technology, and use of modern inputs like fertilizers and machines. An educated workforce makes it easier to train and acquire new skills and technologies required for productivity growth. Thus, contribution of literacy will be substantial on yielding growth and domestic supply of food (Mohd, 2016).

Emmy (2017) argues that education is the sphere of all economic and sustainable development. It's more of the back bone of all the development agendas in the world. In agricultural sustainability, education makes the producers, distributors and users knowledgeable on what they need for the whole system to be sustainable. Education equips the farmers with the best farming methods, pests and diseases control, best storage methods, best distribution methods, best value addition methods and many others that lead to sustainable food production.

Roberto (2014) found out that education in food production, distribution and sustainability is very vital. According to his studies, education equips the relevant stakeholders on the best farming inputs, farming methods, breeds, channels of distribution and even the future trends in food production; leading to sustainability. OXFAM (2017) adds that besides its role in enabling the farmers become knowledgeable of the tools and farm inputs to use, education can help farmers to understand the climatic patterns of a place and clearly predict the best kind of farming to be practised during various sessions for better yields.

Kubai (2014) did a study and found that education has a very significant role in food security sustainability. He notes that education equips the producers with best production processes and relevant foods production, it equips the middlemen and value addition agencies with the best methods of value addition and best channels of food distribution,

and it determines the trends of the consumers and gives the future projections and trends in food consumption. The WB (2017) has indicated that if sustainability in agriculture has to be achieved in Africa, education must be core. According to the study, education helps the farmers to understand the various ways of managing their water systems, use of adaptable crops and animals, use technology in pests and diseases control besides production, education will help them in understanding how to manage their environment for future production and many more.

2.2.3 Crop Diversification and implementation of Sustainable Food Security Programmes

Studies carried out by a number of bodies and scholars have a common agreement that diversification of crops and other agricultural produce will lead to food sufficiency in the world. In his study that focused on the 10 key steps towards sustainable food production in India, Mohd (2016) argues that, food availability is a necessary condition for food security. India is more or less self-sufficient in cereals but has deficit in pulses and oilseeds. Due to changes in consumption patterns, demand for fruits, vegetables, dairy, meat, poultry, and fishery products has been increasing. There is a need to increase crop diversification and improve allied activities to produce such crops that produces in which we are deficient.

According to the report published by FAO (2014) in Latin America, crop diversification is the only strategy that can be applied in the urban or the rural agricultural zones to ensure sustainable nutrition and diets. In Haiti, Peru and Venezuela for example, FAO's Plant Production and Protection Division (AGP) works to strengthen global food security by promoting sustainable crop production intensification (SCPI), which aims at producing more from the same area of land while conserving resources, reducing negative impacts on the environment and enhancing natural capital and the flow of ecosystem services. Besides, AGP also supports crop diversification for sustainable diets, nutritional health and income generation, and supports the global food economy through the implementation of international treaties.

Piñeiro, Bianchi and Trucco (2016) have noted that the food production in the world since 2008 has been on the declining trend at alarming rates despite the fact that the population of the world has been on the increasing trend; demanding for more food. In their study that was carried out in 5 countries from the Latin America, it was found out that policies like the introduction of variety crops and even animal species shall ensure food security in the region. According to them, food security policies and measures should ensure that farmers move from grains cultivation and integrate other foods like the horticultural foods, traditional foods and other crop species that are both resistant to pests, diseases and extreme weather conditions.

According to USAID Ethiopia (2015), Ethiopia is among the countries that have been facing famine and lack of food since the start of the millennium due to two major reasons. One of them is the poor policies that link urbanisation and food production and two; over-reliance in the cereals by both the local population and the urban population. Due to climate change, the cereals (rice) production has been shrinking each year as the population continues to grow; making the country very insecure in terms of food production. The country has been pushed by bodies like the USAID and WFP to adopt other types of crops and even animal species yield more and are adaptable to the changes in climate. These have led to a series of regional workshops today in Ethiopia to promote and support implementation of fruit and vegetable programmes at national or sub-national level in developing countries.

Stefania (2015) did a study on the influence of crop diversification and the sustainability of food production in Tanzania and found out that there is a positive and significant effect of crop diversification on long-term food security and child nutritional status, in particular for very young children and children living in households with limited market access. She has also concluded that crop diversification is important since it ensures food security, nutrition and health in Tanzania; it secures source of income, employment and high value products; and it resilience of farming systems and environmental services.

Paula and Chen (2015) did a study on the effect of agricultural diversification and commercialization on the anthropometric outcomes of children: evidence from Tanzania

and other 10 countries- Kenya included. In the study, using household data from Guatemala, Philippines, Kenya, Rwanda, Malawi and Gambia, New Guinea, Rwanda, Sierra Leone, and Zambia, they found out that crop diversification have a significant influence on food and nutrition in these countries. Crop diversification in the study included the cultivation of fruits, vegetables, intercropping, mixed cropping, adoption climate resilient crops and growing of a variety of cereals as opposed to dependence on maize and rice. World Bank (2016) did a study in western Kenya and the general conclusion from this study was that, diversification is an inevitable strategic action for smallholder farmers in order to reduce those risks associated to the mono-cropping system, whilst increasing food security and ultimately improving people's standard of living.

2.2.4 Integrated Water Management and its Influence on Sustainable Food Security Programme

A study by Mohd (2016) has shown that India needs to produce more crops per unit of land and water resources. Alarming rates of groundwater depletions and increasing environmental and social problems pose acute threats to mankind. Improved management of irrigation water is essential in enhancing production and productivity, food security and poverty alleviation. Agriculture is the biggest user of water accounting for over 80 percent of the water withdrawals. There are pressures for diverting water from agriculture to other sectors. It has been projected that availability of water for agriculture use in India may be reduced by 21 percent by 2020, resulting in drop of yields, especially rice, leading to price rise and threat to food security of the poor. The needs of other sectors for water cannot be ignored. As a result, it is necessary that an integrated water use policy is formulated and judiciously implemented. Modern methods of irrigation like sprinkler, drip irrigation, fertigation, among other water efficient tools need to be adopted on larger scale.

According to Bindraa et al (2017) on their study on sustainable integrated water resources management for energy production and food security in Libya, water management influences sustainable food production leading to food security in the country. The study

added that water planning, policies for water conservation, water recycling, water harvesting, technology use in water management and many other initiatives influence the water amounts that have a direct influence on sustainable food security. A similar study by the World Bank (2016) has shown that the country was better placed in terms of feeding its people before the uprising of the Arab spring wars. Some of the reasons why the country was doing well are its ability to manage both its underground and service waters well.

OECD (2017) has shown key policies measures among its member states that influence the sustainability of food security programmes and these are purely tied to effective use and management of its waters. The policies include; to Recognise the complexity and diversity of managing water resources in agriculture; Strengthen institutions and property rights for water management in agriculture; Ensure charges for water supplied to agriculture at least reflect full supply costs; Improve policy integration between agriculture, water, energy and environment policies; Address knowledge and information deficiencies to better guide water resource management; and Balance consumptive water uses across the economy with environmental needs.

Sirega (2017) notes that adoption of water irrigation efficient methods such as basin or Zypit and terraces promotes livelihoods and food production. Besides, sustainable best practices that include conservation of riparian land, construction of the rain water harvesting structures and local conservation techniques such as the construction of terraces help in increasing food production and livelihood of local communities. Equally, World Bank (2016) notes that, water scarcity has a huge impact on food production in most parts of Kenya like Kisumu, Siaya, Migori and parts of western Kenya. Without water people do not have a means of watering their crops and, therefore, to provide food for the fast growing population. Agriculture is constantly competing with domestic, industrial and environmental uses for a scarce water supply. The Government should purpose to supply all homes in the study areas and other affected areas with basic water requirement for preserving human survival and well-being.

World Bank; CIAT (2015) did a study and focused on climate-smartness categories and sub-categories that influence food sustainability. Climate smartness in sustainable agriculture that is closely tied to water management, allows reduction in the volume of water consumption per unit of product (food) (l/kg/ha, l/ha etc.), enhances water quality available for agricultural production (by reducing chemicals, sediments, metals in the water bodies), enhances water and moisture retention in soils (mm/m, %), promotes protection/ conservation of hydric sources (especially headwaters), and promotes water capture/ use of rainwater for agricultural production. Therefore, water management should be adopted for better agriculture production. Water harvesting for irrigation, livestock and human use is another area of integrated water management for use in agricultural production in Kenya according to FAO (2017). FAO has assisted the Government in developing an investment proposal for the construction and/or rehabilitation of 600 major water storage structures within the country which could potentially transform agricultural development.

2.3 Theoretical Framework

This study shall be guided by two theories i.e. the development theory and the post development theory

2.3.1 Development Theory

For one to understand the development theory, it is prudent to define development. Development means different things to different people in different places (OECD, 2107), and it represents an improvement of people's everyday lives. An improvement to something better than the current situation, either it is technological, social, cultural political and/or economic. By this, development means, "changing the world to the better" (WB, 2016), and is often changes that start at the bottom rather than the top of the bureaucracy. When development is used as a term in the study, the main approach is poverty reduction and increasing poor people's livelihoods.

According to Karplus (2014), for sustainable livelihoods and healthy families, the development theories were developed immediately after World War II. According to him, development theories are sets of propositions that are applied in the explanation of how

development has taken place in the past and in the explanation of how to create development in the future. According to Chant and McIlwaine (2009), there is no just one single definition of development, and there is no just one theory trying to explain it. Development theory is a suggestion of what development should imply. Historically there have been several different theories trying to create and explain development. The two main meta- theories explaining the world are modernisation- and dependency theory. The former is a theory that believes development is an irreversible and positive process that eventually all societies will pass through. The intellectual roots lies in the nineteenth century sociologists such as Max Weber and Emilie Durkheim, who both drew on Darwin's evolution theory in their explanation of the transition of societies from 'traditional' to 'modern' economies. The latter grew forward as a critique to the modernisation theory and the fact that Europe was used as a model on how to create development in developing countries.

The dependency theory argues that the widespread poverty in developing countries is a result of an exploitative attitude among industrialised countries. Scholars, such as Andre Günder Frank and Paul Baran, who supports the dependency theory, argue that the growth of Europe and other developed countries was only possible because of active underdevelopment of developing countries through active exploitation. Today's developing countries have a different starting point for creating development than developed countries had (Chant and McIlwaine, 2009).

In the 1980s the neoliberal approach quickly became the most accepted approach towards development. The major institutions such the World Bank, the International Monetary Fund (IMF) and World Trade Organisation (WTO), all institutions with severe power in shaping the world, adopted the neoliberalism in one way or another. The principle of neoliberalism is deregulation of markets, comparative advantage and the promotion of free trade, which some would argue is partly the reason why the gap between developed and developing countries have become this large, due to the unequal power relationship (Chant and McIlwaine, 2009). As a reaction to the neoliberalism, the 15 post-development strategies grew forward, a critique to the standards assumptions about development and progress. This approach sees the perspective of developing regions, and

argues against the modernisation idea, supports a pro-poor growth, focusing on development from below and is approaching development on a more individualistic way, where the different countries' needs are set first and it is not used a universal development strategy. This is a very recognized approach toady in the development debate, and has in a larger extent been adopted by the major global policy actors in dealing with poverty; one of which is manifested in food insecurity.

2.3.2 Post Development Theory

Post-development theory argues that development theory and the practice of Post-World War II development projects have failed because the entire concept of development is a Western, non-universal measure of progress. Indeed, examples of failed development interventions abound from around the world. While development experts argue amongst themselves about how best to deliver development interventions in order to minimize the failures of development, post-development theorists believe that no amount of tweaking will make the development agenda a success. They argue that the problem with development is not about how it is implemented, but rather that development itself is a flawed concept which should be eliminated from the discourse on human progress (Karplus, 2014).

The term development encompasses a broad range of ideas, services, and goals. One such development goal is food security. From a post-development perspective, problems of food security are not properly addressed by the current development discourse and practice. Post-development theorists have argued that studies of famine and poverty are incorrectly depoliticized by development organizations. They argue instead that food security is inherently political and that there is a distinct disarticulation between agencies delivering food aid and food security services and the politics of food in recipient countries. A post-development analysis of food security interventions can identify problems with the development agenda as well as offer alternatives to development as potential solutions to food insecurity. This paper will use a post-development perspective to answer the question; do development practices adequately address issues of food security (Karplus, 2014).

2.4 Conceptual Framework

In this study, a conceptual framework has been included to show the relationship between the dependent variables and the independent variable, as shown in the figure 1 below. Also included are the intervening variables (variables that have some influence on the dependent variable but have not been included in the study).

Figure 2.1: Conceptual Framework

Independent Variables

Peace Building

- Hostilities between communities
- Understand between communities
- Conflicts between communities
- Shared resources of production between communities
- Tolerance between communities
- Communal wars

Education

- Extension education
- Education on modern farming methods
- Education on better farm inputs
- Education on modern farming technology
- Education on value addition
- Knowledge on food distribution
- Knowledge on consumption patterns
- Knowledge on climate change

Crop Diversification

- Horticulture farming-fruits and vegetables
- Intercropping and mixed farming
- Drought resistant crops
- Traditional foods cultivation
- Hybrid crops cultivation
- Cereals varieties

Integrated Water Management

- Modern water harvesting
- Modern technology in irrigation
- Controlled exploitation of underground water
- Water catchment areas conservation
- Water treatment and recycling
- Controlled industrial and domestic water use

Dependent

Sustainable food security programme implementation

- Sufficient food supply
- Assured future food production
- Hunger and malnutrition
- Food prices

- **Climate change**
- **Technology adoption**
- **Agricultural research**

2.5 Knowledge gap

Table 2.1 Research Knowledge Gap

	Researcher	**Focus**	**Finding**	**Knowledge gap**
i	Micheni (2015)	Factors influencing household food security among the pastoral communities: the case of Pokot North District in Kenya	Security is very vital in ensuring food security at the household levels.	However, this study has failed to link security and sustainability in food security. Besides, the study has only addressed food at the household level and has failed to identify the gaps that face sustainability of food security programme. This study shall address this gap by examining the various issues surrounding sustainable implementation of food security both at the household levels and the national level.
ii	Kubai (2014)	Factors influencing food security in East Africa; a case of Eastern Africa Farmers Federation	Levels of education of the farmers and their knowledge on the varieties of crops influence food security in East Africa.	However, this study has failed to explain further how these two mentioned factors influence the sustainability of the food security programme in these changing times. Besides, the study was carried out in four major zones with modified equatorial climate that has high amounts of rainfall every year. This study shall give detailed explanation on how such factors influence sustainable food security and the study also shall be carried out in arid and semi-arid Kenya that has low

				unreliable rainfall.
iii	FAO (2016)	Determinants food security programme implementation in western Kenya	Water management has a direct influence on crop cultivation and food security.	However, this study failed to address other components of integrated water management like use of modern technology in water recycling, water reservation and water harvesting. The current study shall explore the influence of integrated water management in the implementation of sustainable food security programme
iv	Stefania (2015)	The influence of crop diversification and the sustainability of food production in Tanzania	There is a positive and significant effect of crop diversification on long-term food security	The study has not focused on food security from the children nutrition point and has failed to examine the food security programme as a whole. Also the study has been carried out in Tanzania. This current study shall focus food security as a whole programme and it shall focus its efforts in Kenya's ASALs with very different socio-economic characteristics.

2.6 Summary of the chapter

In a summary, the study has shown that the concept of sustainability in agriculture is very well comprehended across the globe and it is strongly tied to sustainable food security programme being fronted by a number of countries. The study has been guided by two theories (the development theory and post development theory), and it has been concluded by a conceptual framework that has shown the relationship between the various variables (Independents variables, dependent variable and intervening variables).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The section gives the methodology used in the study to gather the primary data. This includes the introduction, research design, target population, sampling size and sampling procedure, data collection instrument, reliability and validity, the ethical considerations and data analysis procedure.

3.2 Research Design

Orodho (2003) describes research design as the scheme, outline, or plan that is used to generate answers to a research problem. This study adopted a descriptive survey design. Descriptive survey design entails an in-depth empirical collection of facts and data about a certain phenomenon. It also describes actions as they are or as they happen rather than manipulation of variables and collects data from a wide/diverse category of respondents. Descriptive survey design was used by the researcher to explore the opinion of the household heads and other bodies dealing with food security on the determinants of sustainable food security in the Tana River County. Mugenda and Mugenda (2003) contend that the purpose of a descriptive research is to describe behaviors and characteristics as they are without interfering with anything.

3.3 Target Population

Kothari (2004) defines a target population as a representation of the members of real set of people, objects or events the researcher or investigator opts to generalize results of the study. In this study, the target population involved the household heads of the families that had been documented by the county ministry of agriculture to have been actively participated in food production and the 11 employees of the county ministry of agriculture only. According to the report in the county headquarters, there were 46, 123 farmers who ranged from small scale to middle scale producers who fed the county (Tana River Department of Agriculture, 2018). The household heads from these farm categories made the target of study population together with the 11 employees in the department at the county level as shown below in table 3.1

Table 3.1: Target Population

Category	N(Population)
Household heads	46 123
County agriculture officers.	11
Total	**46 134**

Source (Tana River Department of Agriculture, 2018)

3.4 Sample Size and Sampling Procedure

A sample can be defined as a representation of the real population of study with similar characteristics and expected responses (Kothari, 2004). According to Mugenda and Mugenda (2003) sampling therefore can be defined a methodical selection of demonstrative cases from the larger population, and its objective is to get precise experimental data at a portion of the cost that it would take to study all probable cases. In this study, the sample size was calculated by use of the Krejcie and Morgan table of 1970 attached as appendix. From the table, when N (target population) is 46 123 and 11, and s (sample size) is picked to be 381 and 10 respectively. This is shown in table 3.2 below:

Table 3.2 Sample Size

Category	N(Population)	s (sample size)
Household heads	46 123	381
County agriculture officers.	11	10
Total	**46 134**	**391**

Sample size source (Krejcie and Morgan Table of 1970)

Therefore, a total sample size of 391 respondents was picked for the study. The sampling procedure involved two categories whereby stratified sampling was applied to group the respondents to their stratum and later on simple random sampling was applied to pick the exact number of respondents as guided by the Krejcie and Morgan sampling table of 1970.

3.5 Data Collection Instruments

Secondary data for this study shall be obtained from the journals, books, website materials, periodicals and other documented literature sources. The primary data from the field shall be obtained by use of a questionnaire. According to Dawson (2002), questionnaires are the best instruments of data collection since they are easy to construct, easy to administer and easy to collect. Also, questionnaires are preferred in social sciences since they are able to exactly extract the required information, attitudes, beliefs and feeling of the various respondents in relation to a given subject of study. The questionnaire shall have two sections with the first one requiring the respondents to give their background information while the second section shall require the respondents to answer various questions in relation to the study objectives. The questions in the questionnaires are structured in relation to the objectives of the study only.

3.5.1Pilot Testing

Since the research instrument had to be tested to ascertain its reliability, a pilot study was carried in the Tana River County. Specific 20 households' heads were approached and requested to fill the questionnaire and they were never considered during the final study. The questionnaire was administered and later re-administered after 2weeks and the results were used to modify the final questionnaire before the actual study was carried out. All the questionnaires were filled and they were used in calculating the Cronbach's alpha that was used to determine the reliability of the research instrument.

3.5.2 Validity of the Instruments

Kothari (2008) define validity as the degree to which an instrument measures what it purports to measure. Both content validity and face validity were checked. In this study content validity was used whereby the researcher subjected the research instrument into

scrutiny by the University supervisor and two other students who were undertaking their PHD course in the same subject (project planning and management) of study in the University of Nairobi, Mombasa campus.

3.5.3 Reliability of the Instruments

Mugenda (2013) define reliability as the extent to which a measurement procedure or technique can be rested upon to secure unswerving outcomes upon recurrent application. In this study, reliability was tested by use of the Cronbach formula whereby the pilot tested questionnaires were subjected to the formula and a correlation alpha obtained. The alpha value of 0.85 was achieved and the instrument was considered reliable. This is considered very good according to Cronbach's recommendations.

3.6 Data Collection Procedure

The researcher defended the research proposal and when he was allowed to go to the field, he obtained a letter of transmittal from the University of Nairobi's postgraduate department for the research. The researcher also obtained a letter of introduction to the households from the Agriculture department in the County and also one from the county commissioner in charge of security due to the security situation in the county. The researcher then trained 4 research assistants who helped in distributing and translating the instrument of research. These research assistants were picked from the local community so that they could easily translate anything not well understood. The researcher together with the research assistants booked appointments with the respondents, dropped the questionnaires and requested for the respondents to answer them so that they could be picked immediately to avoid non-respondents. The exercise was distributed as per the sub counties and took place in two weeks. The county officers were allowed to fill theirs and be picked later.

3.7 Ethical Considerations

The researcher requested the respondents not to use anything that could disclose their identity like their names. The researcher used codes to identify the various questionnaires. The researcher also requested voluntarily participation of the respondents

and assured them that the study was basically academic in nature and had nothing beyond academic use.

3.8 Data Analysis Techniques

The completed questionnaires were sorted out, edited for consistency and completeness before processing responses. After data cleaning, data shall was coded, entered into the computer for analysis. Data was analyzed using Statistical Package for Social Sciences (SPSS). The data was analyzed and presented using descriptive statistics such as means and percentages, frequency counts, and standard deviations. The hypothesis (relationship between the various variables) was obtained by use of the Chi-Square.

3.9 Operationalization of the variables

Table 3.3 Operationalization

Objective	Independent Variable	Indicators	Scale	Types of analysis
To examine the extent to which peace building influences sustainable food security programme implementation in arid and semi-arid Kenya; a case of Tana River County.	**Peace Building**	• Hostilities between communities • Understand between communities • Conflicts between communities • Shared resources of production between communities • Tolerance between communities • Communal wars	Ordinal Scale	Descriptive Statistics
To determine the influence of Education on sustainable food security programme implementation in arid and semi-arid Kenya; a case of Tana River County	**Education**	• Extension education • Education on modern farming methods • Education on better farm inputs • Education on modern farming technology • Education on value addition	Ordinal Scale	Descriptive Statistics

		• Knowledge on food distribution • Knowledge on consumption patterns • Knowledge on climate change		
To establish the extent to which crop diversification influences sustainable food security programme implementation in arid and semi-arid Kenya; a case of Tana River County.	**Crop Diversification**	• Horticulture farming-fruits and vegetables • Intercropping and mixed farming • Drought resistant crops • Traditional foods cultivation • Hybrid crops cultivation • Cereals varieties	Ordinal Scale	Descriptive Statistics
To assess the extent to which integrated water management influences sustainable food security programme implementation in arid and semi-arid Kenya; a case of Tana River County.	**Integrated Water Management**	• Modern water harvesting • Modern technology in irrigation • Controlled exploitation of underground water • Water catchment areas conservation • Water treatment and recycling • Controlled industrial and domestic water use	Ordinal scale	Descriptive Statistics

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATIONS

4.1 Introduction

The chapter represents the data that was collected and analyzed in order to give a clear picture of findings. The data was collected by use of questionnaires that were prepared in relation to the objectives. The chapter has outlined the questionnaire return rate, the questions in relation to the objectives and the tested hypotheses in a summary.

4.2 Questionnaires Return Rate

Out of the allocated 391 questionnaires, a total of 290 questionnaires were filled and returned from the household heads and 10 questionnaires from the county officers which made 76% and 100% response rates as shown in table 4.1 below:

Table 4.1: Return Rate

Respondents	s (sample size)	returned	percent
Household heads	381	290	76%
County agriculture officers.	10	10	100%
Total	391	300	

4.3 Demographic Characteristics of the Respondents

The research targeted the household heads of the county who have been engaged in food production and the county employees who have been advocating for food security programmes. Therefore there basic information was sought for to understand them better. This included the sex, academic achievements, work experience, family size as shown in table 4.2 below:

Table 4.2:Background Information of the Respondents

Bio data	Frequency	Percent
Female	100	33%
Male	200	67%
Total gender	300	100%
Primary level	100	33%
Secondary (O) level education	120	40%
Diploma level	45	15%
University degree	35	11.7%
Post Graduate	00	0%
Total academic qualification	300	100%
Unemployed	180	60%
1-9	30	10%
10-19	30	10%
20-29	45	15%
More than 30	15	5%
Total Work experience	300	100%
1-4 members	60	20%
4-9 members	180	60%
10 -14 members	45	15%
over 15 members	15	5%
Total family members	300	100%

Majority of the respondents in the study were male gender represented by 67% followed by female who scored 33%. Secondary education scored the highest in the study with 40% followed by 33% for the elementary education achievers. Postgraduate did not achieve any response. Majority of the participants did not have formal employment (60%) while those between 20 to 29 years of work experience made the majority of the employed 15%. Finally, majority of the families (60%) had between 4 and 9 members followed by 10 to 14 members.

4.4 How Peace Building Influences Sustainable Food Security Programme Implementation in Arid and Semi-Arid Kenya

In a non-rated question, the researcher asked respondents whether they supported the argument that peace building influences sustainable food security programme implementation in Arid and Semi-Arid Kenya. In the responses, the respondents were asked to give three reasons for their support and the results were as shown in Table 4.3 below

Table 4.3: Peace Building and Food Security Programmes

		Frequency	Percent
	Yes	295	98.0
	No	05	2.0
	Total	300	100.0

These are descriptive results which indicate that a higher percentage of the respondents %=98 supported the idea that peace building influences sustainable food security programme implementation in Arid and Semi-Arid Kenya. The same respondents on average %=95 agreed that when there is peace, equally shared resources and better channels of resolving conflict, community members participate more in production leading to food security in the county.

Also, the researcher required the respondents to rate a number of ideas that were cutting across the peace building and its influence on sustainable food security programme implementation in Arid and Semi-Arid Kenya. The results were interpreted by use of the mean and the standard deviation as shown in table 4.4 below

Table 4.4: Effect of Peace Building on Sustainable Food Security Programme Implementation in Arid and Semi-Arid Kenya

	N	Mean	Standard Deviation
Hostilities between communities influence food production and availability in the county significantly.	300	4.42	0.663
Understand between communities is closely linked to food stability, availability and the general food security in the county	300	4.52	0.767
Conflicts between communities influence the availability, production and the trends of food security in the county	300	4.23	0.987
Peaceful and equally shared resources of production between communities influences sustainable implementation of food security in the county	300	4.67	0.999
Tolerance between communities influences sustainable implementation of food security in the county	300	3.98	1.01
Communal wars influence sustainable implementation of food security in the county significantly	300	4.67	1.09

These are descriptive results which indicate that majority of the respondents agreed with the following factors in consideration in the following ways. They agreed that: hostilities between communities m=4.42; Conflicts between communities m=4.23; and Tolerance between communities m=3.98 influences sustainable implementation of food security in the county. They strongly agreed that: Understand between communities m=4.52; Peaceful and equally shared resources of production between communities m=4.67; and Communal wars m=4.67 influence sustainable implementation of food security programme in the county significantly. Generally, the results indicate the respondents agreed that peace building influences sustainable implementation of food security programme in the county.

Since the direction of influence is not determined as the alternative hypotheses are non-directional, this calls for a single sample two-tailed test computed by use of SPSS.

Because the population mean is unknown, the *t*-test with n-1 degrees of freedom is the most appropriate test. The study assumed a 0.05 level of confidence. As the sample size was larger than 40 and based on the central limit theorem, the sampling distribution of the mean will be approximately normal (after Privitera). Computing the *value:*.

Table 4.5: Hypothesis Results as per Objective One

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	10.060[a]	1	.111		
Continuity Correction[b]	.807	1	.321		
Likelihood Ratio	2.515	1	.061		
Fisher's Exact Test				.306	.105
Linear-by-Linear Association	2.431	1	.164		
N of Valid Cases	**300**				

Results: *p-value*=0.306

Accept H_1Peace building has a significant influence on the implementation of sustainable food security programmes in arid and semi-arid regions of Kenya.

Reject H_0Peace building has no significant influence on the implementation of sustainable food security programmes in arid and semi-arid regions of Kenya.

Since the calculated *p* value of 0.306 was less that 0.5 ($p < 0.5$), at 0.05 confidence level, the alternative hypothesis was accepted and null rejected. Thus, peace building has a significant influence on the implementation of sustainable food security programmes in arid and semi-arid regions of Kenya.

4.5 Influence of Education on Sustainable Food Security Programme Implementation

In a non-rated question, the researcher asked respondents whether they supported the argument that education influences sustainable food security programme implementation in Arid and Semi-Arid Kenya. In the responses, the respondents were asked to give three reasons for their support and the results were as shown in Table 4.6 below

Table 4.6: Education and Food Security Programmes

		Frequency	Percent
	Yes	270	90.0
	No	30	10.0
	Total	300	100.0

These are descriptive results which indicate that a higher percentage of the respondents %=90 supported the idea that education influences sustainable food security programme implementation in Arid and Semi-Arid Kenya. The same percentage of respondents on average agreed that levels of knowledge on modern farming inputs and methods, education on modern technology in farming and farm management influences the implementation of the food security programme in the county.

Also, the researcher required the respondents to rate a number of ideas that were cutting across the education and its influence on sustainable food security programme implementation in Arid and Semi-Arid Kenya. The results were interpreted by use of the mean and the standard deviation as shown in table 4.7 below

Table 4.7: Effect of Education on Sustainable Food Security Programme Implementation in Arid and Semi-Arid Kenya

	N	Mean	Standard Deviation
Level of knowledge (expertise) and education influences sustainable food security implementation in Tana River County.	300	4.55	0.701
Education on modern farming methods influences sustainable food security implementation in Tana River County.	300	4.65	0.777
Education on better farm inputs influences sustainable food security implementation in Tana River County.	300	4.51	0.992
Education on modern farming technology influences sustainable food security implementation in Tana River County.	300	4.71	0.679
Education on value addition influences sustainable food security implementation in Tana River County.	300	4.21	0.781
Knowledge on food distribution influences sustainable food security implementation in Tana River County.	300	4.22	1.21
Knowledge on consumption patterns influences sustainable food security implementation in Tana River County.	300	3.78	0.872
Knowledge on climate change influences sustainable food security implementation in Tana River County.	300	3.56	1.821

These are descriptive results which indicate that majority of the respondents agreed with the following factors in consideration in the following ways. They strongly agreed that: Level of knowledge (expertise) and education m=4.55; Education on modern farming methods m=4.65; Education on better farm inputs m=4.51; and Education on modern farming technology m=4.71 influences sustainable implementation of food security in the county. They agreed that: Education on value addition m=4.21; Knowledge on food distribution m=4.22; Knowledge on consumption patterns m=3.78; and Knowledge on climate change m=3.56 influence sustainable implementation of food security programme in the county significantly. Generally, the results indicate the respondents agreed that education influences sustainable implementation of food security programme in the county.

Since the direction of influence is not determined as the alternative hypotheses are non-directional, this calls for a single sample two-tailed test computed by use of SPSS. Because the population mean is unknown, the *t*-test with n-1 degrees of freedom is the most appropriate test. The study assumed a 0.05 level of confidence. As the sample size was larger than 40 and based on the central limit theorem, the sampling distribution of the mean will be approximately normal (after Privitera). Computing the *value:*.

Table 4.8 Hypothesis Results as per Objective Two

	Value	**df**	**Asymp. Sig. (2-sided)**	**Exact Sig. (2-sided)**	**Exact Sig. (1-sided)**
Pearson Chi-Square	19.120[a]	1	.021		
Continuity Correction[b]	.907	1	.181		
Likelihood Ratio	3.515	1	.071		
Fisher's Exact Test				.216	.225
Linear-by-Linear Association	4.401	1	.194		

N of Valid Cases	**300**

Results: *p-value*=0.216

AcceptH$_1$Education has a significant influence on the implementation of sustainable food security programme in arid and semi-arid regions of Kenya.

Reject H$_0$ Education has no significant influence on the implementation of sustainable food security programme in arid and semi-arid regions of Kenya.

Since the calculated *p* value of 0.216 was less that 0.5 ($p < 0.5$), at 0.05 confidence level, the alternative hypothesis was accepted and null rejected. Thus, education has a significant influence on the implementation of sustainable food security programme in arid and semi-arid regions of Kenya.

In a non-rated question, the researcher asked respondents whether they supported the argument that crop diversification influences sustainable food security programme implementation in Arid and Semi-Arid Kenya. In the responses, the respondents were asked to give three reasons for their support and the results were as shown in Table 4.9 below

Table 4.9: Crop Diversification and Food Security Programmes

	Frequency	**Percent**
Yes	240	80.0
No	60	20.0
Total	300	100.0

These are descriptive results which indicate that a higher percentage of the respondents %=80 supported the idea that crop diversification influences sustainable food security programme implementation in Arid and Semi-Arid Kenya. The same percentage (80%) of respondents on average agreed that growing a variety of crops, growing drought

resistant crops, intercropping and inclusion of hybrid crops influences the implementation of the food security programme in the county.

Also, the researcher required the respondents to rate a number of ideas that were cutting across crop diversification and its influence on sustainable food security programme implementation in Arid and Semi-Arid Kenya. The results were interpreted by use of the mean and the standard deviation as shown in table 4.10 below

Table 4.10: Effect of Crop Diversification on Sustainable Food Security Programme Implementation in Arid and Semi-Arid Kenya

	N	Mean	Standard Deviation
Horticulture farming (fruits and vegetables) has an influence on sustainable food security in the county.	300	3.55	0.811
Intercropping and mixed farming has an influence on food availability, stability; leading to food security	300	3.99	0.997
Drought resistant crops influences food availability and sustainability in the county	300	4.61	0.872
Traditional foods cultivation influences sustainable food security implementation in the county.	300	4.51	0.771
Hybrid crops cultivation influences food security in the county	300	4.55	0.651

These are descriptive results which indicate that majority of the respondents agreed with the following factors in consideration in the following ways. They strongly agreed that: Drought resistant crops m=4.61; Traditional foods cultivation m=4.5; and Hybrid crops cultivation m=4.55 influences sustainable implementation of food security programme in the county. They agreed that: Horticulture farming (fruits and vegetables) m=.3.55; and Intercropping and mixed farming m=3.99 influence sustainable implementation of food

security programme in the county significantly. Generally, the results indicate the respondents agreed that crop diversification influences sustainable implementation of food security in the county.

Since the direction of influence is not determined as the alternative hypotheses are non-directional, this calls for a single sample two-tailed test computed by use of SPSS. Because the population mean is unknown, the *t*-test with n-1 degrees of freedom is the most appropriate test. The study assumed a 0.05 level of confidence. As the sample size was larger than 40 and based on the central limit theorem, the sampling distribution of the mean will be approximately normal (after Privitera). Computing the *value:*.

Table 4.11: Hypothesis Results as per Objective Three

	Value	**df**	**Asymp. Sig. (2-sided)**	**Exact Sig. (2-sided)**	**Exact Sig. (1-sided)**
Pearson Chi-Square	15.001[a]	1	.001		
Continuity Correction[b]	.607	1	.121		
Likelihood Ratio	1.011	1	.051		
Fisher's Exact Test				.006	.201
Linear-by-Linear Association	2.001	1	.154		
N of Valid Cases	**300**				

Results: *p-value*=0.006

Accept H_1Crop diversification influences the implementation of sustainable food security programmes in arid and semi-arid regions of Kenya significantly.

Reject H_0 Crop diversification doesn't influence the implementation of sustainable food security programmes in arid and semi-arid regions of Kenya significantly.

Since the calculated *p* value of 0.006 was less that 0.5 ($p < 0.5$), at 0.05 confidence level, the alternative hypothesis was accepted and null rejected. Thus, crop diversification influences the implementation of sustainable food security programmes in arid and semi-arid regions of Kenya significantly.

4.6 Influence of Integrated Water Management on Sustainable Food Security Programme Implementation

In a non-rated question, the researcher asked respondents whether they supported the argument that crop diversification influences sustainable food security programme implementation in Arid and Semi-Arid Kenya. In the responses, the respondents were asked to give three reasons for their support and the results were as shown in Table 4.12 below

Table 4.12: Integrated Water Management and Food Security Programmes

	Frequency	Percent
Yes	285	95.0
No	15	5.0
Total	300	100.0

These are descriptive results which indicate that a higher percentage of the respondents %=95 supported the idea that integrated water management influences sustainable food security programme implementation in Arid and Semi-Arid Kenya. Over 90 percentage of the respondents on average argued that modern technology use in irrigation, controlled use of the waters and harvesting the rain water influences the implementation of the food security programme in the county.

Also, the researcher required the respondents to rate a number of ideas that were cutting across integrated water management and its influence on sustainable food security

programme implementation in Arid and Semi-Arid Kenya. The results were interpreted by use of the mean and the standard deviation as shown in table 4.13 below

Table 4.13: Effect of Integrated Water Management on Sustainable Food Security Programme Implementation in Arid and Semi-Arid Kenya

	N	Mean	Standard Deviation
Modern water harvesting has an influence on sustainable food security implementation when effectively utilized	300	4.50	0.511
Modern technology in irrigation influences food security and food production	300	4.65	0.767
Controlled exploitation of underground water is linked to sustainable food security implementation in the county	300	4.51	0.772
Water catchment areas conservation has an influence on sustainable food security implementation	300	4.56	0.765
Water treatment and recycling influences sustainable food security implementation in the county	300	3.75	0.551
Controlled industrial and domestic water use influences food security programme implementation in the county	300	3.52	0.662

These are descriptive results which indicate that majority of the respondents agreed with the following factors in consideration in the following ways. They strongly agreed that: Modern water harvesting m=4.50; Modern technology in irrigation m=4.65; Controlled exploitation of underground water m=4.51; and Water catchment areas conservation m=4.56 influences sustainable implementation of food security programme in the county. They agreed that: Water treatment and recycling m=3.75; and Controlled industrial and domestic water use m=3.52 influence sustainable implementation of food security programme in the county significantly. Generally, the results indicate the respondents agreed that integrated water management influences sustainable implementation of food

security programme in the county.

Since the direction of influence is not determined as the alternative hypotheses are non-directional, this calls for a single sample two-tailed test computed by use of SPSS. Because the population mean is unknown, the *t*-test with n-1 degrees of freedom is the most appropriate test. The study assumed a 0.05 level of confidence. As the sample size was larger than 40 and based on the central limit theorem, the sampling distribution of the mean will be approximately normal (after Privitera). Computing the *value:*.

Table 4.14: Hypothesis Results as per Objective Four

	Value	**df**	**Asymp. Sig. (2-sided)**	**Exact Sig. (2-sided)**	**Exact Sig. (1-sided)**
Pearson Chi-Square	14.531[a]	1	.099		
Continuity Correction[b]	.547	1	.199		
Likelihood Ratio	1.331	1	.098		
Fisher's Exact Test				.095	.401
Linear-by-Linear Association	3.031	1	.166		
N of Valid Cases	**300**				

Results: *p-value*=0.095

Accept H_1Integrated water management has a significant influence on the implementation of sustainable food security programmes in arid and semi-arid regions of Kenya,

Reject H_0 Integrated water management has no significant influence on the implementation of sustainable food security programmes in arid and semi-arid regions of Kenya.

Since the calculated *p* value of 0.095 was less that 0.5 ($p < 0.5$), at 0.05 confidence level, the alternative hypothesis was accepted and null rejected. Thus,integrated water management influences the implementation of sustainable food security programmes in arid and semi-arid regions of Kenya significantly.

CHAPTER FIVE:
SUMMARY OF THE RESEARCH FINDINGS, INTERPRETATIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a summary of the findings of the study and interpretation of the data analysis, discussions, conclusions and recommendations based on the findings. Further areas of study are also suggested.

5.2 Summary of the Findings

The purpose of this study was to examine the determinants of the implementation of sustainable food security programmes in arid and semi-arid Regions of Kenya; a case of Tana River County.

The first objective of the study was to examine the extent to which peace building influences the implementation of sustainable food security programmes in arid and semi-arid Regions of Kenya. A higher percentage of the respondents %=98 supported the idea that peace building influences sustainable food security programme implementation in Arid and Semi-Arid Kenya. On average %=95 agreed that when there is peace, equally shared resources and better channels of resolving conflict, community members participate more in production leading to food security in the county. Majority of them also strongly agreed that: Understand between communities m=4.52; Peaceful and equally shared resources of production between communities m=4.67; and Communal wars m=4.67 influence sustainable implementation of food security programme in the county significantly. Since the calculated *p* value of 0.306 was less that 0.5 ($p < 0.5$), at 0.05 confidence level, the alternative hypothesis was accepted and null rejected.

The second objective was to determine the influence of Education on the implementation of sustainable food security programmes in arid and semi-arid Regions of Kenya. A higher percentage of the respondents %=90 supported the idea that education influences sustainable food security programme implementation in Arid and Semi-Arid Kenya. The same percentage of respondents on average agreed that levels of knowledge on modern farming inputs and methods, education on modern technology in farming and farm management influences the implementation of the food security programme in the county. They also strongly agreed that: Level of knowledge (expertise) and education m=4.55; Education on modern farming methods m=4.65; Education on better farm inputs m=4.51; and Education on modern farming technology m=4.71 influences sustainable implementation of food security in the county. Since the calculated *p* value of 0.216 was less that 0.5 ($p < 0.5$), at 0.05 confidence level, the alternative hypothesis was accepted and null rejected.

The third objective was to establish the extent to which crop diversification influences the implementation of sustainable food security programmes in arid and semi-arid Regions of Kenya. A higher percentage of the respondents %=80 supported the idea that crop diversification influences sustainable food security programme implementation in Arid and Semi-Arid Kenya. The same percentage (80%) of respondents on average agreed that growing a variety of crops, growing drought resistant crops, intercropping and inclusion of hybrid crops influences the implementation of the food security programme in the county. They also strongly agreed that: Drought resistant crops m=4.61; Traditional foods cultivation m=4.5; and Hybrid crops cultivation m=4.55 influences sustainable implementation of food security programme in the county. Since the calculated *p* value of 0.006 was less that 0.5 ($p < 0.5$), at 0.05 confidence level, the alternative hypothesis was accepted and null rejected.

The final objective was to assess the extent to which integrated water management influences the implementation of sustainable food security programmes in arid and semi-arid Regions of Kenya. A higher percentage of the respondents %=95 supported the idea

that integrated water management influences sustainable food security programme implementation in Arid and Semi-Arid Kenya. Over 90 percentage of the respondents on average argued that modern technology use in irrigation, controlled use of the waters and harvesting the rain water influences the implementation of the food security programme in the county. They strongly agreed that: Modern water harvesting m=4.50; Modern technology in irrigation m=4.65; Controlled exploitation of underground water m=4.51; and Water catchment areas conservation m=4.56 influences sustainable implementation of food security programme in the county.Since the calculated p value of 0.095 was less that 0.5 ($p < 0.5$), at 0.05 confidence level, the alternative hypothesis was accepted and null rejected.

5.3 Discussions of the Findings

The first objective of the study was to examine the extent to which peace building influences the implementation of sustainable food security programmes. A higher percentage of the respondents %=98 supported the idea that peace building influences sustainable food security programme implementation in Arid and Semi-Arid Kenya. On average %=95 agreed that when there is peace, equally shared resources and better channels of resolving conflict, community members participate more in production leading to food security in the county. Emmy (2017) asserts that peace and stability is a cornerstone of sustainable food security. According to her, food availability and distribution greatly depend on the availability of peace. Further, conflict negatively affects all four dimensions of food security: availability, access, utilization, and stability.

The second objective was to determine the influence of Education on the implementation of sustainable food security programmes in arid and semi-arid Regions of Kenya. A higher percentage of the respondents %=90 supported the idea that education influences sustainable food security programme implementation in Arid and Semi-Arid Kenya. The same percentage of respondents on average agreed that levels of knowledge on modern farming inputs and methods, education on modern technology in farming and farm management influences the implementation of the food security programme in the county. These findings agree with a number of scholars' findings in the literature

reviewed. For example, Roberto (2014) found out that education in food production, distribution and sustainability is very vital. According to his studies, education equips the relevant stakeholders on the best farming inputs, farming methods, breeds, channels of distribution and even the future trends in food production; leading to sustainability.

The third objective was to establish the extent to which crop diversification influences the implementation of sustainable food security programmes in arid and semi-arid Regions of Kenya. a higher percentage of the respondents %=80 supported the idea that crop diversification influences sustainable food security programme implementation in Arid and Semi-Arid Kenya. The same percentage (80%) of respondents on average agreed that growing a variety of crops, growing drought resistant crops, intercropping and inclusion of hybrid crops influences the implementation of the food security programme in the county. According to the report published by FAO (2014) in Latin America, crop diversification is the only strategy that can be applied in the urban or the rural agricultural zones to ensure sustainable nutrition and diets. This means that crop diversification is a sure way of ensuring food security. Also, Stefania (2015) also argues that there is a positive and significant effect of crop diversification on long-term food security and child nutritional status, in particular for very young children and children living in households with limited market access. She has also concluded that crop diversification is important since it ensures food security, nutrition and health in Tanzania; it secures source of income, employment and high value products; and it resilience of farming systems and environmental services.

The final objective was to assess the extent to which integrated water management influences the implementation of sustainable food security programmes in arid and semi-arid Regions of Kenya. A higher percentage of the respondents %=95 supported the idea that integrated water management influences sustainable food security programme implementation in Arid and Semi-Arid Kenya. Over 90 percentage of the respondents on average argued that modern technology use in irrigation, controlled use of the waters and harvesting the rain water influences the implementation of the food security programme

in the county. Bindraa et al (2017) have similar opinion. In their study on sustainable integrated water resources management for energy production and food security in Libya, water management influences sustainable food production leading to food security in the country. The study added that water planning, policies for water conservation, water recycling, water harvesting, technology use in water management and many other initiatives influence the water amounts that have a direct influence on sustainable food security.

5.4 Conclusions

The research concludes that peace building significantly influences the availability, distribution and production of food thus enhancing food security. When there is peace, communities are engaged in productive activities that can lead to food production thus sustainability of the food security programme.

Education is another major factor influencing food security in the county. Well educated individuals are able to use modern methods of food production, add value and use technology which in turn leads to sustainable food security.

Crop diversification influences the sustainability of food security programme in the county significantly. This includes growing a variety of crops, intercropping, adoption of hybrid crops and moving to horticultural agriculture.

Finally, integrated water management influences the sustainability of food security programme. This includes harvesting water during the rain seasons, using modern technology in irrigation, exploring underground waters and preservation of water catchment areas.

5.5 Recommendations

i. The community members should be sensitized on the importance of peace and harmonious living since this is the first step towards food security in any given part of the world.

ii. They should also be exposed to both formal and non-formal education through various programmes that aim at equipping them with information that can help them achieve food security.

iii. The various agencies should invest in advising the farmers on the importance of crop diversification and non-reliance on one type of food crop (maize). They should also invest very much in research and extension so as to come up with a variety of crops that are adapted to the environment and the harsh climate in the region.

iv. Finally, the researcher recommends that the water in the region must be managed properly through well laid policies of water use and preservation. The water catchment areas should be conserved and modern technology should be used to ensure that water is harvested during the rain seasons.

5.6 Suggestions for Further Studies

i. The influence of credit and financing on sustainable food security programme implementation in Arid and Semi-Arid Kenya; a case of Tana River County

ii. Influence of modern farming technology on sustainable food security programme implementation in Arid and Semi-Arid Kenya; a case of Tana River County

iii. Influence of legal frameworks on sustainable food security programme implementation in Arid and Semi-Arid Kenya; a case of Tana River County

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APPENDICES

APPENDIX I: LETTER OF TRANSMITTAL

AbdikadirAdhan
P.O Box 38-70101
Hola.

Dear participant,

My name is Abdikadir Adhan and I am a student undertaking a Master of Arts Degree in Project Planning and Management at the University of Nairobi. To fulfill the completion of this course, I am carrying out a study determinants of food security programme implementation in arid and semi-arid Kenya; a case of Tana River County. Since the matter affects the whole community, I am inviting you to participate in this research study by completing the attached questionnaire.

If you choose to participate in this research, please answer all questions as honestly as possible. Participation is strictly voluntary and you may decline to participate at any time. In order to ensure that all the information will remain confidential, you do not have to include your name. The data collected will be for academic purposes only.

Thank you in advance.

Sincerely

AbdikadirAdhan

0727375610

Email: dhnabdikadir@yahoo.com

APPENDIX II: RESEARCH QUESTIONNAIRE

SECTION ONE: Background Information:

Below are a number of questions that shall target getting your basic information for easy understanding of the respondents the researcher is dealing with. Please read them and tick/ put any mark where necessary.

1. Indicate your gender (sex).

Male [ ]

Female [ ]

2. What are your highest academic qualifications?

Primary level [ ] Secondary (O) level education [ ] Diploma level [ ]
University degree [ ] Post Graduate [ ]

3. Work experience (if employed only)

1-9 [ ],10-19 [ ], 20-29[ ], More than 30 [ ]

4. The number of members in the family

1-4 members [ ] 4-9 members [ ] 10 -14 members [ ] over 15 members [ ]

SECTION TWO: Objective Based Questions

Peace Building and Sustainable Food Security Programme Implementation in Arid and Semi-Arid Kenya

1. In your own views, do you support the idea that peace building influences sustainable food security programme implementation in Arid and Semi-Arid Kenya?

Yes [ ] No [ ]

2. Give 3 reasons for your answer in 1 above

i. **……**

ii. **……**

iii. **……**

3. Indicate the degree to which you are or disagree with the following statements. **Use a scale of 1 to 5, where: 1= strongly disagree, 2= disagree, 3= neutral, 4= agree, and 5= strongly agree (kindly seek clarification where you don't understand)**.

Statement	1	2	3	4	5
Hostilities between communities influence food production and availability in the county significantly.					
Understand between communities is closely linked to food stability, availability and the general food security in the county					
Conflicts between communities influence the availability, production and the trends of food security in the county					
Peaceful and equally shared resources of production between communities influences sustainable implementation of food security in the county					

Tolerance between communities influences sustainable implementation of food security in the county					
Communal wars influence sustainable implementation of food security in the county significantly					

Influence of Education on Sustainable Food Security Programme Implementation

1. Do you support the idea that education influences sustainable food security programme implementation in Tana River County?

2. If yes, support your answer by giving only 2 brief reasons

i. ……..

ii. ……

3. On a like rating scale giving an intensity of 1 to 5 where: 1= strongly disagree, 2= disagree, 3= neutral, 4= agree, and 5= strongly agree, indicate the extent to which you agree or disagree with the following statements

Statement	1	2	3	4	5
Level of knowledge (expertise) and education influences sustainable food security implementation in Tana River County.					
Education on modern farming methods influences sustainable food security implementation in Tana River County.					
Education on better farm inputs influences sustainable food security implementation in Tana River County.					
Education on modern farming technology influences sustainable food security implementation in Tana River County.					
Education on value addition influences sustainable food security implementation in Tana River County.					
Knowledge on food distribution influences sustainable food security implementation in Tana River County.					

Knowledge on consumption patterns influences sustainable food security implementation in Tana River County.					
Knowledge on climate change influences sustainable food security implementation in Tana River County.					

Crop Diversification and Sustainable Food Security Programme Implementation in Arid and Semi-Arid Kenya

1. In your own thinking, do you support the idea that crop diversification influences sustainable food security programme implementation in Tana River County?

Yes [ ]

No [ ]

2. Below are a number of statements in relation to crop diversification and food security programme implementation in Tana River County. On a rating scale of 1-5 where: 1= strongly disagree, 2= disagree, 3= neutral, 4= agree, and 5= strongly agree, indicate the extent to which you agree or disagree with the following statements

	1	2	3	4	5
Horticulture farming (fruits and vegetables) has an influence on sustainable food security in the county.					
Intercropping and mixed farming has an influence on food availability, stability; leading to food security					
Drought resistant crops influences food availability and sustainability in the county					
Traditional foods cultivation influences sustainable food security implementation in the county.					
Hybrid crops cultivation influences food security in the county Cereals varieties cultivation influences food availability and security in the county					

Integrated Water Management Influences Sustainable Food Security Programme Implementation in Arid and Semi-Arid Kenya

1. Do you support the idea that integrated water management influences sustainable food security programme implementation in arid and semi-arid Kenya?

Yes [ ]

No [ ]

2. Support your answer with only 3 examples

i. ……

ii. ……

3. On a rating scale of 1 to 5 where: 1= strongly disagree, 2= disagree, 3= neutral, 4= agree, and 5= strongly agree, indicate the extent to which you agree or disagree with the following statements

Statement	1	2	3	4	5
Modern water harvesting has an influence on sustainable food security implementation when effectively utilized					
Modern technology in irrigation influences food security and food production					
Controlled exploitation of underground water is linked to sustainable food security implementation in the county					
Water catchment areas conservation has an influence on sustainable food security implementation					
Water treatment and recycling influences sustainable food security implementation in the county					
Controlled industrial and domestic water use influences food security programme implementation in the county					

APPENDIX III: Krejcie and Morgan Sampling Table of 1970

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size. *S* is sample size.

Source: Krejcie & Morgan, 1970