Impact of Agricultural Diversification on Food Security among Smallholder Farming Community in Kilifi South Sub-County, Kenya

ABSTRACT

Food security is critical to the economic, social, religious, political and cultural development in Kenya. It is crucial to the attainment of economic growth, poverty reduction and sustainable development. Kilifi Sub-County is food insecure and this is a major hindrance to its rural development strategy. Rainfall unreliability, poor distribution and its erratic nature is major challenge to food security in this Sub-County. Despite past efforts put to increase food agricultural production in the Sub-County, food insecurity continues to be felt. Factors causing food insecurity are not clearly understood. The objective of this study is to: determine the influence of agricultural diversification as a livelihood strategy on food security status in Kilifi Sub-County. The research methodology involved a survey using a standard questionnaire which was administered to a sample size of 384 households selected using systematic random sampling procedure. The main data to be collected are indicators which include food availability and food access. Quantitative research method was used to capture data on agricultural diversification as a livelihood strategy among the smallholder farmers in Kilifi south Sub-County. To further enhance food security and improve food security status in Kilifi South Sub-county, engagement in agricultural diversification activities should be encouraged. The findings of this study would be beneficial to leaders, stakeholders and policy makers in decision making process pertaining suitable interventions in attainment of food security in Kilifi South Sub-county. The data was analyzed using multiple regression to measure the combined contribution of livelihood strategies. The analysis of the influence of agricultural diversification on food security revealed that 19% of the households kept cows, 13% kept sheep, 33% kept goats and 35% kept poultry. Additionally, 62% relied on maize, 9% on cassava, 2% on sorghum, 18% on cowpeas and 9% relied on coconut. The study revealed that the households which kept poultry were 35% food secure and those who planted maize and cowpeas were 62% and 18% food secure respectively. It was recommended that these variables were to be addressed by all stakeholders in order to improve the food security status.

Keywords: Food security; off-farm activities; livelihood strategy; multiple regression; smallholder farmers

1 INTRODUCTION

Agriculture accounts for over 85% of the land cultivated by smallholder farmers in developing countries [1]. A study conducted by [2] reported that despite its importance, the agricultural sector is traditional and subsistence-oriented and it is characterized by poor and declining performance. He further observed that this is attributed by recurrent drought, land degradation, crop and livestock pests and diseases, lack of improved and suitable technologies and poor marketing and service infrastructure. [3] affirmed that farming in developing countries is weather dependent and this brings in price, yield and resource risks. He further reported that these risks influence the production and resource allocation decisions of smallholder farmers. According to him, this is compounded by lack of credit to most of the farming community members in the rural areas. Thus, they are exposed to a variety of risks that include harvest failure due to drought which arise due to climatic variability. A study by [4] observed that due to the risky environment, the smallholder farmers make decisions and employ various risk mitigating strategies.

According to [4], crop diversification is an important effort to increase agricultural production. He further reported that depending on one crop can be disastrous to the smallholder farming community due to slump in the market value of particular crop products which end up reducing their income. Other factors such as unpredictable weather and occurrence of pests could destroy a large part of a crop leaving the farmers counting losses [5]. A study by [2] reported that crop diversification is used in order to reduce income variability. He further observed that it enables farmers to avoid these risks and provides a healthy diet to the family. According to him, the primary objective of crop diversification is to promote food security and this means that smallholder farmers have better diet with carbohydrates, proteins and vitamins while [6] demonstrated that diversification of crops enables the smallholder farmers to increase productivity which results to surpluses that are sold locally. They also reported that diversification of crops also helps the wider community have a greater choice at the market. [2] supported the above argument by stating that crop diversification leads to the local economy being stimulated since the community members can buy locally produced food instead of having to rely on external sources. In this way food security is ensured. According to him, increased family income generated results to other social and environmental benefits and therefore, smallholder farmers are able to send their children to school instead of letting them stay at home. He also reported that crop diversification promotes sustainable development by making smallholder farmers being economically independent.

For the interest of this research, diversification is a response to threats such as risk and climate change. Farmers face risk from bad weather and from fluctuating prices. [7] demonstrated that some crops are more drought resistant than others, but may offer poorer economic returns. According to him, a diversified portfolio of products should ensure that farmers do not suffer greatly when the weather is bad. He also reported that diversification can manage price risk, on the assumption that not all products will suffer low prices at the same time. [8] explains that in contrast, farmers often do the opposite of diversification by planting products that have a high price in one year, only to see the price collapse in the next year as explained by the cobweb theory.

A study by [9] reported that the types of crops that can be grown are affected by changes in temperatures and the length of the growing season. They further stated that, climate change also modifies the availability of water for production. This is experienced in many countries including Kenya where farmers have initiated diversification as a response to climate change.

According to [10], climate variability has negative consequences on agricultural production. He further reported that diversification of crops is a cost-effective method in improving resilience against pests outbreaks and pathogen transmission. A study by [7] demonstrated that the

development of resilient agricultural systems is an essential study because many communities depend on the ecosystem services of such systems for their livelihoods. [10] reported that many agricultural based economies have few livelihood strategies and many smallholder farmers have little capital to invest in expensive coping strategies, which increases the vulnerability of rural agricultural communities to climatic variability.

According to [6] agricultural diversification is enhanced by a functioning biodiversity. They observed that biodiversity enhances ecosystem function because different species perform different roles and therefore occupy different niches. According to them, recognition of biodiversity as an important agent in the maintenance of ecosystem shows its utility in agricultural diversification.

Additionally, [6] reported that the economy of the developing countries is characterized by subsistence mixed farming systems, low agricultural productivity and poor access to major markets. According to them, agricultural production in these countries is characterized by high degree of instability due to unpredictable weather conditions ie erratic and variable rainfall. [2] observed that the unpredictable weather conditions leads to fluctuations in crop yields on one hand and fluctuations in input and output prices on the other. He further argued that agricultural diversification leads to stability of income. Despite past efforts made to improve agricultural production in Kilifi Sub-County by extension officers and community members' participation in farming, poverty and hunger continue to be felt. Unpredictable rainfall patterns and high evaporation rate have resulted into numerous undesirable effects, including frequent crop failure and poor yields, high food commodity prices and famine [11]. Many households in Kilifi Sub-County are characterized by high levels of undernourishment, hunger and lack of education [12]. This means that farmers had to rely on the market purchased food which is not adequate. This is because most of the community members were jobless and thus poor. High food price is a problem of access because community members lack other stable sources of income [13]. Illiteracy led to ignorance of better farming technology. This led to low agricultural production which puts the community in a vicious cycle of poverty. Increased water access and proper farming methods are required in order to improve agricultural production and raise the community members' socio-economic status for sustainable development. Past studies have shown that household characteristics, socio-economic constraints, livelihood resources, livelihood strategies as well as livelihood outcomes determine food security status of communities. These are important at influencing the adoption of agricultural technologies and thus improve the food security status [14]. However, the determinants of food security status in Kilifi Sub-County had not been identified since no study has been done yet. The aim of this study was to bridge this gap. The study investigated whether and how agricultural diversification as a livelihood strategy determined food security status in Kilifi Sub-County. The intervention strategy used was use agricultural diversification. These strategy is also known as coping strategy.

The ability of the farmers to produce enough to ensure household food security depended on the amount and quality of agricultural diversification as a livelihood strategy available to them. This could enhance their production capacity. Assessing the household food security situation could help to identify and understand this basic aspect of well-being of the community members. The study would also help public officials, policy makers, service providers, and the local community at large to assess the changing needs for assistance and the effectiveness of existing programs in the study area. Moreover, determining the food security status of the households at grass root level could provide an indispensable tool for assessment and planning. The result could also be used as an input for researchers involved in similar thematic areas to further knowledge generation in concepts related to food security in drought prone areas of Kenya.

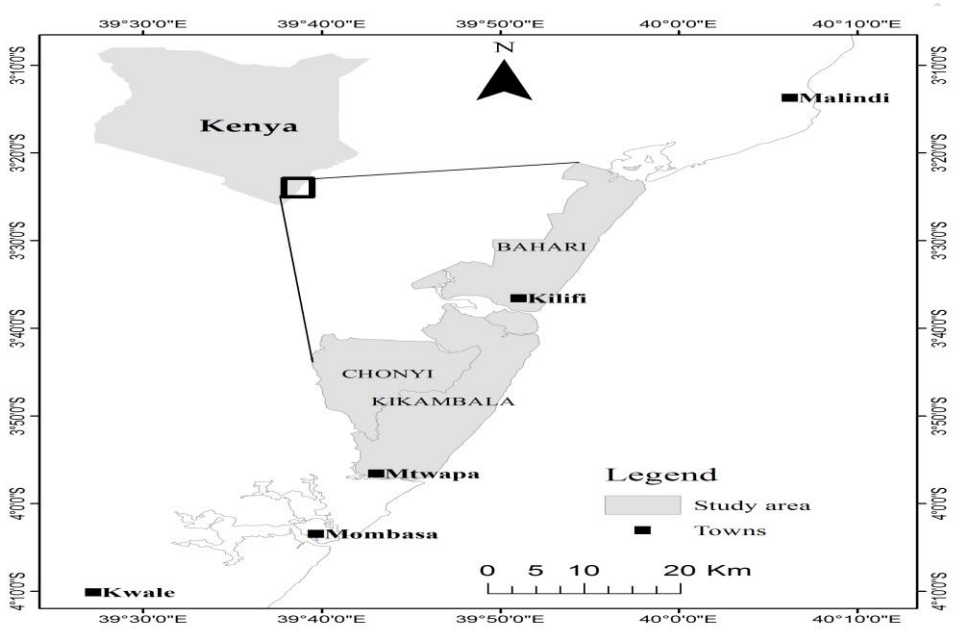
2 RESEARCH METHODOLOGY

2.1 Introduction

This chapter describes research methodology used in this study. It discusses study location, research design, target population, sample size, sampling procedure, research instruments, piloting of the instruments and validity of the instruments. Reliability of the instruments, data collection procedures, data analysis techniques, research ethical considerations, and finally, data management and analysis.

2.2 Study Area

THE MAP SHOWING THE LOCATION OF KILIFI SOUTH SUBCOUNT



SOURCE: Author 2022

Kilifi South Sub-county comprises of Bahari, Chonyi and Kikambala divisions all located in Kilifi County in Coast region. Kilifi South Sub-county is situated along the Kenyan coastal line. The area receives an average annual rainfall of between 400-1250 mm per year which is biannual and unpredictable. Limited research has been carried out on food security in the area. The inhabitants are the Mijikenda community. According to 2009 population census, fourty seven percent of the population were males while fifty three percent were females (Kilifi District Development Plan 2012). Kilifi South Sub-county is both arid and semi-arid, with erratic and unreliable rainfall. Most of the areas are generally hot and dry leading to high rates of evaporation. This combined with unreliable rainfall, limits intensive and meaningful land use and related development activities. The long rains last from March to May and short rains from in November to December. The periods falling between June to September and January to February are usually dry. Kilifi South Sub-county was chosen from other sub-counties because of the magnitude of food insecurity [12].

2.3 The Research Design

This study used survey design and inferential statistics which are methods of collecting information by interviewing and administering questionnaire to a sample of individuals and then

subjecting the data to multiple regressions [15]. This research design is appropriate due to its safeguard against bias and its ability to maximize reliability.

2.4 Target Population

The target population of this study was the rural households of Kilifi South Sub-county. According to Kenya Bureau of statistics population Census (2009), Kilifi South Sub-county has a total population of 28 074 inhabitants comprising of 6 184 households spread across Bahari, Chonyi and Kikambali divisions

2.5 Sampling Procedure

This study used systematic random sampling which involved drawing every nth household in the population starting with a randomly chosen household in each of the villages in the three divisions. The nth household was the 5th household. The respondents were the head of the household or any available responsible adult. Kilifi South Sub-county was chosen from other sub-counties because of the magnitude of its food insecurity whose causes have not been researched or documented.

2.6 Sample Size

A sample size of 384 households' collected based on procedure by [16] was used in this study. This was obtained after data cleaning as some of the questionnaires were incomplete.

$$n = \frac{Z^2pq}{d^2} \quad \text{..... equation 1}$$

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

$$n = \frac{(1.96)}{(0.05)(0.05)/(0.005)^2}$$

n= 384

2.7 Research Instruments

Prior to the commencement of data collection, the researcher obtained all the necessary documents, including a certificate from Pwani University Ethics Review Committee The main data collection instruments that were used in this study included a questionnaire. This was used for the purpose of collecting primary quantitative and qualitative data. Additionally, the questionnaire was used for the following reasons: its potentials in reaching out to a large number of respondents within a short time, able to give the respondents adequate time to respond to the items, offers a sense of security (confidentiality) to the respondent and it is objective method since no bias resulting from the personal characteristics [17].The questionnaire was divided according to the objectives as the main areas of investigation. The study used primary data questionnaires, oral interviews from respondents on their opinion, preferences, feelings, judgments and attitudes to describe the factors that influence household food security among rural households in Kilifi south Sub-county.

2.8 Piloting of the Instruments

A pilot study was conducted as a technique of testing the reliability of the data collection instruments especially the questionnaire and the interview schedules. In this study, a sample of

6 respondents was selected for piloting out of the target population. Piloting helped to identify any unforeseen limitations that could adversely affect the results of the findings of research. Such limitations and challenges were addressed before the actual study started in a bid to mitigate their effects on the study outcome. Piloting of research instruments assisted in increasing their reliability since any defects and possible contradictions, ambiguity or otherwise of the instruments such as the survey questionnaire was identified and corrected before the actual data collection for the study.

2.9 Validity of the Instruments

A panel of three officers in the Department of Agriculture in the sub county was requested to assess the relevance of the content used in questionnaire development. Their recommendations were incorporated in the final questionnaire. The researcher administered the questionnaire twice to selected separate but similar responses to the sample in the study using the test, re test method. The Pwani University supervisors together with other experts from the Crops Department also assessed the instruments to test their adequacy in terms of depth, relevance and clarity. According to [18] validity refers to the extent to which a test or an instrument measures what it is intended to measure. [15] defined validity in the sense raised as the degree to which the empirical measure of the concept, accurately measure the concept. [18] observed that content validity is a matter of judgment by the researcher and professionals in the specific area of study.

2.10 Reliability of the Instruments

The reliability of research instrument covers the extent to which the tool yields the same results on repeated trials hence, the tendency towards consistency found in repeated measurements in what is referred to as the reliability of the research instrument. In this study reliability followed the following steps, the developed questionnaire was given to 6 identical respondents subjects not included in the main study the answered questionnaires were filled manually. After two weeks the same questionnaire was administered to the same group of subjects. Thus, test–retest method was used, the consistency in the answers provided assurance of reliability of the instrument. This showed that questionnaires were reliable and therefore they were used for the final study.

2.11 Data Management and Analysis

Descriptive and inferential statistics was used to analyze the data. The resulting statistics formed inferential analysis basis. Regressions were used to validate the findings of the descriptive statistics because it controls other confounding variables at the same time [18]. Significant relationships between categorical variables were also established. Multiple regression measures the relationship between the categorical dependent variable and independent variables which are usually continuous by estimating probabilities [18].

The regression equation is y= a+ B 1 X1 ……equation 2
where z is the number of independent variables, y is the dependent variable, a is the constant and the Xs are independent variables. The Bs are listed in a column of coefficients.

Food security = α + 79.746 (Agricultural diversification) The study used Adjusted R Squared of 0.691. That is, 69 percent of a change in the dependent variable can be explained by changes in the independent variables. Before running statistical analysis, variables were examined for the presence of stochastic trends using normality test in order to confirm whether data conforms to ordinary least squares (OLS) assumptions. Using the P-P plots of regression, the data were found to be normally distributed.

According to [19], identifying an appropriate food security measure is a difficult issue as not all aspects of food security can be captured by any single outcome measure. This is because the household composition is variable, and the household is in itself subject to varying interpretations; there may be multiple income sources among adult members of one household who have strong incentives not to reveal to each other the full extent of their individual earning power or assets; the responsibility for the production of food may be shared among the adults; and finally, subsistence production is harvested piecemeal and is neither measured nor recorded. In order to avoid this difficulty; most analyses depend on measuring food consumption. Food security can be analyzed in terms of food availability as compared with requirements [20]. They further reported that the net food available after selling the surplus to the market is a function of domestic production at household level. Food security at household level is best measured by food calorie intake [21]. FAO Recommended Daily Calorie Intake was used to determine food security index as shown below.

$$\text{Food security index } Zn = \frac{\text{Household's daily per capita calorie availability (A)}}{\text{Household's daily per capita calorie requirement (B)}}$$

Food security index (Zn) = Yn R …….equition 3
Where Zn is food security index of nth household
Yn is the actual daily calorie intake of the nth household R is the Recommended Daily Calorie Required by nth household. If food security index of each household is greater than or equal to 2060 Kilocalories it means that the household is food secure.

If food security index of each household is greater than or equal to 2060 Kilocalories it means that the household is food secure and if food security index is less than 2060 then, the household is food insecure. The 2060 kcal was used because the Daily Recommended Calorie Requirement for Kenya is 2060 kcal. The daily food (calorie) requirement was estimated by grouping household members into different age groups (Table 1). Total household calorie requirement was then obtained by multiplying total number of adults in each household by the 2060kcal. Total energy requirements for children were converted to adult equivalent using conversion scale in Table 1.

Table 1. Recommended daily energy intake and conversion factor

Age category (Years)	Average energy allowance per day	Conversion factor
<6	750	0.29
7-15	1200	0.51
16-30	1500	0.71
31-50	2350	0.98
51+	2200	0.90

*Source: Kenya National Bureau of Statistics [24]

Daily calorie intake was obtained by converting data on food consumed (maize, cowpeas, sorghum and cassava) by every household per week into kilograms and equating using the information in Table 2.

Table 2. Cereal equivalent conversion ratios

Food crop	**Calorie/kg**	**Milling ratio**	**Maize equivalent ratio**
Maize	3590	0.85	1.00

Cowpeas	3640		0.92
Sorghum	1350	0.65	0.40
Cassava	1490	0.85	0.40

*Source Okigbo [25]

RESULTS AND DISCUSSION

Table3: Influence of Agricultural Diversification as a Livelihood Strategy

Variables	Sample	Percentage %	Food secure %	Food insecure %
Types of Livestock				
Cows	73	19	19	0
Sheep	50	13	0	13
Goats	127	33	33	0
Poultry	134	35	35	0
Total	**384**	**100**	**87**	**13**
Types of Crops				
Maize	238	62	62	0
Cassava	35	9	9	0
Sorghum	8	2	0	2
Cowpeas	69	18	18	0
Coconut	35	9	9	0
Total	**384**	**100**	**98**	**2**

Successful diversification often results in a more and varied mix of activities at farm enterprises. The analysis of the influence of agricultural diversification on food security revealed that 19% of the households kept cows, 13% kept sheep, 33% kept goats and 35% kept poultry. Additionally, 62% relied on maize, 9% on cassava, 2% on sorghum, 18% on cowpeas and 9% relied on coconut (Table 3). The study revealed that the households which kept poultry were 35% food secure and those who planted maize and cowpeas were 62% and 18% food secure respectively. A study conducted by [22] found that 24% of the households practicing agricultural diversification in Himalaya were 15% food secure.

Determinatsn of Food Security Status: An Inferential Analysis

Results of multiple regressions on determinants of food security status were as presented in Table 4.

Table 4: Multiple regression on determinants of food security

Variables	Coefficients (BB)	std error	t	P values
Types of				

Livestock				
Cows	79.746	7.365	1.421	0.003
Sheep	41.361	5.471	1.336	0.007
Goats	63.183	5.968	1.063	0.004
Poultry	72.352	6.913	2.864	0.001
Types of Crops				
Maize	77.036	7.153	2.741	0.001
Cassava	43.315	5.371	1.351	0.003
Sorghum	36,902	4.637	1.136	0.008
Cowpeas	68.731	6.153	2.514	0.003
Coconut	48.271	5.831	1.163	0.006

Dependent variable: Food security status, R^2=0.691, F=1.731, df=15

Agricultural diversification was found to be significant source of livelihood in Kilifi South Sub-county. The relationship between the dependent variable and independent variables was strong (R2 =0.691). As far as animals and crops diversification is concerned, cows, goats, poultry, maize, cassava and cowpeas were found to improve food security status. These findings agree with a study conducted by [23] who observed that diversification of both animals and crops leads to increased food production and improved profits hence improvement of food security status. Livestock like cows and goats enterprises utilizes labour resources better. However, they do not agree with those of [8] who reported that labour requirements for beef may be intensive during one season and fall in another season and therefore inversely related to food security. This is mostly during famine seasons when households are forced to dispose off their cows, goats and poultry at depressed prices in order to purchase grain for consumption.

4.4 Summary of Findings

The findings indicate that household participation in livestock keeping and planting maize, cassava and cowpeas are determinants of food security status. This means the current demand for food can be met by agricultural diversification.

Conclusion

The data analysis sought to find out whether agricultural diversification is a determinant of food security status among smallholder farmers in Kilifi South Sub-county. The conclusion is that households with heads participating in agricultural diversification are more food secure.

Recommendation

The county government should promote agricultural diversification activities such as rearing cows, sheep, goats and poultry and planting crops such as maize, cassava and cowpeas because this study has shown they enhance food security. Promotion of agricultural diversification for enhancing food security must be purposeful and they should be controlled in order to ensure continuous flow of harvests even during the drought season. This should be promoted because they enhance food security. Therefore, to ensure success, an integrated and multi-pronged approach is the surest way towards food security and a minimum intake of 2260 kcal per day.

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