Effectiveness of Adaptation Strategies by Resettled Farmers in Unfamiliar Agro-Ecological Zones in Laikipia Central Sub County, Kenya

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ABSTRACT

This study sought to assess the effectiveness of adaptation strategies adopted by resettled farmers in Shalom Resettlement Scheme in Laikipia Central Sub-County. These farmers originated from Agro-Ecological Zone (AEZ) II in the Rift Valley that comparatively have better agricultural and livestock production potential than AEZ III to IV in Laikipia Central Sub-county of Central Kenya where they are currently settled. AEZs II to III are characterized by medium potential while AEZ IV has semi-arid conditions. Crops and livestock production has remained the farmers' main sources of livelihood and in their new AEZs they are compelled to practice different farming practices to sustain their production. The specific objectives for the study were to identify the adaptation strategies adopted by resettled farmers within AEZs unfamiliar to them in Laikipia Central Sub County and to assess the effectiveness of the adaptation strategies used by resettled farmers within AEZs unfamiliar to them in Laikipia Central Sub County. The study employed Impoverishment Risk and Reconstruction Model. A descriptive survey design was adopted for this study. The target population for the study was 1525household heads. A sample of 233 households was derived from 15% of the targeted population and 4 community leaders. Key informants were sampled through purposive sampling procedure and census survey was used for 4 community leaders. Data was collected from the household heads using questionnaires as well as through focused group discussions with 4 community leaders. Quantitative data was analyzed using Statistical Package for Social Sciences (version 26.0) and presented as descriptive statistics, tables, figures and graphs. Qualitative data was thematically analyzed and inserted in the text during discussion. A t-test at 0.05 significance level for Shalom Vs. Nakuru and Shalom Vs. Uasin Gishu was performed. The t-test value for Shalom Vs. Nakuru was 0.441 and the p value was 0.034 while for Shalom Vs. Uasin Gishu, the t-test value was 0.2511 and the p value was 0.012. The p-values are less than the typical significance level of 0.05, thus there is a significant difference in agro ecological conditions in Shalom and in Nakuru and Uasin Gishu. To mitigate these differences, most resettled farmers have adopted adaptation strategies like water harvesting and conservation, crop diversification and changing of the planting calendar which they consider as the most effective while migration is considered the least effective as it was adopted by the least number of farmers. The study recommended that effective water resource management strategies be implemented in Shalom resettlement scheme to promote sustainable agricultural development. Techniques such as rain water harvesting and constructing water pans should be encouraged to enhance water availability for agricultural activities. Another recommendation is promoting capacity-building programs for farmers in the Shalom resettlement scheme to empower them with the necessary skills and knowledge to adapt to changing climatic conditions. Climate-smart agricultural practices, including efficient water use and crop diversification, can contribute to increased resilience.

Key words: Adaptation Strategies, Agro-Ecological Zones, Arid and Semi-Arid Lands, Laikipia Central Sub County, Resettled Farmers

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I. INTRODUCTION

Global displacement and resettlement is attributed to infrastructural development projects such as dams (Phenopraserth, 2012; Sayatham & Suhardiman, 2015; Vanclay, 2017), roads and railways (Phongsiri, 2019), effects of climate change (Fujikura, 2022) and violent conflicts [United Nations High Commissioner for Refugees (UNHCR), 2018a]. Resettlement creates both risks and opportunities in livelihood due to the differences in social, economic and environmental conditions between the areas of resettlement and the original homes (Keobountham, 2019).The most affected of the resettled are farmers. Disruption of their livelihood after resettlement often leads to poverty and food insecurity (Magaramombe, 2010). Sometimes this may result from infertile soils or changes in environmental factors that require farmers to adapt to new cultivation techniques in their new agro-ecological zone conditions.

In most parts of Africa, governments have continually resettled farmers in semi-arid areas which are agriculturally unproductive (Thebe, 2011). Farmers resettled in Masvingo, Zimbabwe are a good example of resettled

farmers in Zimbabwe who face challenges due to recurrent drought and infertile soils which reduces their agricultural production (Matunhu, 2013). Furthermore, these farmers have limited or no knowledge on farming in drought conditions hence adaptation to those agro-ecological zones' conditions is challenging.

A government resettlement scheme in Kenya known as Solio was set up to resettle forest evictees who had camped on the road sides. Resettled farmers in particular have had their lives and livelihoods affected by being forced to move from the forested areas because their current resettlement areas have unfavorable climatic conditions (MoALF, 2017) that are less compatible to their traditional farming practices. This makes the farmers vulnerable to food insecurity and poverty. To cope, Yang et al. (2020) observed that these farmers diversified their crops, planted drought resistant crops, did casual labour and relied on non-governmental organizations (NGOs) for relief food.

Most parts of Laikipia County are in agro-ecological zone III-V, semi-arid lands (ASALs) which experience frequent droughts and unreliable rainfall (Wiesmann et al., 2014). These conditions have been worsened by the effects of climate change. Shalom Resettlement Scheme is located in Laikipia Central Sub County, a semi-arid region. It is prone to climate variability with dry spells recurring every 4 to 5 years. This translates to low agricultural potential. Resettled farmers are therefore most affected as they are left to fend themselves in agro climatic systems which are different from that of their origin, especially aridity which leads to crop failure in some seasons. This study sought to identify the adaptive strategies that resettled farmers in Shalom Resettlement Scheme consider effective in their quest for food security in that unfamiliar agro-ecological zone.

1.1 Objectives of the Study

i. To identify the adaptation strategies adopted by resettled farmers within agro-ecological zones unfamiliar to them in Laikipia Central Sub County.
ii. To assess the effectiveness of the adaptation strategies used by resettled farmers within agro-ecological zones unfamiliar to them in Laikipia Central Sub County.

II. LITERATURE REVIEW

2.1 Theoretical Framework

This study was informed by Impoverishment Risk and Reconstruction Model (IRR). The model was developed by Michael Cernea in 1997. Since then the model has undergone considerable revitalization by other scholars. The model has identified the impoverishment risks associated with forced resettlement and the necessary measures to minimize those impacts (Cernea, 2000). The Impoverishment Risk and Reconstruction (IRR) model outlines a series of risks and their corresponding mitigations. The risk of landlessness is addressed through land-based resettlement strategies. Joblessness is countered by efforts to promote reemployment. The issue of homelessness is tackled through house reconstruction initiatives. Marginalization is mitigated by fostering social inclusion. Increased morbidity is addressed by improving health care services. Food insecurity is managed by ensuring adequate nutrition. The loss of access to community assets and services is addressed by restoring these vital resources. Finally, social disarticulation is mitigated by strengthening networks and focusing on community rebuilding efforts.

According to Cernea (2002), the impoverishment and risk reconstruction model performs four functions: predictive function which helps new "hidden" problems that may result from resettlement; diagnostic function which identifies socioeconomic hazards and possible outcomes of the impending displacements in order to come up with counter-risk measures; problem-resolution function where the model points out strategies to reconstruct the resettled people's livelihoods and pushing these strategies beyond short term coping measures to long term redevelopment measures; and research function which guides social researchers on data collection in the field and to coherently aggregate diverse empirical findings along the model's key variables.

This model is suitable in that its language is direct and easy to understand which enables the resettlers to participate in identifying the most suitable mitigation strategies for the risks they will face. However, it presents a highly negative picture of the impacts of resettlement making it difficult for people to view resettlement positively and agree to accept it.

This model will inform the study on the problems that may result from resettlement, the measures that can be adopted to reconstruct the resettler's livelihoods beyond short term relief mechanisms to redevelopment and construction of the questionnaires for data collection in the field.

2.2 Overview of Literature

Internationally resettlement of farmers has been driven by social, natural and economic factors. Once farmers are resettled, adapting can be quite challenging since they encounter an environment that is different from what they

are accustomed to, hence the need to change their customary coping mechanisms. Besides, disintegration from their closely knit social groups interferes with the beneficial knowledge and skills that they would share to adapt and reconstruct their livelihood strategy. There is also loss of the original knowledge on ecology when they are resettled in a new environment (Mathur, 2013). For survival and food security, adopting adaptive strategies that prove effective in their areas of resettlement is paramount.

Wiederkehr et al. (2018) examined the adaptation strategies adopted by sub Saharan households due to changes in environmental conditions. Some types of the adaptation strategies from the study included crop diversification, soil and water management, livestock management, income diversification, food provision, social networks, humanitarian aid provided by the government and non-governmental organizations, information from weather forecasts and extension officers, migration and religious activities like praying. According to Pauline et al., (2017), some strategies like crop diversification, livestock management and soil and water conservation are long term and require good capital and extension services from the government which is mostly unavailable to small scale farmers.

After independence in Kenya, new settlement schemes were established to house squatters and make useful the unused tracts of land. By 1985 there were 13 settlements in Kwale and Kilifi districts. Despite being situated at a close range, these schemes had different agro-ecological potential and cropping patterns. Some were situated in CL3 zone (coconut-cassava) while the others are in CL4 (cashew nut- cassava). One of the schemes is Magarini settlement scheme in Malindi, Kenya. It is situated in a fragile environment with low and unreliable rainfall. To help them cope in this marginal environment, the Australian International Development Assistance Bureau (AIDAB) introduced dry land farming of food and cash crops to sustain their livelihoods. They drilled boreholes for them and explored ground water. However, the aquifers they identified did not produce sufficient ground water. After the first harvests failed to yield, the resettled farmers abandoned the new farming systems and went back to their off farm activities whilst receiving support from the NGOs (Porter et al., 1991).

Meinecke et al. (2012) undertook a study in Solio resettlement scheme village 3, in Laikipia East, Kenya, to assess crop production and livelihood strategies. The resettlement scheme was set up to resettle the IDPs in 2007 post-election violence and the evictees from the Mount Kenya and Aberdare forests. Most of the resettlers are farmers. The area being an ASAL has unfavorable conditions for farming. To cope with the harsh environmental conditions, therefore, the farmers have diversified their crops. Most farmers plant drought resistant crops like sorghum and beans while minorities of them harvest water for irrigating their crops. Other farmers have engaged in off farm adaptation strategies such as setting up small businesses and engaging in casual labour as livelihood means (Gakuru, 2017). The farmers' choice of crop production is influenced by the training they get and knowledge from their previous experience with farming.

III METHODOLOGY

3.1 Research Design

To achieve the set objectives, a descriptive survey design was used to acquire meaningful data that would shed light on the effectiveness of the adaptation strategies adopted by resettled farmers in unfamiliar agro-ecological zones. Data on the adaptation strategies adopted and the effectiveness of these strategies in unfamiliar agro-ecological zones in Laikipia Central Sub County was collected.

3.2 Study Population

This study targeted a total population of 1525 household heads of Shalom Resettlement Scheme. Data from 4 community leaders from Shalom settlement scheme was also collected. Mugenda and Mugenda (2013), state that sample size of between 10% and 30% is a good representation where the target population is less than 10,000. The study therefore used 15% of the target population to derive the sample size (1525×0.15=228.75). Approximately 229 households were therefore sampled. Census survey was used to consider the 4 community leaders, making a total sample population of 233 respondents. Purposive sampling was used to select the respondents.

Table 1
Sample Size of the Population

Village	Target population (N)	Sample Population (n) 15% of Target Population
A	423	63
B	405	61
C	324	49
D	373	56
TOTAL	**1525**	**229**

3.3 Data Collection Methods and Tools

To understand the effectiveness of the adaptation strategies adopted by resettled farmers, the researcher administered questionnaires to household heads in the four villages of Shalom Resettlement Scheme, village A, B, C and D. The questionnaires were filled in face to face interviews with 229 household heads in the four villages as shown in table 1. Interviews were also conducted with 4 community leaders in the resettlement scheme, making the sample size have a total of 233 respondents.

The households were purposively sampled to ensure that the respondents were from Nakuru and Uasin Gishu counties which were the epicenters of post-election violence and therefore constitute the highest percentage of the resettled population. In these two counties also crop and livestock production is the main source of livelihood hence most resettled people were farmers. Informed consent was sort from all the respondents prior to the interviews.

3.4 Reliability of the Research Instrument

Reliability refers to a measure of the degree to which research instruments yield consistent results (Mugenda & Mugenda, 2013). The pre-testing aims at determining the reliability of the research tools including the wording, structure and sequence of the questions. The research instruments were subjected to overall reliability analysis using the split half method. This was done by collecting data from a given number of respondents into two halves (often odd-even). The two halves will be correlated using Pearson's correlation. A coefficient of 0.80 or more implied that there is a high degree of data reliability (Mugenda & Mugenda, 2003). The purpose was to refine the research tools so that respondents in the major study had no problem in answering the questions and examining whether the same response was obtained.

3.5 Data Analysis

Mugenda and Mugenda (2013) assert that data obtained from the field in raw form is difficult to interpret unless it is cleaned, coded and analyzed. The collected data was analyzed using both quantitative and qualitative data analysis methods. Quantitative method involves descriptive statistics such as frequencies, means and percentages. This also helped to present quantitative data in form of tables and graphs. Data from questionnaire was coded and logged in the computer using Statistical Package for Social Science (SPSS V 26.0). This involved coding both open and closed ended items in order to run simple descriptive analyses to get reports on data status. Qualitative data was analyzed thematically and the summary was inserted in the text during discussion.

IV. FINDINGS & DISCUSSIONS

4.1 Response Rate

The overall response rate was 88.7 per cent in the four villages. The distribution of the response rate was 22.6 per cent, 20.3 per cent, 23.9 per cent and 21.9 per cent in villages A, B, C and D respectively.

Table 2
Response Rate of the sample population

Village	Sample Population	Response Rate in %
A	63	22.6
B	61	20.3
C	49	23.9
D	56	21.9

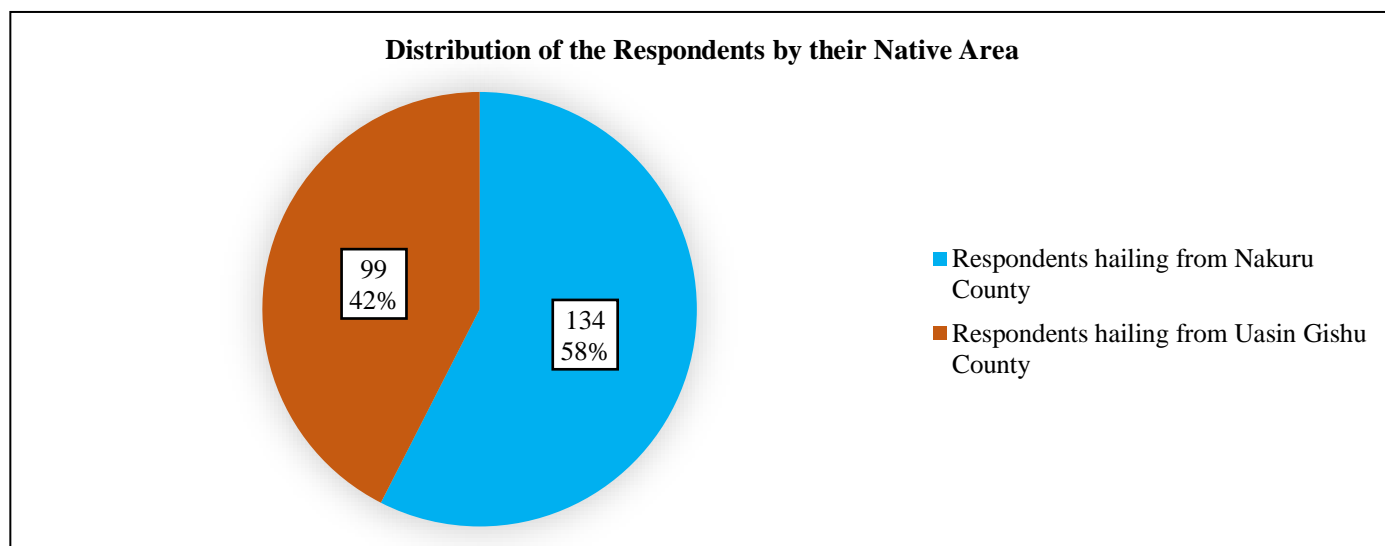**4.1.1 Distribution of the Respondents by the Current Residential Area in Shalom**

The studies considered 233 respondents and were distributed as follows from villages A, B, C, and D. Village A emerges as a substantial focal point, encompassing 65 individuals and constituting 28 per cent of the overall sample. Village B hosts 61 respondents, representing 26 per cent. Village C comprises 49 respondents, making up 21 per cent, while Village D accommodates 57 respondents, contributing 25 per cent. The distribution ensured fair representation to minimize biases, offering a more accurate reflection of the community's demographics.
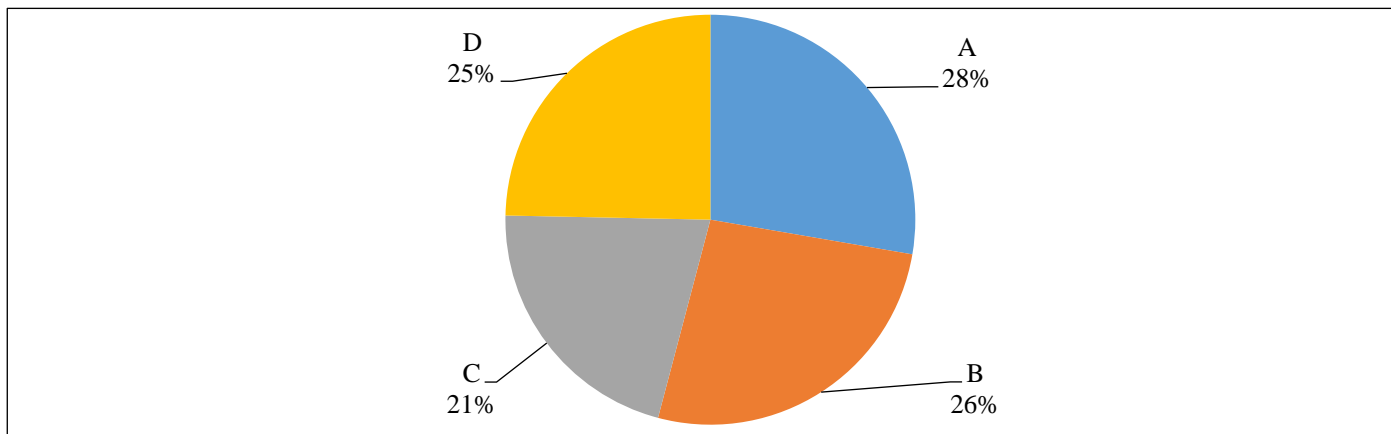
Figure 1
Sampling Distributions of Study Respondents from each of the 4 Village in Shalom

4.1.2 Distribution of the Respondents by their Native Area

Out of the total respondents, 99 individuals originate from Uasin Gishu, while 134 from Nakuru. The fairly balanced representation avoids skewed distributions. Consequently, provides unbiased insights into the experiences and perspectives of the resettled individuals.
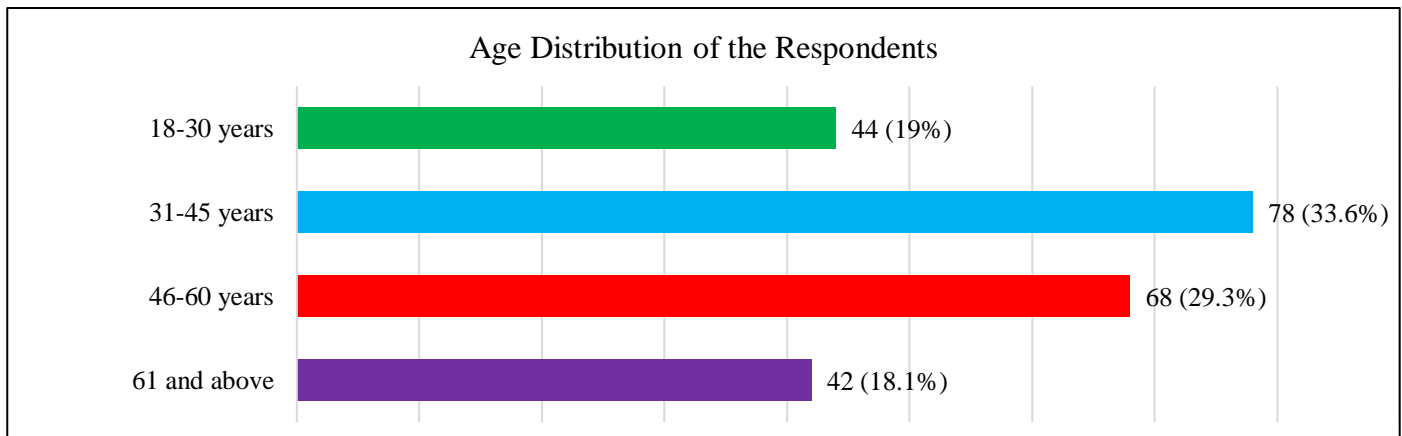

Figure 2
Distribution of the Respondents by their Native Area

4.1.3 Age of the Respondents

The majority of respondents fall within the age range of 31-45 years, comprising approximately 33.62 per cent or 78 respondents of the total sample. This is the active working population, playing a crucial role in the agricultural activities within the resettlement area. Following closely, individuals aged 46-60 years constitute around 29.31 per cent, which is 68 respondents, contributing to the diversity of experiences and perspectives in the study. The age group of 18-30 years and those aged 61 and above made up approximately 18.97 per cent (44 respondents) and 18.10 per cent (42 respondents) respectively.
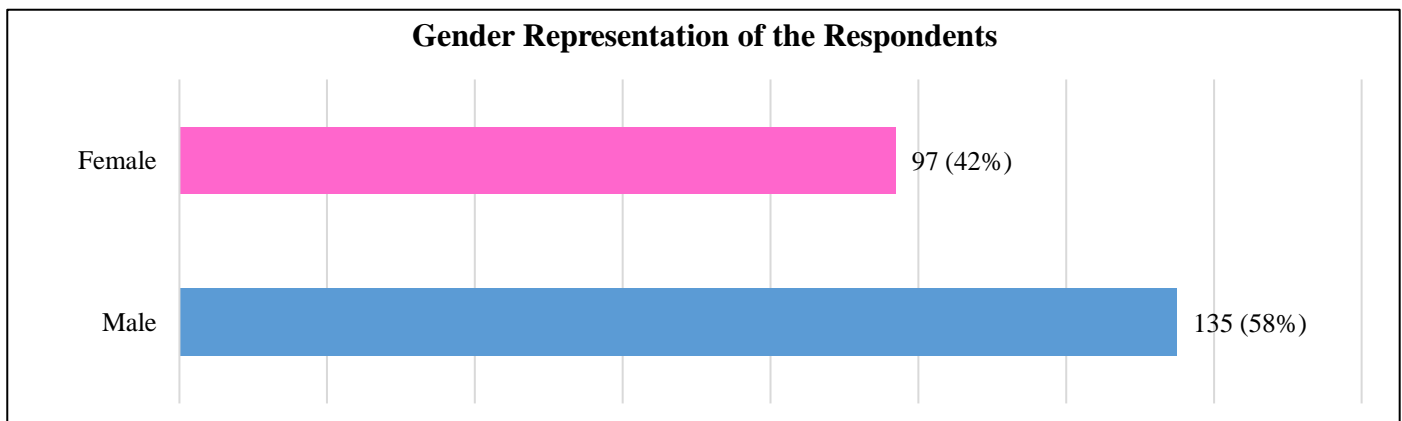
Figure 3
Age Distribution of the Respondent

### 4.1.4 Gender Representation of the Respondents

The gender representation in the study is characterized by a balanced yet slightly skewed distribution, with males comprising 58% of the total respondents and females constituting 42%.

Figure 4
Gender Representation of Respondents

### 4.1.5 Education Background of the Respondents

The majority of the respondents, comprising 48.3%, has completed primary education, 25.4% have attained secondary education while, 13.8% have reached tertiary levels of education. However, 12.5% of respondents report no formal education.
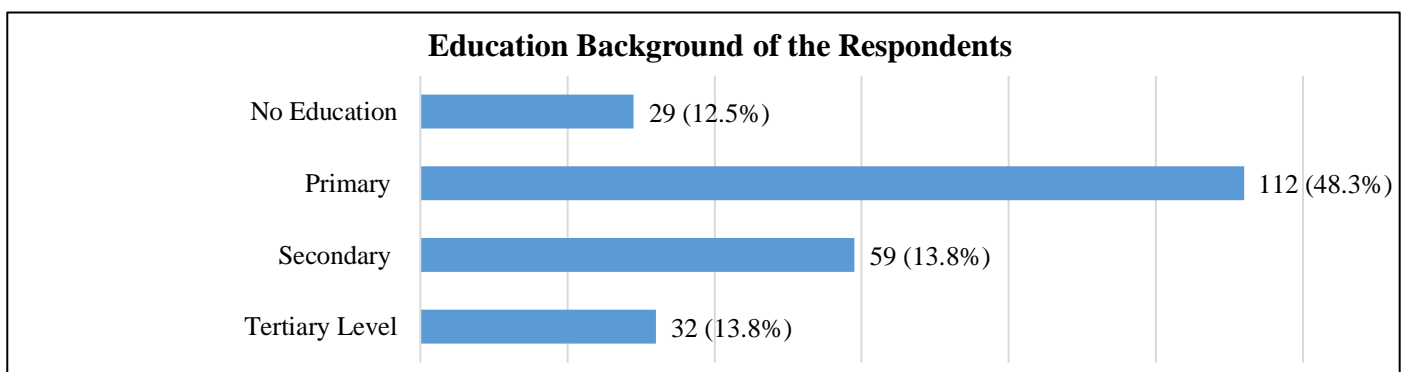
Figure 5
Education Background of Respondents

### 4.1.6 Household Composition of the Respondent

As shown in Figure 6, 39% of the respondents are from small families, comprising 1-3 members. 41.0% of respondents reside in medium-sized families, encompassing 4-6 members. Finally, 20% of households are characterized as large families, with 7 or more members.
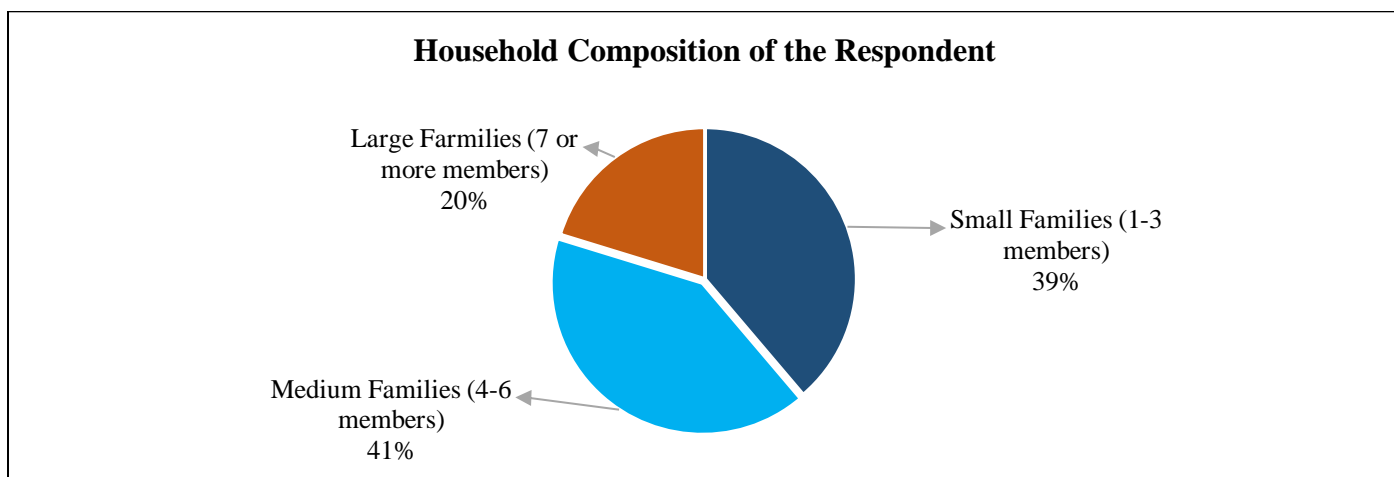
Figure 6
Household Composition of Respondents

4.1.7 Occupation of the Respondents

The findings show that 64% of respondents primarily involve in farming, 4% are dedicated to non-agricultural occupations such as business or service. Furthermore, 32% of the respondents pursue a mixed occupation, involving both agricultural and non-agricultural activities.
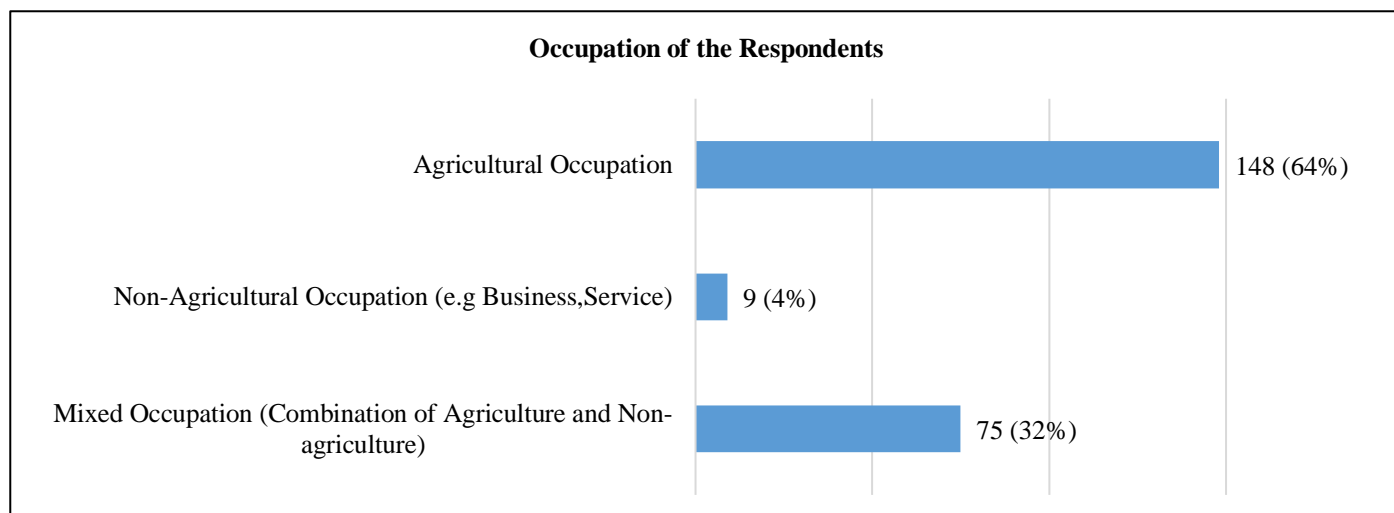
Figure 7
Occupation of Respondents

4.2 Agricultural and Livestock Production Conditions
4.2.1 Comparison of Agro-Ecological Conditions

Kenya is divided into seven agro-ecological zones that is, zone I to IV based on climatic factors, soil properties, landforms, topography and land cover that act as potentials or constraints for land use (Food and Agriculture Organization of the United Nations [FAO], 1996). Nakuru and Uasin Gishu lie in agro-ecological zone II which is a high potential area with favourable conditions for crop and livestock production while Shalom Resettlement Scheme is in zone IV semi-arid area ((Wiesmann et al., 2014). Considerable differences therefore exist in climate, soil properties, landforms and land cover between Nakuru and Uasin Gishu and Shalom Resettlement Scheme. The study highlights the differences as follows:

I. Climatic Conditions

Agricultural production primarily relies on rainfall, given the consistent temperatures throughout the year. The data below shows annual average rainfall amount in Shalom Settlement Scheme, Nakuru, and Uasin Gishu as indicated by data from respective County Meteorological Offices.'

Table 4

Mean Annual Rainfall in Millimeters (mm) 2017-2021

Station	2017	2018	2019	2020	2021	Average
Shalom Resettlement Scheme	571.3	551.4	918.1	633.8	5051	635.9
Average for all stations in Nakuru County	870.3	1116.4	1443.9	833.4	1500.7	1152.94
Average for all stations in Uasin Gishu County	999.3	1389.3	1216.9	1560.4	1449.3	1323.04

A t-test at 0.05 significance level for Shalom vs. Nakuru and Shalom vs. Uasin Gishu gave a P-Value of 0.034 and 0.012 respectively. The p-values are less than the typical significance level of 0.05, thus there is a significant difference in mean annual rainfall between the two places.

I. Soil Quality

Soil at Shalom is black cotton with a neutral to moderately alkaline pH at the top layer (pH-H_2O values of 6.8 to 7.4) and tend to be slightly acidic to moderately alkaline in the subsoil (pH values ranging from 6.5 to 7.7). The impact of insufficient and unpredictable rainfall has prevented Shalom from realizing the full agricultural productivity of its soils. In Uasin Gishu County, there are four main soil types: red loam, red clay, brown loam, and brown clay soils. Red loam soils are mainly found in the northern part of the county, red clay soils are found around Soy, upper Moiben, and Nandi border areas and Brown clay soils are found on the plateau. Deep brown loam soils are found in the high altitudes.

Nakuru County's soils, developed on sediments mainly from volcanic ashes, are well-drained, deep, dark reddish-brown to yellowish-brown, friable to loose sandy loam to loamy sand.

II. Topography

Uasin Gishu County, situated in the highlands of the Rift Valley, exhibits a topography that includes both highland plateaus and lower-lying areas, with an average elevation of 6,342 Ft. and ranging from 3,304 Ft. to 9,469 ft. The county's topographical features impact soil types and drainage patterns.

The region features parts of the Mau escarpment with steep slopes and varied elevations, ranging from 5,755 Ft. to 7,467 ft. The varying topography influences microclimates within Nakuru County, creating different temperature regimes and precipitation patterns. These variations in elevation contribute to the county's rich agricultural diversity, allowing for the cultivation of various crops in different agro-ecological zones.

On the other hand, in Laikipia County, where Shalom is situated, the topography displays diverse elevations, ranging from a minimum of 2,979 ft. around the Lekurruki Conservancy to a maximum of 16,686 ft. in Rugongo. The county comprises 90 per cent dry land, limiting agricultural activities. The terrain in Laikipia County is characterized by undulating landscapes, flat plains, and elevated areas.

III. Laikipia County Land use and Land Cover Changes

The table illustrates the changes in land use and land cover in Laikipia County between 1990 and 2020, revealing substantial shifts in various categories.

Table 5

Changes in Land Use and Land Cover in Laikipia County

| Class Name	Ares in (Km²) 1990	Area in %	Ares in (Km²) 2000	Area in %	Ares in (Km²) 2010	Area in %	Ares in (Km²) 2020	Area in %
Agriculture	2,230.92	23.51	977.99	10.31	1,667.19	17.57	2,600.53	27.41
Bare land	2,312.27	24.37	2,164.62	22.81	1,323.54	13.95	685.49	7.22
Forest	524.94	5.53	397.16	4.19	594.05	6.26	1,276	13.45
Grass	3.957.57	41.71	5,325.24	56.12	5,344.42	56.32	4,332.81	45.66
Urban Dev.	462.99	4.88	623.66	6.57	559.53	5.90	593.74	6.26
Total area	**9,488.69**	**100**	**9,488.69**	**100**	**9,488.69**	**100**	**9,488.69**	**100**

The analysis of land use and land cover changes in Laikipia County provides insights into the broader context within which the Shalom Resettlement Scheme operates. Specifically, the observed shifts in land use patterns within the county can have implications for the agricultural and environmental conditions.

4.3 Challenges in Shalom Resettlement Scheme
Figure 8 highlights the challenges faced by the resettled farmers in Shalom resettlement scheme.

Figure 8
Challenges Faced by Resettled Farmers in Shalom Resettlement Scheme
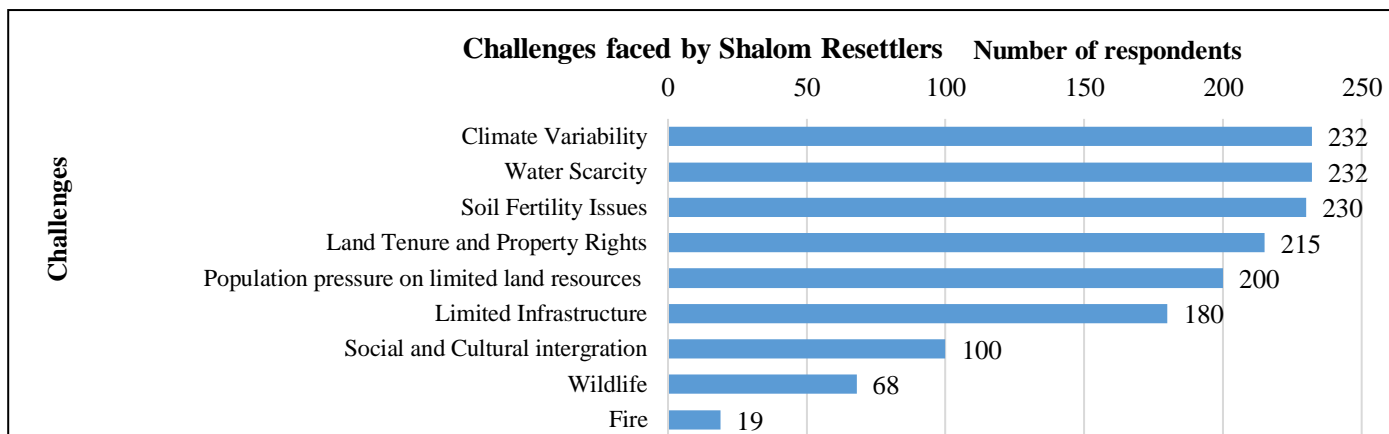
MoALF (2017) highlights climate variation and drought as one of the challenges in Laikipia County. This corresponds with the study's findings that climate variability and water scarcity emerged were universal concerns, impacting 100% of the respondents. A study carried out by Matunhu (2011) is in line with this study that soil infertility is one of the challenges facing resettled farmers. In this study, soil fertility issues affected 99.1% of the respondents, indicating a widespread challenge in sustaining crop and livestock production. Land tenure and property rights posed significant challenges for 92.7% of the respondents, underscoring the importance of secure land tenure for agricultural practices. Population pressure on limited land resources was a concern for 86.2% of respondents, indicating the strain on available agricultural spaces due to increasing population demands. Limited infrastructure, mentioned by 77.6% of respondents, further complicates the agricultural landscape, hindering efficient transportation and market access.

Social and cultural integration, 43.1%, indicates the importance of understanding and incorporating local customs and practices in the resettlement process. Wildlife (29.3%) and fire (8.2%) were identified as challenges with lowest degrees of impact.

4.4 Adaptive Strategies
The adaptive strategies represent integral elements of the farmers' responses to challenges related to soil fertility and the unpredictability of rainfall patterns.

Table 6
Adoption Levels of Various Adaptive Strategies by Resettled Farmers in the Shalom Resettlement Scheme

Adaptive Strategies	Fully adopted	Mostly adopted	Moderately adopted	Slightly adopted	Not adopted
Crop Diversification	190	26	10	6	0
Planting early maturing and drought tolerant crops	162	36	23	12	0
Changing the planting calendar	200	29	4	0	0
Water Harvesting and Conservation	230	3	0	0	0
Integrating trees and shrubs into agricultural landscapes to enhance soil fertility	77	43	66	31	15
Improved Irrigation Methods	136	57	32	6	1
Migration	9	0	0	0	223
Improving livestock breeds	22	11	179	11	9
Minimum and zero tillage methods	83	76	15	33	25
Off farm activities	159	10	11	23	30

According to MOALF (2017), farmers in Laikipia County have adopted several adaptation strategies against climate risk for instance crop diversification, planting early maturing crops, planting crops earlier than the usual dates, harvesting water and irrigation. This study found out the following about the mentioned adaptation strategies:

Crop diversification emerges as a widely embraced strategy, with a substantial 190 respondents indicating full adoption. This robust adoption suggests a proactive stance among farmers in mitigating climate variability and bolstering overall agricultural resilience through diversified cultivation.

In a study conducted by Mkonda et al. (2018), small holder farmers in Tanzania opted adaptation strategies like early planting and planting crops that take a shorter time to grow to mitigate climate variability. This is conforms with the findings of this study whereby respondents adopted planting early maturing and drought resistant as a mitigation measure against inadequate and unreliable rainfall, with 169 of them highly adopting, 36 mostly adopting, 23 moderately adopting and 12 slightly adopting. Changing of the planting calendar by adjusting the planting date to earlier or later was fully adopted by 200 respondents about 86% indicating that it is among the most popular adaptation strategies among the respondents. It is only 4 respondents who minimally adopted this measure.

Water harvesting and conservation practices also stand out, with 230 respondents fully adopting these measures. This near-universal acceptance underscores the collective acknowledgment of the critical importance of efficient water management, likely driven by concerns over water scarcity and the need for sustainable agricultural practices.

Concerns about soil fertility are addressed through the integration of trees and shrubs into agricultural landscapes, with 120 respondents fully or mostly adopting this strategy. However, the presence of respondents in the moderately and slightly adopted categories suggests a potential area for targeted awareness and promotion to maximize the benefits of this soil enhancement approach.

Sieber et al. (2015) undertook a study in Tanzania and found out that irrigation was the least implemented adaptation strategy by farmers to enhance food security. This deviates from the findings of this study whereby improved irrigation methods demonstrate high adoption rates, with a total of 136 respondents fully or mostly embracing this strategy. This indicates a widespread recognition of the necessity of water use in farming during drought and to supplement rain-fed agriculture.

In reviewed literature, Lam (2011) observed that 3 out of 42 farmers in South Sudan adopted migration as a coping strategy against climate variability and change. This agrees with this study as migration appears to be a minimally adopted strategy, with 223 respondents not incorporating it into their adaptive measures. This suggests a prevailing preference among farmers to stay and adapt to local conditions rather than seeking alternative livelihoods through migration.

The improvement of livestock breeds is moderately adopted by 179 respondents, emphasizing the perceived importance of enhancing the resilience and productivity of livestock for sustainable farming practices. Additionally, minimum and zero tillage methods witness substantial adoption, with 159 respondents fully or mostly embracing these sustainable land management practices.

Off farm activities like looking for casual or permanent jobs and putting up small scale businesses was fully adopted by 159 respondents, mostly adopted by 10 respondents, moderately adopted by 11 respondents and slightly adopted by 23 respondents. However, 30 respondents did not adopt any off farm activities. Adopting off farm activities like casual jobs resonates with the findings of Gakuru (2017) and Porter et al. (1991).

4.4.1 Effectiveness of the Adaptation strategies

Resettled farmers in Shalom resettlement scheme have adopted diverse adaptation strategies both off farm and on farm to mitigate the challenges that they face. The effectiveness of these adaptation strategies also vary. According to Craft and Fisher (2016), the effectiveness of adaptive capacity is determined by intermediate outcomes of the adaptation activities. Effectiveness of the adaptive strategies among the respondents will therefore be measured by the level of adoption by the respondents. High adoption of a particular adaptive capacity indicates that that particular strategy is the most effective among the respondents while low adoption indicates least effectiveness. Figure 9 visually illustrates the effectiveness of the adaptive strategies.
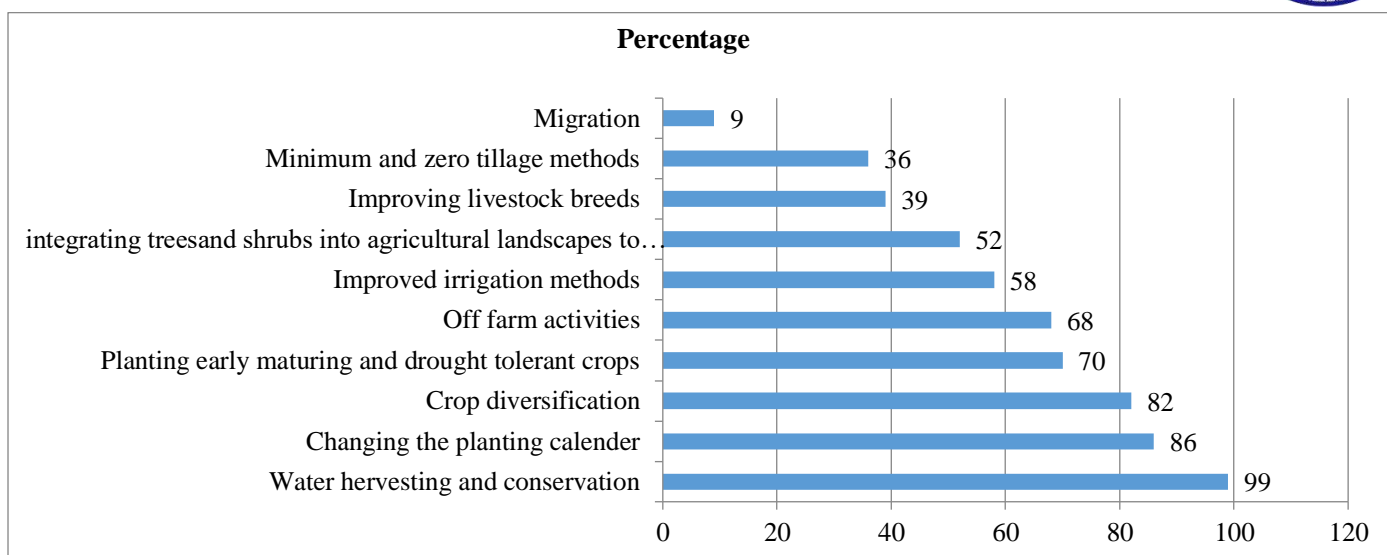
Figure 9
Effectiveness of Adaptation Strategies

V. CONCLUSIONS & RECOMMENDATIONS

5.1 Conclusions

The purpose of this study was to assess the effectiveness of adaptation strategies adopted by resettled farmers in Shalom Resettlement Scheme in Laikipia Central Sub-County. The study reveals distinctive climatic conditions between Shalom resettlement scheme and Nakuru-Uasin Gishu counties especially on mean annual rainfall. The analysis of soil quality in Shalom exposed challenges in soil fertility attributed to inadequate and unreliable rainfall. However in Uasin Gishu and Nakuru, County, the soil types are well drained and support various crops and livestock activities. There is climate variability and water scarcity in Shalom implying vulnerability due to changing weather patterns and the critical importance of water resources. In response to these challenges, farmers in Shalom have adopted Crop diversification, water harvesting and conservation, changing the planting calendar, crop diversification, planting early maturing and drought tolerant crops, improved irrigation methods, livestock breeding and minimum and zero tillage methods. In a nutshell, these approaches highlight resilience and proactive techniques of resettled farmers in Shalom, as they navigate the complex agro-ecological landscape and seek sustainable solutions to emerging challenges.

5.2 Recommendations

The study recommended that water resource management strategies be implemented in Shalom resettlement scheme to promote sustainable agricultural development. Given the identified challenges of water scarcity in the area, adopting techniques such as water harvesting and conservation methods is paramount. Constructing small-scale reservoirs and encouraging rainwater harvesting can significantly enhance water availability for agricultural activities. Another recommendation from this study is to enhance soil fertility for long-term agricultural success in Shalom resettlement scheme. This will be possible through promoting organic farming practices and regular soil health assessments.

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