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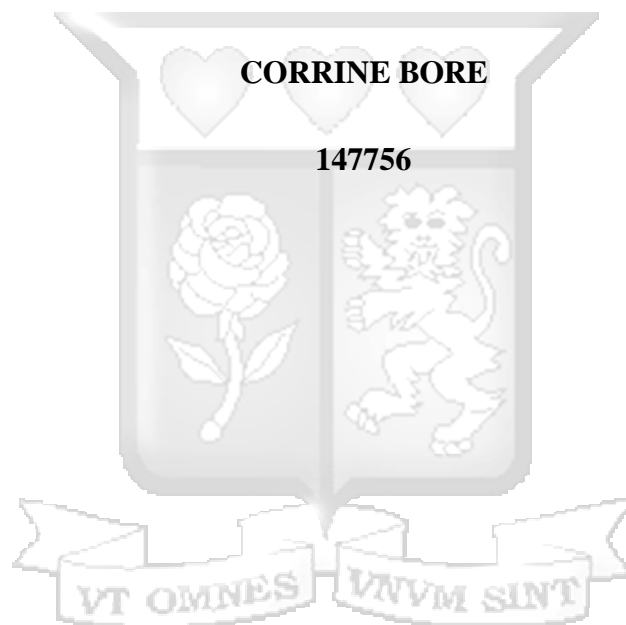
Bore, Corine
Strathmore Business School
Strathmore University

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**RISK COMMUNICATION MEDIA AND ADOPTION OF CLIMATE
CHANGE ADAPTATION STRATEGIES AMONG SMALLHOLDERS'
MAIZE FARMERS IN KAKAMEGA COUNTY**



**A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF
PUBLIC POLICY AND MANAGEMENT AT STRATHMORE UNIVERSITY
BUSINESS SCHOOL**

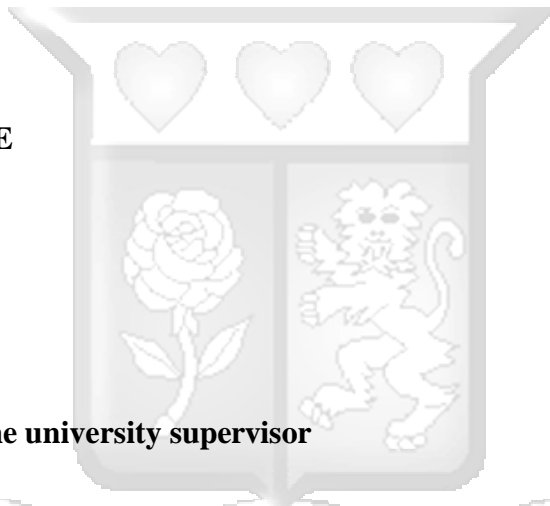
DECLARATION

I declare that this dissertation is my original work and has not been submitted for degree in any other university.

Signed: 

Date: 9/5/2025

CORRINE BORE



Declaration by the university supervisor

This dissertation has been submitted for examination with my approval as university supervisor.

Signed: 

Date:9/5/2025.....

Prof. S. Wagura Ndiritu

DEDICATION

This dissertation is dedicated to my family and friends who have been concerned with my welfare when I was writing this project.



ACKNOWLEDGEMENT

I foremost acknowledge God for gifting good health during the time I wrote the proposal. Secondly, I thank my supervisor for supervision that was good. Lastly, I thank faculty staff, the librarians at Strathmore who I interacted with as I wrote the research project.



ABSTRACT

Climate change continues to threaten the livelihoods of smallholder maize farmers in Kakamega County, Kenya, through declining crop yields and increased food insecurity. While various communication tools exist to support climate change adaptation, their effectiveness among this population remains underexplored. This study investigated the role of social media, traditional media, and volunteer groups in promoting the adoption of climate-smart agricultural practices. It also examined how socio-demographic factors—including age, gender, education, and income—influence farmers' responsiveness to climate communication.

The study was grounded in the Technology Acceptance Model (TAM), Agenda-Setting Theory, and Social Cognitive Theory, providing a multidimensional framework for understanding communication-driven behavioral change. A mixed-methods design was employed, combining quantitative data from structured questionnaires with qualitative insights from open-ended responses. A stratified random sample of 384 smallholder farmers across 12 sub-counties was selected. Quantitative data were analyzed using a multivariate probit model, while thematic analysis was applied to qualitative data. The findings revealed that all three communication channels significantly influenced the adoption of climate-smart practices. Social media platforms such as WhatsApp and Facebook enhanced access to real-time, peer-driven advice but were limited by digital access and literacy. Traditional media, especially radio, was widely trusted and accessible, though less interactive. Volunteer groups—including NGOs and local community organizations—emerged as especially effective in fostering trust, contextualizing technical knowledge, and encouraging participatory learning. Socio-demographic factors moderated the relationship between communication exposure and adaptation behavior. The study concludes that risk communication media play a critical, complementary role in supporting climate adaptation among smallholder farmers. However, disparities in digital access, infrastructural limitations, and the one-way nature of some media channels present barriers to inclusivity. To address these gaps, the study recommends a multi-platform communication strategy that enhances digital infrastructure, promotes localized content in traditional media, and strengthens the capacity of volunteer networks to deliver climate information in trusted, participatory formats.

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LIST OF ABBREVIATIONS AND ACRONYMS

COVID	Coronavirus Disease
FAO	Food and Agriculture Organization
ICT	Information and Communication Technology
IPCC	Intergovernmental Panel on Climate Change
KES	Kenya Shillings
KNBS	Kenya National Bureau of Statistics
MVP	Multivariate Probit Model
NACOSTI	National Commission of Science, Technology and Information
NGO	Non-Governmental Organization
SDGs	Sustainable Development Goals
SPSS	Statistical Package for Social Sciences
TAM	Technology Acceptance Model
TV	Television
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme

DEFINITION OF TERMS

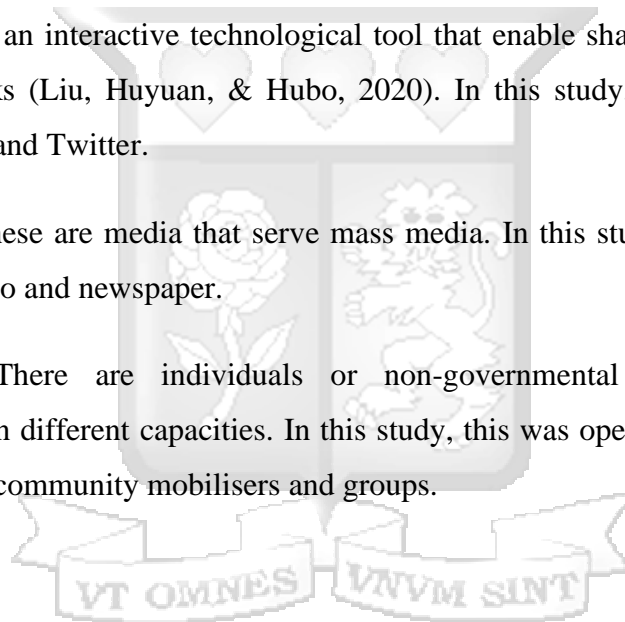
Climate Adaptive strategies for farmers- growing crops that are adaptive to droughts (Lamichhane, Hadjikakou, & Miller, 2022).

Risk communication- it is a process of giving out information to audiences on risks of different nature such as health, safety or environmental risks so that the public stays informed and is able to take appropriate decisions (Barnett, Neil, & Paola, 2020).

Social media- This is an interactive technological tool that enable sharing of information in social networks (Liu, Huyuan, & Hubo, 2020). In this study, this refers to use of Facebook, X and Twitter.

Traditional media- These are media that serve mass media. In this study it represent use of television, radio and newspaper.

Volunteer groups- There are individuals or non-governmental players who serve communities in different capacities. In this study, this was operationalised to refer to use of NGOs, community mobilisers and groups.



CHAPTER ONE

INTRODUCTION TO THE STUDY

1.1 Background of the Study

Climate change has emerged as a defining challenge of the 21st century, threatening agricultural systems, natural ecosystems, and human well-being across the globe (Ngcamu, 2023). Its effects—ranging from prolonged droughts and erratic rainfall to increased temperatures and flooding—disproportionately affect low-income countries, particularly in sub-Saharan Africa, where livelihoods depend heavily on rain-fed agriculture (Matamanda et al., 2022).

Agriculture, and especially smallholder farming, is among the most vulnerable sectors due to its dependence on climate-sensitive inputs. In Kenya, smallholder farmers produce approximately 70% of the country's food and are thus central to food security and rural development (KNBS, 2023). However, the increasing unpredictability of rainfall patterns, soil degradation, pest outbreaks, and extreme weather events have rendered traditional farming practices inadequate, particularly for maize farmers in regions like Kakamega County (Mumo et al., 2021; Hasan et al., 2021).

To address these challenges, various climate change adaptation strategies have been promoted. Adaptation involves modifying systems, behaviors, and technologies to reduce vulnerability and increase resilience to climate stressors (Hossain et al., 2022). Among smallholder farmers, common adaptation strategies include the adoption of drought-tolerant seeds, crop diversification, water conservation, and conservation tillage (Suci et al., 2023). However, the adoption of these strategies is not uniform and is often hindered by a lack of timely, accessible, and actionable information.

In this regard, risk communication—the exchange of real-time information to help individuals understand and respond to risks—plays a pivotal role (Warren & Lofstedt, 2022). Effective risk communication not only raises awareness but also influences perceptions, decisions, and behavior (Warren & Lofstedt, 2022). It is essential for supporting adaptation by conveying information on weather forecasts, climate trends, and agricultural innovations.

Traditional media platforms such as radio, television, and newspapers remain widely used in Kenya, particularly in rural areas with low digital connectivity (Adera et al., 2022). These platforms have historically served as key channels for disseminating public policy, health information, and agricultural extension services. On the other hand, digital tools—especially social media platforms like WhatsApp and Facebook—are gaining traction among younger and more connected farmers, enabling rapid sharing of weather alerts, training materials, and community best practices (Celine, Jack, & Stephane, 2023).

Recent evidence suggests that community organizations and volunteer groups, such as agricultural cooperatives, NGOs, and extension agents, play an equally critical role in contextualizing and localizing climate-related messages (Lejano et al., 2023; Shabana et al., 2022). These groups often act as trusted intermediaries who translate technical information into culturally appropriate and actionable knowledge. However, while the range of communication channels is expanding, there remains a significant research gap in evaluating their effectiveness in supporting climate adaptation. Particularly in Kakamega County—where maize farming is predominant, land is highly fragmented, and climate shocks are increasing—there is limited empirical evidence on how different communication tools influence farmers' decisions to adopt adaptive practices (Mutai et al., 2022). Questions remain about which channels are trusted, which reach the most marginalized, and how they shape behavior across gender, age, and income levels.

Moreover, most existing studies in Kenya have focused on general perceptions of climate change or government policy implementation but have not sufficiently interrogated the role of communication channels in climate adaptation (Musafiri et al., 2022; Waaswa et al., 2021). There is therefore an urgent need to explore how various risk communication tools—digital, traditional, and community-based—interact with farmer characteristics to promote or hinder the uptake of adaptation strategies. This study seeks to address that gap by investigating the role of risk communication media—including social media, traditional media, and volunteer groups—in promoting the adoption of climate change adaptation strategies among smallholder maize farmers in Kakamega County. By analyzing communication reach, content trust,

and perceived usefulness, the study provides insights to support evidence-based, inclusive communication policies that enhance climate resilience.

1.1.1 Public Policy Communication

Public policy communication refers to the deliberate transmission of policy-related messages by government bodies and affiliated institutions to influence public understanding, engagement, and compliance (Shabana, Kiarie, & Okumu, 2022; Lejano et al., 2023). According to Akpan et al. (2021), it encompasses the strategic use of media and outreach platforms to communicate development plans, risk information, and behavioral guidelines to targeted segments of the population. Kaihura and Atela (2020) emphasize that in climate-sensitive contexts, public policy communication is not just about informing communities, but also about creating spaces for feedback, interpretation, and local appropriation of information.

In Kenya, public policy communication related to agriculture and climate adaptation is carried out through a mix of mass media (e.g., radio, TV), digital platforms (e.g., government websites, WhatsApp), and face-to-face community mechanisms (e.g., barazas, field demos). Institutions such as the Kenya Meteorological Department (KMD), Ministry of Agriculture, and National Drought Management Authority (NDMA) disseminate information on weather updates, resource allocation, subsidies, and risk mitigation programs using these multi-channel systems (UNDP Kenya, 2021; Kipkosgei & Ng'etich, 2021).

However, access and responsiveness to public policy messaging vary significantly based on infrastructure quality, trust in government, media preferences, and literacy levels (Lejano et al., 2023). While national digital platforms like e-extension services are expanding, uptake among rural farmers remains low due to digital barriers and affordability constraints (Celine, Jack, & Stephane, 2023). Conversely, radio continues to dominate as the most reliable and trusted source of public policy communication, especially in marginalized and low-literacy communities (Adera et al., 2022).

Importantly, scholars stress that effective public policy communication must not only inform but also foster trust, enable participation, and contextualize messages (Lejano et al., 2023; Shabana et al., 2022). This becomes especially crucial in climate

adaptation, where behavioral uptake of new practices depends on how well messages are localized, co-produced, and perceived as credible by smallholder communities.

This study therefore considers public policy communication as a key variable in understanding how risk information about climate change adaptation is disseminated, received, and acted upon by smallholder maize farmers in Kakamega County.

1.1.2 Risk Communication Media

As climate change intensifies, the need for effective communication of climate risks to vulnerable populations has become increasingly urgent. In this context, risk communication refers to the timely dissemination of information about environmental hazards and adaptation strategies, enabling individuals and communities to make informed, proactive decisions (Warren & Lofstedt, 2022). It extends beyond broadcasting warnings—encompassing trust-building, accessibility, clarity of interpretation, and behavioral influence. For smallholder farmers facing disruptions like erratic rainfall or pest outbreaks, the effectiveness of risk communication directly shapes their adaptive responses.

Yet, digital inequality—manifested in limited internet access, low digital literacy, and high data costs—remains a significant barrier to the full utilization of social media platforms in rural Kenya (Kipkosgei & Ng’etich, 2021; Celine et al., 2023). However, the presence of these barriers does not eliminate the need for research; rather, it underscores it. While infrastructure challenges are real, they do not fully explain the variability in adoption of climate adaptation practices. Many farmers with similar levels of access respond differently to communication tools, suggesting that other factors—such as trust in the source, relevance of content, perceived credibility, and media familiarity—play a critical role (Lejano et al., 2023; Adera et al., 2022). Furthermore, even in low-connectivity settings, hybrid communication models that integrate traditional media with mobile-based platforms are increasingly used to reach diverse populations (Shabana et al., 2022). Therefore, this study is not merely advocating for improved digital infrastructure (though important), but seeks to identify which communication tools—traditional, digital, or community-based—are most effective under current socio-economic conditions. The goal is to generate evidence that can guide targeted investments in communication strategies, ensuring that efforts to promote climate adaptation are inclusive, efficient, and responsive to

farmers' realities.

Traditional media, particularly radio and television, remain the dominant sources of public information for many rural households. According to the Kenya National Bureau of Statistics (KNBS, 2023), more than 80% of rural households rely on radio as their primary source of agricultural and weather-related information. Stations such as West FM, Mulembe FM, and Radio Maisha have been pivotal in relaying government advisories, weather forecasts, and subsidy programs. Their use of local languages and familiar presenters fosters trust and relevance among farming communities (Adera et al., 2022).

Beyond formal communication channels, community-based groups and volunteer networks play a vital intermediary role. These include farmer cooperatives, religious institutions, youth organizations, and NGOs such as One Acre Fund and Vi Agroforestry, which are active in Kakamega County. These entities often act as trust brokers, translating national policies into localized, culturally relevant messages (Lejano et al., 2023). Participatory methods such as farmer field schools, public barazas, and demonstration plots further enhance engagement and accountability through feedback loops between farmers and policymakers.

An integrated communication approach—where traditional media, social platforms, and community organizations are used in tandem—has been shown to improve message reach and behavioral impact. For example, Shabana et al. (2022) found that layering messages across multiple media significantly improved climate awareness and action in rural Kenya. Similarly, Mutai et al. (2022) emphasize that the repetition of trusted messages across varied platforms strengthens retention and uptake, especially in regions with fragmented infrastructure.

However, despite these advances, the comparative effectiveness of these communication tools in supporting climate adaptation remains poorly understood. Research suggests that communication in many sub-Saharan African contexts is often top-down, fragmented, and not tailored to farmers' knowledge systems—weakening its behavioral impact (Tambo & Wünscher, 2019). Furthermore, few empirical studies have systematically compared the uptake of climate messages disseminated via social media, traditional media, and community-based mechanisms (Mutai, Ouma, & Chebet,

2022; Shabana, Kiarie, & Okumu, 2022; Musafiri, Odira, & Njoroge, 2022).

Given that media usage and trust are shaped by socio-demographic variables such as age, gender, education, and income, it is crucial to assess which platforms are most effective in diverse rural settings like Kakamega (Lejano et al., 2023; Adera, Ketema, & Girma, 2022). Without such evidence, communication strategies may inadvertently exclude marginalized groups or fail to prompt desired behavioral responses.

This study therefore examined how each of these communication channels—social media, traditional media, and volunteer groups—influences the adoption of climate change adaptation strategies among smallholder maize farmers. By evaluating their comparative reach, credibility, and utility, the research contributes to developing evidence-based, inclusive, and context-sensitive risk communication frameworks aligned with the socio-economic realities of rural Kenya.

1.1.3 Climate Change Adaptation Strategies among Smallholders Farmers

Climate change poses a significant and growing threat to smallholder agriculture globally. Increasingly erratic rainfall, prolonged droughts, soil degradation, and pest invasions are disrupting farming systems and compromising food security (Ngcamu, 2023; Kogo et al., 2021). In sub-Saharan Africa, including Kenya, smallholder farmers—who cultivate the majority of agricultural land—are particularly vulnerable due to limited access to capital, technology, extension services, and reliable climate information (Suci et al., 2023).

Climate change adaptation strategies are defined as adjustments in practices, processes, and systems that enable communities to reduce their vulnerability and enhance resilience to climate variability and long-term changes (Hossain et al., 2022; Tambo et al., 2021). Among smallholder farmers, these strategies often emerge as integrated responses to both environmental stress and socio-economic constraints. Based on a synthesis of recent literature, climate adaptation strategies generally fall into four broad categories: agronomic practices, water management, livelihood diversification, and institutional or community-based support mechanisms (Asfaw et al., 2020; Kogo et al., 2021; Lejano et al., 2023).

Agronomic adaptation strategies focus on modifying crop production techniques to better suit changing climatic conditions. These include the use of drought-resistant

seed varieties, early-maturing crops, crop rotation, intercropping, and conservation tillage (Suci et al., 2023; Abid et al., 2022). Such techniques are designed to optimize yields despite uncertain weather patterns and degraded soils. In Kenya, adoption of climate-resilient maize and legumes is gaining ground among smallholders, often supported by NGOs and research institutions (Hasan et al., 2021). These methods are knowledge- and labor-intensive, requiring sustained extension services and risk communication for proper implementation.

Water management strategies aim to conserve and efficiently use water resources, especially in regions affected by rainfall variability. Techniques include rainwater harvesting, construction of small dams, mulching, shallow wells, and drip irrigation systems (Fadjry et al., 2022). These approaches help maintain soil moisture, reduce evaporation, and stabilize yields during dry spells. Despite their effectiveness, adoption is often constrained by high upfront costs and lack of technical guidance, making access to credible information and support mechanisms essential (Waaswa et al., 2023).

Livelihood diversification involves spreading income sources beyond staple crop farming to reduce economic risk. Farmers may engage in poultry, beekeeping, agro-processing, small-scale trade, or wage labor (Kipkosgei & Ng'etich, 2021; Asfaw et al., 2020). This approach helps households absorb shocks from crop failure or price volatility and enhances food security. Diversification also includes growing high-value crops, especially for women and youth, who may lack access to land. Communication of market information and training opportunities is vital to support uptake of diversification strategies.

Institutional strategies include participation in farmer cooperatives, climate-smart training programs, savings groups, and community seed banks. These mechanisms enhance collective resilience by pooling resources, facilitating access to credit, and creating networks of trust for information sharing (Shabana et al., 2022; Lejano et al., 2023). Community-based organizations and volunteer networks play a crucial intermediary role in translating scientific knowledge into actionable practices and fostering social learning. Their effectiveness depends on inclusivity, leadership structures, and external linkages with policy actors.

In this study, the variable “climate change adaptation strategies” was operationalized based on the four-category typology above. Each category was represented by a set of observable, farmer-reported behaviors, including (but not limited to) the use of drought-tolerant seed, water harvesting practices, income diversification, and participation in community training or cooperatives. The study adapted indicators used in previous African agricultural adaptation research (e.g., Tambo et al., 2021; Abid et al., 2022), ensuring contextual relevance to smallholder maize farmers in Kakamega. This operationalization aligns with the conceptual framework of the study, which integrates adaptation strategies as dependent variables influenced by communication channels (independent variables) and farmer socio-demographics (control variables).

Despite efforts to promote climate-smart agriculture (CSA) across Kenya, uptake remains uneven. Waaswa et al. (2020) highlight that adaptation decisions are influenced not only by biophysical conditions, but also by farmers’ perceptions of risk, access to trusted information, and support networks. Similarly, Abid et al. (2016) demonstrated that in Pakistan, the presence of early warning systems, social networks, and trusted information channels significantly influenced adaptation behavior—lessons that are directly applicable to African contexts where information asymmetry persists.

In Kenya, CSA practices include drought-tolerant seed varieties, pest-resistant crops, and conservation techniques tailored to local agro-ecological zones. For example, water harvesting methods such as shallow wells, drip irrigation, and roof catchment systems are increasingly adopted in regions facing rainfall variability (Fadjry et al., 2022). Similarly, organic farming, composting, and conservation tillage are being implemented to improve soil structure, moisture retention, and long-term land productivity (Hasan et al., 2021).

Crop diversification, whether across growing seasons or within a single field, is promoted to reduce dependency on monoculture and spread production risks. This strategy also enhances household nutrition and income stability. Rotational farming and agroforestry are gaining popularity as sustainable methods to restore soil fertility and bolster ecosystem health, particularly in regions experiencing land degradation (Mumo et al., 2021).

In Kakamega County, maize remains both a staple food and a key economic crop. However, climate variability has contributed to declining maize yields—by as much as 25–30% over the past decade—driven by soil exhaustion, increased pest outbreaks (e.g., fall armyworm), and extreme rainfall events that cause flooding and erosion (KNBS, 2023; Kogo et al., 2021). These challenges are compounded by land fragmentation, which reduces plot sizes, limits mechanization, and constrains economies of scale necessary for implementing large-scale adaptation technologies.

To cope, many smallholder farmers in Kakamega have begun to adopt low-cost, high-impact strategies. These include using cover crops, mulching, improved maize varieties, and joining farmer cooperatives or savings groups to improve access to farm inputs. However, adoption remains inconsistent, and is often mediated by gender, education, household income, and—critically—access to information (Celine, Jack, & Stephane, 2023).

Empirical evidence increasingly underscores the role of risk communication in influencing the adoption of adaptation strategies. Farmers with access to localized, timely, and credible information—such as weather forecasts, early warnings, and agronomic advice—are more likely to take proactive measures to reduce climate risks (Lejano et al., 2023; Musafiri et al., 2022). This positions communication tools as not just a delivery mechanism but a central determinant of adaptive capacity.

In summary, the adoption of climate change adaptation strategies among smallholder farmers involves an interplay of agronomic innovation, resource management, livelihood flexibility, and institutional support. These strategies are not mutually exclusive but often operate in tandem, shaped by local conditions, information flows, and socio-cultural factors. In this study, the concept is grounded in this four-fold categorization, consistent with recent empirical and theoretical literature (Tambo et al., 2021; Asfaw et al., 2020). This framing provides the foundation for analyzing how communication tools influence adaptive behaviors in the rural Kenyan context.

1.1.4 Smallholder Maize Farmers in Kakamega County

This study sought to understand how smallholder maize farmers in Kakamega County adopt specific climate adaptation strategies in response to risk communication disseminated through social media, traditional media, and community-based

organizations. The research aimed to identify which strategies are being implemented, how communication channels influence adoption behavior, and what barriers persist in translating knowledge into practice.

Kakamega County is located in western Kenya, covering approximately 3,033.8 km², and is bordered by Nandi, Bungoma, Trans Nzoia, and Vihiga counties (County Government of Kakamega, 2023). The region experiences a bimodal rainfall pattern, with annual precipitation ranging from 1,200 mm to 2,200 mm and temperatures between 18°C and 29°C. Its population of 1.8 million people is distributed across 12 sub-counties. Agriculture is the backbone of the county's economy, accounting for over 65% of household income (KNBS, 2023). Maize is both a staple food and a key income crop, yet its productivity has declined due to land fragmentation, climate variability, and pest pressures. These dynamics underscore the relevance of this study in investigating how farmers in the region access, trust, and act upon climate-related communication.

The main economic activity of the county is agriculture as it is for other parts in Kenya. Most of the residents are involved in mixed farming where they grow crops and rear livestock. The staple food of the County is maize and most natives grow their own maize in small parcels of land. However, the sustainability of smallholder maize farmers in Kakamega is in jeopardy. Firstly, land segmentation as a result of increasing population has reduced the acreage under maize farming. Moreover, climate change has not spared the smallholder maize farmers. Climate change exacerbates the dire situation that exist in most parts of Kakamega County due to land segmentation. This study is therefore justified due to the aforementioned facts and also considering that over 65 %n of total earnings in Kakamega is from agricultural activities (KNBS, 2023).

1.2 Problem Statement

Smallholder farmers account for over 75% of Kenya's agricultural producers, supplying an estimated 70% of the country's food (KNBS, 2023). However, this critical sector faces intensifying climate stressors—including prolonged droughts, unpredictable rainfall, soil erosion, and pest outbreaks—that significantly undermine productivity and food security. In Kakamega County, a key maize-producing region, maize yields have declined by 25–30% over the past decade due to climate variability and land fragmentation (Mumo et al., 2021; FAO, 2023).

Globally, empirical studies have shown that access to risk communication plays a crucial role in how smallholder farmers adopt climate change adaptation practices. In India, Kattumuri et al. (2021) found that farmers exposed to multi-platform climate information (SMS, radio, field visits) were significantly more likely to adopt drought-tolerant crops and insurance schemes. In Bangladesh, Hossain et al. (2022) demonstrated that access to localized climate forecasts improved timely planting decisions and reduced input losses. Cairns et al. (2021) reported similar results in Guatemala, where participatory weather advisories enhanced trust and uptake of water conservation practices. Zhang & Mullan (2020), studying smallholders in China, emphasized that trust in messengers and institutional credibility were just as important as the information content in shaping farmer behavior.

Regionally, in Tanzania, Rwengabo et al. (2022) found that mobile-based agro-weather updates improved early planting and fertilizer use among maize farmers, but adoption varied by gender and digital literacy. Tambo et al. (2021), in a meta-study across sub-Saharan Africa, confirmed that adoption of climate-smart agriculture is heavily influenced by how adaptation messages are framed, delivered, and localized. In Uganda, Nabukalu & Agaba (2023) highlighted that combining radio campaigns with farmer field schools led to higher uptake of mulching and agroforestry. Getahun & Melesse (2020), studying Ethiopian highlands, found that community trust networks often outperformed formal channels in driving behavior change, especially among low-literacy groups.

These global and regional studies confirm that risk communication is a key behavioral determinant in climate adaptation. However, they also underscore the need for context-specific evidence, as media trust, access, and interpretation vary by geography, culture, and socio-economic profile. In Kenya, most existing studies have focused on general perceptions of climate change (Musafiri et al., 2022; Nyang'au et al., 2021) or on extension officers' roles (Waaswa et al., 2021), without systematically comparing how different communication media influence farmers' adaptation decisions. A recent report by the Kenya Climate Innovation Center (KCIC, 2023) shows that over 65% of farmers in Western Kenya rely on unverified sources—such as peers, village leaders, or hearsay—for climate-related information, raising concerns about misinformation and inaction. This research therefore sought to fill a critical gap

by analyzing how social media, traditional media, and volunteer/community-based channels influence the adoption of adaptation strategies among smallholder maize farmers in Kakamega. The goal is to inform evidence-based, inclusive communication frameworks aligned with Kenya's national climate resilience agenda.

1.3 General Objective

The general objective of the study was to examine how different risk communication media influence the adoption of climate change adaptation strategies among smallholder maize farmers in Kakamega County.

1.3.1 Specific Objectives

This study was guided by the following specific objectives:

- i. To evaluate the effect of social media on adoption of climate change adaptation strategies among smallholders' maize farmers in Kakamega County.
- ii. To examine the effect of traditional media on adoption of climate change adaptation strategies among smallholders' maize farmers in Kakamega County.
- iii. To evaluate the effect of community-based organizations and volunteer groups on adoption of climate change adaptation strategies among smallholders' maize farmers in Kakamega County.

1.4 Research Questions

The study endeavoured to answer the following research questions:

- i. What is the effect of social media on adoption of climate change adaptation strategies among smallholders' maize farmers in Kakamega County?
- ii. What is the effect of traditional media on adoption of climate change adaptation strategies among smallholders' maize farmers in Kakamega County?
- iii. What is the effect of community-based organizations and volunteer groups on adoption of climate change adaptation strategies among smallholders' maize farmers in Kakamega County?

1.5 Scope of the Study

This study was conducted within Kakamega County, Kenya, and focused on smallholder maize farmers across all 12 sub-counties. The research examined how different forms of risk communication media—namely social media, traditional media, and community-based volunteer groups—influence the adoption of climate change adaptation strategies. Thematically, the study addressed climate adaptation practices such as crop diversification, drought-tolerant seed use, water conservation, and participation in institutional support systems.

The methodological scope of the study employed a mixed-methods approach, combining both quantitative and qualitative data collection and analysis. Quantitative data were obtained using structured questionnaires with Likert-scale items, while qualitative insights were gathered through open-ended responses. The study applied a stratified random sampling technique to select a sample of 384 smallholder maize farmers. Quantitative data were analyzed using a multivariate probit model to assess the relationship between exposure to communication channels and the likelihood of adopting multiple adaptation strategies. Thematic analysis was used to interpret qualitative responses.

The theoretical scope was grounded in four key frameworks: the Technology Acceptance Model (TAM), Agenda-Setting Theory, Social Cognitive Theory, and Trust Determination Theory. These theories collectively guided the investigation into how communication tools, perceived credibility, media framing, social learning, and behavioral intention influence farmers' decisions to adopt adaptive practices.

The time scope of the study spanned from November 2024 to April 2025, encompassing the research design, data collection, analysis, and final reporting phases. Data were collected during the short-rain agricultural season, a critical period for maize production and climate-sensitive decision-making in the region. The study was limited to smallholder maize farmers and adaptation strategies only. It did not include commercial or large-scale farming systems, nor did it investigate mitigation practices. The scope also excluded non-agricultural communication domains such as health or education, although implications for broader public policy communication are acknowledged in the discussion.

1.6 Significance of the Study

This study addresses a critical knowledge gap in climate change communication research by examining how different risk communication media—social media, traditional media, and community-based organizations—affect the adoption of climate change adaptation strategies among smallholder maize farmers in Kakamega County. Most existing research in Kenya and the region has focused on general perceptions of climate change or the role of government policies, with limited empirical evidence comparing the effectiveness of diverse communication channels in influencing behavioral change at the grassroots level. This study provides a context-specific, comparative analysis that helps fill that void.

For policymakers, particularly in Kakamega County and similar agricultural regions, the study offers evidence-based insights to guide the development of inclusive, targeted, and effective risk communication strategies. The findings can inform which platforms—radio, WhatsApp, extension forums, or farmer cooperatives—are most trusted and impactful among different farmer groups based on gender, age, education, and income levels. This enables the design of communication policies that reduce information asymmetries and promote climate resilience more equitably.

The study is also significant to management practitioners and development partners involved in agricultural extension, rural development, and climate risk reduction. It provides guidance on how to tailor communication campaigns, enhance trust in information sources, and improve outreach to marginalized communities. Beyond agriculture, these lessons are applicable to other crisis communication contexts, such as health emergencies (e.g., COVID-19), where rapid, trusted information dissemination is vital.

From a theoretical perspective, the study contributes to the literature on risk communication, behavioral adaptation, and rural media usage. It integrates and applies frameworks such as the Technology Acceptance Model, Agenda-Setting Theory, Social Cognitive Theory, and Trust Determination Theory to a rural African setting—offering insights that can inform future comparative and cross-country studies. Finally, the study provides a foundation for future academic inquiry into how communication tools influence adaptive behavior in low-income, climate-vulnerable

contexts. Researchers can build on its findings to explore longitudinal impacts, test communication interventions, or evaluate other media forms such as climate apps or vernacular podcasts.



CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature on the role of risk communication tools in promoting the adoption of climate adaptation strategies among smallholder maize farmers. It explores theoretical and empirical studies on the effectiveness of communication platforms—such as social media, traditional media, and community networks—in disseminating climate change information. The chapter also identifies gaps in existing research, particularly in the context of Kakamega County, Kenya. Additionally, it outlines the study’s conceptual framework, linking communication tools to the adoption of adaptive practices, and provides a structured operationalization of variables to guide analysis. This review establishes the study’s foundation within the field of Public Policy and Management, emphasizing the need for effective communication in addressing climate resilience challenges.

2.2 Theoretical Literature

Theoretical literature entails a discussion of relevant theories that expound on the concepts and variables of a study. The study was based on Technology Acceptance Model (TAM), Agenda-Setting Theory, Social Cognitive Theory and Trust Determination Theory.

2.2.1 Technology Acceptance Model

The Technology Acceptance Model (TAM), developed by Fred Davis (1989), is one of the most widely used frameworks for understanding the adoption of technology by individuals. The model proposes that behavioral intention to use a technology is primarily influenced by two core constructs: perceived usefulness—the extent to which a user believes that the technology enhances their task performance—and perceived ease of use—the degree to which using the technology is free of effort (Davis, 1989; Venkatesh & Bala, 2008).

TAM is directly relevant to the first objective of this study, which seeks to evaluate the effect of social media on the adoption of climate change adaptation strategies. In this context, social media platforms like WhatsApp, Facebook, and YouTube are

considered information technologies through which smallholder maize farmers may access timely climate information, agricultural training content, and peer knowledge-sharing. To operationalize TAM in this study, the questionnaire includes items that specifically measure perceived usefulness (e.g., “How helpful is social media in improving your farming practices?”) and ease of use (e.g., “How easy is it for you to access and navigate social media?”), ensuring alignment between the theoretical constructs and empirical design.

Empirical research has validated TAM’s relevance in agriculture and climate communication. For instance, Alalwan et al. (2017) found that both perceived usefulness and ease of use were statistically significant predictors of social media adoption among farmers in Jordan, particularly in accessing climate and market information. Similarly, Khanal et al. (2022), in a study on smallholder farmers in Nepal, demonstrated that perceived usefulness strongly influenced the use of mobile platforms for adopting climate-smart agricultural practices. These findings reinforce the utility of TAM in explaining digital tool adoption in rural farming contexts.

Despite its strengths, TAM has been subject to important critiques. Scholars argue that it underrepresents contextual variables, such as socio-economic constraints, institutional support, and cultural norms, which are particularly influential in low-resource agricultural settings (Bagozzi, 2007; Dwivedi et al., 2020). The model also assumes rational behavior and decision-making, often overlooking emotional drivers, peer influence, and trust factors that shape technology uptake in social systems. Furthermore, TAM does not adequately address the credibility of information sources, which is especially critical when assessing social media’s role in climate risk communication (Miller et al., 2021).

Despite its limitations, TAM remains essential for this study because it operationalizes how farmers assess and engage with digital communication tools—specifically social media. In the conceptual framework, social media is one of the key independent variables, and TAM provides the constructs (perceived usefulness, ease of use) that shape behavioral intention to adopt climate adaptation strategies. Empirically, these constructs are measured using Likert-scale survey items and analyzed against farmers’ adoption behaviors. The theory supports the first objective by explaining the mechanism through which digital communication influences

behavior, especially when moderated by socio-demographic variables such as age and education. TAM's explanatory strength is enhanced through integration with Trust Determination Theory, which addresses the role of messenger credibility—something TAM alone cannot fully capture.

2.2.2 Agenda-Setting Theory

Agenda-Setting Theory, developed by McCombs and Shaw (1972), asserts that the media has significant power to shape public perception by selecting and emphasizing specific topics in news coverage. The theory posits that by repeatedly highlighting certain issues, the media indirectly sets the public agenda—guiding audiences on what to think about, even if not what to think. In the context of public policy, agenda-setting influences how citizens perceive the salience and urgency of issues such as climate change, and by extension, the behaviors they adopt in response (McCombs, 2004).

This theory is directly aligned with the second objective of this study, which seeks to examine the effect of traditional media (radio and television) on the adoption of climate change adaptation strategies among smallholder maize farmers in Kakamega County. In rural Kenya, traditional media remains the most accessible and trusted source of public information, and how it frames messages related to drought, floods, or pest outbreaks can significantly shape farmers' prioritization of adaptive practices.

Empirical studies support this theoretical linkage. Tadesse et al. (2021) found that drought preparedness programs aired on Ethiopian rural radio significantly increased the adoption of water conservation practices. Similarly, Matamanda et al. (2022) observed that television broadcasts in South Africa enhanced awareness and adoption of climate-smart agriculture by framing climate risks as urgent policy concerns. In Kenya, rural radio stations such as West FM and Radio Mulembe play a comparable role in shaping public awareness of seasonal forecasts and government programs.

However, the theory is not without limitations. A key critique is that it underemphasizes the active role of audiences in interpreting media messages. It assumes a relatively passive audience, which is problematic in rural contexts where community dialogue, local knowledge systems, and interpersonal communication may mediate or even override media influence (Wanta & Ghanem, 2007; Chikezie et al., 2021). In particular, cultural beliefs, literacy levels, and trust in messengers heavily shape how climate

information is received and acted upon.

Another limitation is its narrow focus on traditional media in an era of rapidly expanding digital platforms. The rise of mobile phone ownership, WhatsApp groups, and social media in rural Africa means that traditional agenda-setting mechanisms are increasingly fragmented and multi-directional (Celine, Jack, & Stephane, 2023). As a result, audience members no longer receive messages passively; instead, they select, remix, and redistribute content—a dynamic not accounted for in classical Agenda-Setting Theory.

Despite its critiques, Agenda-Setting Theory remains relevant for explaining how traditional media, as shown in the conceptual framework, influences farmers' climate adaptation decisions through issue salience and framing. The theory directly informs the second objective, which assesses traditional media's effect on behavior change. Empirically, the study examines how frequently farmers are exposed to certain risk messages via radio/TV and whether that exposure correlates with adoption of specific strategies. This aligns with the conceptual framework's pathway from media exposure (independent variable) to behavioral adoption (dependent variable), with moderators such as trust and education mediating the effect. Integrating this theory helps explain why certain issues receive priority attention in public perception, thereby influencing climate response behavior.

2.2.3 Social Cognitive Theory

Social Cognitive Theory (SCT), developed by Albert Bandura (1986), provides a comprehensive framework for understanding human behavior in social contexts. It posits that behavior is shaped through a process of triadic reciprocal determinism—where personal factors, environmental influences, and behavioral responses interact dynamically (Bandura, 2001). This theory departs from linear cause-effect models by emphasizing that individuals not only react to their environments but also actively shape them.

A central construct in the theory is observational learning, which refers to learning that occurs by watching others' actions and the outcomes of those actions. In agricultural systems, observational learning is prevalent in farmer field schools, peer-to-peer exchange, and community-based demonstration plots, where farmers witness the

success of adaptive strategies such as crop rotation, conservation tillage, or drought-resistant seed use (Tambo, Abdoulaye, & Kansiime, 2021; Musiime et al., 2022).

Another pivotal construct is self-efficacy—the belief in one's capacity to perform specific behaviors successfully. SCT emphasizes that individuals are more likely to adopt new practices when they believe they can implement them effectively, even under challenging conditions (Bandura, 2001). This is particularly relevant in Kakamega County, where volunteer groups, community mobilizers, and NGOs help farmers develop confidence in trying out new climate-resilient practices. Empirical evidence from East Africa shows that higher self-efficacy is linked with greater adoption of climate-smart agriculture (CSA) practices, especially when support is embedded in trusted social networks (Lejano et al., 2023; Ayal et al., 2022).

SCT also underscores the importance of social reinforcement and modeling—people are more likely to emulate behaviors that are positively reinforced and performed by credible role models. This has direct implications for the third objective of this study, which examines how volunteer and community-based groups influence adoption. For example, Musiime et al. (2022) found that smallholders in Uganda were more likely to implement soil conservation practices when these were introduced by respected peers or community leaders, rather than by external agents. Similarly, Shabana et al. (2022) demonstrated that community engagement improved adaptation outcomes by aligning messages with culturally embedded norms and relational trust.

Despite its strengths, SCT is not without limitations. First, the theory assumes a level of rational decision-making and agency that may not exist in contexts of poverty, insecurity, or cultural constraint. For instance, even if a farmer observes a neighbor successfully implementing an adaptation practice, they may lack the financial or institutional capacity to replicate the action (Wreford, Ignaciuk, & Gruère, 2017). Second, SCT places heavy emphasis on individual learning, potentially underplaying structural or policy barriers that constrain behavioral choices, such as access to inputs or market incentives. These critiques are particularly relevant in the Kenyan rural context, where land fragmentation, unreliable extension services, and limited credit access can inhibit even well-informed farmers from adopting new strategies (Otieno et al., 2022).

SCT is well-aligned with the third objective and is directly embedded in the conceptual framework, where community-based organizations and volunteer groups are modeled as channels of influence on farmer behavior. The theory provides constructs like observational learning, self-efficacy, and peer reinforcement, which explain how interpersonal interactions within farmer groups or NGOs influence behavior adoption. These constructs are reflected empirically in survey items assessing trust, group participation, and modeling of adaptive practices. SCT explains how social learning and trust-based modeling serve as causal pathways between risk communication (independent variable) and strategy adoption (dependent variable), especially when filtered through demographic moderators such as gender or income. It thus provides the behavioral mechanism missing in purely cognitive or technological models.

2.2.4 Trust Determination Theory

This theory was coined by Covello (1996) and purposes to examine reception of risk-related communication. The theory envisions that where people are upset, they more often than not distrust the messenger relying the information (Peters & Covello, 2015). Therefore, trust is a major ingredient in risk communication. In this theory, risk is considered any occurrence that is hoped for and if it happens it may result into loss. Thus, risk is existence of threats. Risks are therefore bad events that distorts the usual way of life for individuals and this tends to cause losses. The theory also identifies risk communication as any exchange that happens between parties in relation to information about risk. Risk communication therefore is passing of information from one party warning another about an impending danger or threats (Hendricks, 2021).

In view of trust determination theory, risk communication is fundamentally effective if characterised by three aspects namely: knowledge and understanding on what is the risks and its prevalent, trust and credibility of risk communication and appropriateness of attitudes and behaviours (Neff, 2021). Hence, risk communication does not just happen but is deliberately structured to be received by the intended users. Moreover, risk communication is critical because it delivers real or perceived threats and this leads to behaviour changes. This is because, risk communication must be precise so as to create anticipation that eventually builds preparation and adoption of risk mitigation practices (Covello,2022).

Additionally, the theory indicates that target audiences are keen in evaluating risk communication. For instance, the audiences considers such factors like empathy, care and compassion in the message way before they decide whether to adapt the practices that are being propagated by the risk message. Moreover, honesty and openness, competence and expertise are key components of risk communication (Yubin, Zhou, Chan, Jin, & Miao, 2023). This is because, people tend to quickly examine the message, messenger and decided whether to trust the message and the messenger.

The appropriateness of trust determination theory is because it offers good framework for understanding risk communication. In this study, the overarching goal is to examine effectiveness of risk communication with the focus being climate change communications. The theory envisions that where information, channel and messenger are trusted and honest, risk communication is readily adapted (Covello, 2022 (Marylene, et al., 2022)). Where the information, channel, messenger prove to be trusted, the target audience readily accepts the risk communication.

Trust Determination Theory offers the foundational rationale for evaluating the credibility and perceived integrity of communication across all three media types in the conceptual framework. It applies to each of the independent variables—social media, traditional media, and community-based groups—by identifying trust as the key determinant of message reception and behavior change. In empirical terms, trust is operationalized through questions on perceived honesty, empathy, transparency, and reliability of both the message and the messenger. This theory enriches all three objectives and underscores the importance of trust as a cross-cutting moderator in the conceptual model. It complements TAM, Agenda-Setting, and SCT by emphasizing why farmers may or may not act on the information they receive, regardless of access or frequency of exposure.

2.3 Empirical Literature

This section presents empirical review in line with the objectives.

2.3.1 Social Media and Climate Change Adaptation

Social media has proven to be a critical tool for facilitating climate change adaptation globally, regionally, and locally, particularly among smallholder farmers. This section reviews recent empirical studies related to the role of social media in promoting

climate-smart agricultural practices, focusing on the methodologies, findings, and recommendations of each study.

A foundational study by Kabir, Zubair, and Alam (2021) used the Technology Acceptance Model (TAM) to investigate smallholder farmers' adoption of social media platforms for climate adaptation in Bangladesh. Surveying 400 farmers, the study found that both perceived usefulness and trust in the platform were significantly associated with higher adoption rates of climate-smart practices such as the use of drought-resistant seeds and IPM (Integrated Pest Management). Notably, farmers who actively used WhatsApp and Facebook reported a 45% improvement in adaptive behavior over one agricultural season. However, while the TAM framework helped explain individual motivations, the study fell short of addressing collective behavioral dynamics, such as how farmers validate information through peer discussions or local norms. Furthermore, the authors did not consider how misinformation, a growing concern on open digital platforms, could erode trust and lead to counterproductive practices—an oversight that limits the applicability of their conclusions in regions like Kakamega, where digital trust is not uniform. This gap indicates the need for theoretical integration with Trust Determination Theory or Social Cognitive Theory to more fully capture the nuanced decision-making landscape.

Tambo and Wünscher (2020) offer a regionally comparative critique of digital climate communication in West Africa. Their study found that while mobile-based platforms accelerated climate information flow, many initiatives were top-down and decontextualized, limiting their relevance and uptake. Farmers often received generic messages with no reference to their local soil, crops, or socio-economic conditions. This critique is especially relevant for policy, as it reveals a disconnect between message design and end-user realities. The authors recommend co-creation of content, where farmers participate in message formulation, increasing the likelihood of behavioral adoption. Their insights reinforce the need for inclusive frameworks, where social media is seen not just as a tool for broadcasting, but as a participatory space for collaborative learning and decision-making.

Focusing on youth in Nigeria, Chisenga and Abdu-Raheem (2021) demonstrated that social media was particularly effective in facilitating climate-smart agriculture (CSA) among digitally confident rural youth. Their study emphasized the power of youth-led

digital communities in accelerating the spread of adaptive techniques like organic farming and water harvesting. While this finding is encouraging, the study's applicability to broader smallholder populations is constrained by its limited demographic scope. Older, female, or less digitally literate farmers—who form the majority in Kenyan agriculture—are rarely active participants in such networks. This points to a crucial equity concern: digital adaptation programs may unintentionally exclude vulnerable groups if they are not designed with universal access and targeted capacity-building in mind. The study highlights the importance of intergenerational and gender-sensitive digital training programs as prerequisites for any social media-driven climate communication strategy.

Patel, Ochieng, and Ndiema (2022) explored the use of digital platforms among smallholder farmers in Kenya, Uganda, and Tanzania, emphasizing how social media supported risk perception, preparedness, and responsiveness. Using a mixed-methods approach involving surveys, FGDs, and statistical modeling, the study reported that 72% of farmers who received climate alerts through social media experienced a 30% reduction in climate-induced crop losses. The authors attributed this to real-time access to market prices, rainfall forecasts, and crop disease alerts. However, the study also raised the red flag of digital misinformation, noting that in the absence of institutional verification mechanisms, farmers often encountered contradictory or exaggerated claims about adaptation strategies. While their recommendation to integrate digital communication with traditional extension services is valid, the study lacks depth in analyzing how demographic factors such as gender, age, or educational attainment mediate access to and interpretation of digital messages. This omission limits the study's policy utility for targeted interventions and suggests the need for intersectional analysis in future digital communication frameworks.

In an attempt to examine the synergistic power of integrated communication, Ali et al. (2023) focused on rural communities in Kenya, Ethiopia, and Rwanda to analyze how social media can complement traditional media such as radio and television. Drawing from Collaborative Governance Theory, the study found that 68% of farmers who received climate messages through combined platforms reported increased levels of trust, comprehension, and adoption intent. Community participation in adaptation initiatives rose by 40%, highlighting that media integration enhances legitimacy and

message reinforcement. Yet, the study's major limitation lies in its failure to distinguish between exposure and action. While trust and awareness are important, measuring actual behavioral change—such as the number of farmers implementing new irrigation techniques or shifting planting seasons—was absent. In addition, the study did not explore whether local dialects, literacy levels, or cultural beliefs shaped how farmers processed media content. These limitations point to the importance of going beyond reach and framing to deep engagement and participatory message design, particularly in contexts where social norms shape decision-making as much as—if not more than—access to information.

In one of the few studies specific to Kakamega County, Wekesa et al. (2022) conducted a cross-sectional survey involving 300 smallholder maize farmers and assessed their use of WhatsApp and Facebook for climate-related agricultural decision-making. The study found that 56% of social media users adopted at least one CSA strategy, such as crop diversification or zero tillage, compared to just 32% among non-users. Farmers cited the use of vernacular messages, local success stories, and peer-shared experiences as factors enhancing message relevance and trust. This study offers compelling support for community-driven digital communication, yet it falls short in evaluating barriers to digital inclusion, such as cost of smartphones, gender-based access disparities, or intergenerational digital literacy gaps. Furthermore, it does not contrast the effectiveness of social media with alternative or complementary communication models, such as radio-based group listening sessions or village-based farmer field schools. The absence of comparative design means that while the study proves correlation, it is less useful in designing integrated, context-sensitive communication strategies for broader policy scaling.

A study by Mungai, Kiragu, and Kimani (2023) investigated how digital trust and peer validation influence the uptake of adaptation strategies in rural Kenya. Conducted in Nakuru and Murang'a, the study found that WhatsApp groups acted as both information filters and amplifiers, with trusted individuals—often respected farmers or local leaders—playing a key role in verifying, framing, and promoting adaptation practices. The study confirmed that relational trust was more important than institutional affiliation, and that locally adapted messages, delivered in Kiswahili or mother tongues, were more likely to inspire change. This aligns with Social Cognitive

Theory, where observation, modeling, and reinforcement through social interaction lead to behavior change. However, the study did not explore whether this trust-led engagement translates into sustained adoption over time, especially beyond a single growing season. It also did not test whether misinformation from trusted peers could backfire—raising questions about the fragility of informal networks and the need for digital governance mechanisms to complement peer-based systems.

2.3.2 Traditional Media and Climate Change Adaptation

Traditional media—particularly radio, television, and print materials—has long served as a key conduit for disseminating public policy, agricultural extension messages, and emergency alerts. In the context of climate change adaptation, these platforms remain crucial, especially in rural and semi-literate settings where internet penetration and digital literacy are low. The utility of traditional media lies in its broad reach, linguistic accessibility, and cultural resonance. However, empirical evidence suggests that while these channels can raise awareness, their ability to drive behavioral change and support interactive knowledge exchange may be limited unless integrated with community-based outreach or two-way communication mechanisms. The studies reviewed in this section highlight both the enduring power and the evolving limitations of traditional media in influencing adaptation behavior among smallholder farmers.

In their study on cholera risk communication in Ethiopia, Adera et al. (2022) explored the role of television, radio, and print media in shaping public preparedness during outbreaks. Through qualitative interviews and thematic analysis, they found that radio and television were effective, simple, and trusted tools for conveying critical health and environmental messages in a timely manner. However, print materials—though widely distributed—were found to be ineffective among rural populations due to low literacy levels and limited contextual adaptation. While the study was health-focused, it reveals important parallels with climate communication: success often depends not just on message delivery, but also on the audience's ability to understand and apply the information. However, the study stops short of assessing behavioral outcomes, a key gap for understanding whether awareness leads to action—particularly in agrarian settings.

A study by Gao et al. (2022) in China took a media framing approach by analyzing the impact of the film *Dying to Survive*, which addressed public health and environmental

risks. Using a fixed effects model, the authors demonstrated that visual storytelling in mass media could elevate public concern and influence perceptions of risk. While the study focused on health policy, its findings have strong implications for climate communication: when traditional media combines emotionally resonant narratives with factual messaging, it can shape both awareness and behavioral intention. Nevertheless, this media effect may differ across contexts; in rural African settings, where oral traditions dominate and cinema is less accessible, radio dramas and storytelling formats may be more culturally effective than documentary-style productions. Thus, the study underscores the need for culturally tailored formats when leveraging mass media for climate risk communication.

In their analysis of adaptation behavior among smallholder farmers in Ethiopia, Asfaw et al. (2019) examined how factors like income, education, and access to information channels affected strategy adoption. The study found that timeliness, accessibility, and credibility of information—rather than the mere presence of communication—were decisive. Importantly, the authors noted that farmers trusted radio broadcasts more than extension agents when the content was localized and consistent. While the study did not explicitly assess media effects, its findings suggest that channel choice matters deeply in influencing adaptation. However, it failed to evaluate how different media channels interact or overlap, leaving a gap in understanding whether multi-platform reinforcement of messages leads to stronger uptake of adaptation strategies.

Mier (2021) investigated how radio, TV, and print materials were used to communicate volcanic risk in the Mayon Volcano region of the Philippines. The study revealed that 74% of respondents credited radio and television with enhancing their disaster preparedness, whereas print materials were underutilized due to low literacy and limited contextual tailoring. The study made a strong case for context-driven content design, recommending that traditional media be localized, repeated, and simplified for maximum impact. This has clear relevance for rural Kenyan farmers, where climate-related risks—like floods and prolonged droughts—require clear and actionable information. However, the study did not consider whether preparedness translated into long-term behavior change, such as changes in livelihood strategies, limiting its applicability to sustained adaptation scenarios.

A recent study by Chikulo et al. (2023) focused on rural Malawi and evaluated the

impact of radio-based climate programs on smallholder farmers' behavior. Using a quasi-experimental design, the study found that farmers exposed to weekly climate radio segments on soil management and crop timing were 33% more likely to adopt at least one CSA practice than those who did not listen. The findings emphasized that repetition, use of local language, and community call-in sessions enhanced engagement and trust. This study offers a rare attempt to quantify behavioral impact, moving beyond awareness to assess outcomes. However, it did not compare the impact of radio with other communication forms, leaving questions about comparative effectiveness unanswered.

Wambua et al. (2023) evaluated the use of radio in disseminating agricultural policy information among smallholder farmers in Western Kenya. Their survey of 450 farmers revealed that those who frequently listened to government-sponsored programs on stations like Radio Citizen and Mulembe FM were significantly more aware of subsidy programs, planting guides, and water conservation practices. About 61% of regular listeners reported changing at least one agricultural practice in the past two years. The study noted that credibility of the host, language use, and timing of the programs played a crucial role in adoption. However, it also revealed a weakness: only 12% of female-headed households had access to radios due to economic or cultural barriers, highlighting a gender gap in media reach. These findings point to the need for targeted programming and intersectional strategies when using traditional media for climate risk communication.

Collectively, these studies reaffirm the enduring importance of traditional media in climate adaptation, particularly in rural African settings. Radio and television continue to serve as trusted, culturally embedded communication tools, especially where digital exclusion, illiteracy, or infrastructural constraints persist. However, the literature reveals persistent gaps—notably a lack of comparative studies assessing media effectiveness, limited understanding of long-term behavioral outcomes, and insufficient attention to demographic disparities such as gender and age in media access and response. This study contributes to closing these gaps by assessing not just how traditional media is accessed in Kakamega County, but how it compares with other risk communication strategies in influencing measurable adoption of climate adaptation strategies among smallholder maize farmers.

2.3.3 Community-Based Organizations and Volunteer Groups and Climate Change Adaptation

Volunteer groups, community-based organizations (CBOs), and farmer cooperatives play an increasingly vital role in promoting the adoption of climate change adaptation strategies. These local entities act as intermediaries, translating policy into practice, enhancing trust, facilitating participatory learning, and addressing contextual constraints—especially in marginalized communities where government extension services are limited or absent. Their embeddedness within communities enables them to align risk communication with local socio-cultural dynamics, making them powerful agents of behavioral influence. The literature reviewed below demonstrates both the promise and the limitations of volunteer-based communication systems in driving climate-resilient farming.

Bedeke et al. (2019) examined maize farmers in Ethiopia and found that the presence of extension officers and volunteer-based organizations significantly improved the adoption of climate-smart agricultural (CSA) strategies. These local actors not only disseminated technical knowledge but also facilitated collective experimentation and peer validation of practices like crop rotation, composting, and water harvesting. The study argued that the credibility of local volunteers enhanced information uptake, especially when compared to top-down government campaigns. However, it did not evaluate how long-term adoption is sustained or how volunteer effectiveness compares to other communication mechanisms. This suggests a gap in understanding the durability and comparative impact of such interventions.

Although focused on the COVID-19 pandemic, Tambo et al. (2021) provide critical insights into how community engagement improves public response to risk messaging. Their study found that early community involvement led to higher levels of preparedness, trust in public health measures, and voluntary compliance. These results resonate with the climate adaptation context, where risk perception and timely behavior change are equally crucial. The authors emphasized that community volunteers served as trusted messengers, whose presence bridged the credibility gap between institutions and the rural population. This reinforces the applicability of Trust Determination Theory in volunteer-led climate communication.

Lejano et al. (2023) applied a quasi-experimental design to study risk communication in disaster-prone areas and introduced a relational model, which views target audiences as co-producers of knowledge rather than passive recipients. Volunteer groups, they argue, are essential for implementing this model, as they personalize messages, facilitate feedback loops, and ensure contextual relevance. Findings showed that where relational engagement occurred—e.g., through participatory meetings or field demonstrations—the uptake of adaptation behaviors was significantly higher. However, the study cautioned that volunteer burnout, lack of formal training, and inconsistent funding could erode trust and effectiveness over time.

Shabana et al. (2022) emphasized that risk communication is most effective when local stakeholders are involved in both planning and execution phases. Their analysis of COVID-19 risk messaging in rural Kenya found that when local volunteers and community leaders were co-designers of messaging strategies, adoption of recommended behaviors was markedly higher. While the study focused on health risks, its insights are transferable to climate change communication, where adaptive action requires not only awareness but also perceived agency and social endorsement. A limitation, however, was that the study did not quantify changes in long-term resilience or agricultural behavior, leaving an important empirical gap for climate-specific research.

Amede et al. (2020) conducted research on farmer field schools (FFS) in Kenya and Ethiopia that were run primarily by local volunteers and agricultural champions. They found that community-led training, especially when done through group demonstrations, had a statistically significant impact on the adoption of CSA practices. About 63% of participating farmers adopted at least two new practices, compared to 28% in control groups. The authors attributed this to collective learning and the credibility of peers, which enhanced knowledge retention and experimentation. However, the study highlighted gender disparities in participation, with women less likely to be involved due to time constraints and socio-cultural norms—a critical issue that must be addressed in the Kakamega context.

In a study across Kakamega and Kisii counties, Mwaura et al. (2023) examined how volunteer groups bridge the digital divide by integrating messages from radio, SMS alerts, and extension bulletins. Acting as trusted interpreters, they convened group

meetings where they explained forecasts and adaptive strategies in local languages, often using storytelling or songs. This hybrid model was especially impactful for older farmers and women, who were less likely to access digital platforms. The study found that 59% of farmers who engaged in such sessions adopted at least one new practice within six months. However, the research cautioned that volunteers require ongoing capacity-building and motivation, lest the model become unsustainable.

Collectively, the reviewed studies provide robust evidence that volunteer groups, when well-structured and supported, can significantly influence the adoption of climate adaptation strategies. Their localized knowledge, social trust, and capacity for participatory engagement make them uniquely suited to translate abstract climate messages into concrete behavioral action. However, the literature also highlights several persistent challenges: volunteer attrition, lack of training, unequal access (particularly for women), and inconsistent integration with formal systems. For smallholder farmers in Kakamega County, whose information environments are diverse and uneven, volunteer-led communication must be part of a multi-channel, inclusive, and feedback-oriented strategy. This study contributes to filling existing gaps by evaluating not just the presence but the effectiveness and sustainability of volunteer-based communication in driving climate-resilient practices.

2.3.4 Control Variables and Climate Change Adaptation

Control variables such as age, gender, education, and income have consistently been found to influence farmers' decision-making processes and their capacity to adopt climate change adaptation strategies. While not the central focus of most adaptation studies, these variables function as critical enablers or constraints in determining the extent and speed of behavioral change among smallholder farmers. They shape access to resources, interpretation of risk messages, technological openness, and ultimately the ability to respond effectively to climate-related threats.

Education, in particular, has been repeatedly cited as a strong predictor of climate adaptation. Ahmed et al. (2023) demonstrated in a study conducted among smallholder farmers in flood-prone areas of Pakistan that those with secondary education or higher were 45% more likely to interpret and act on climate-related warnings. Similarly, Otieno et al. (2022), in a Kenyan context, found that education significantly influenced

the uptake of soil conservation practices, with more educated farmers showing greater engagement with climate-smart techniques. In both cases, the authors emphasize that education enhances comprehension of risk communication, trust in institutional messaging, and willingness to adopt innovation.

Income level is another key determinant of adaptive behavior. Higher-income households often have better access to inputs, labor-saving technologies, and credit facilities, all of which facilitate the implementation of labor-intensive or resource-demanding strategies such as irrigation or agroforestry. Tadesse et al. (2023), in a quasi-experimental study in Ethiopia, found that farmers with more disposable income were able to invest in water conservation infrastructure such as drip irrigation systems. Gebre et al. (2023) similarly found that income level was a significant predictor of adaptation diversity in Kenya, with wealthier farmers adopting a broader array of techniques than their low-income counterparts.

Gender also plays a pivotal role, particularly in patriarchal rural contexts where women often face barriers to land ownership, credit access, and participation in decision-making. Tadesse et al. (2023) found that female-headed households were less likely to adopt new adaptation technologies unless supported by community-driven initiatives. Asare-Nuamah and Amungwa (2021) reported comparable findings in Ghana, where gender-sensitive extension services significantly improved women's climate adaptation outcomes. These studies suggest that gender intersects with social norms and institutional structures to either facilitate or hinder access to adaptation-enabling resources.

Age has yielded mixed findings across contexts. Some studies argue that younger farmers are more innovative and open to new information channels such as social media. For instance, Mwangi and Mutua (2022) found that farmers below the age of 40 in Tanzania were 60% more likely to adopt drought-resistant crops compared to older farmers. In contrast, older farmers—though often more experienced—may be less inclined to change long-standing practices due to risk aversion or lack of digital literacy. Mutai et al. (2022), studying smallholder maize farmers in Kakamega County, observed that older farmers were more resistant to diversification practices, primarily due to entrenched habits and limited exposure to contemporary agronomic knowledge.

From a broader regional perspective, studies such as Shikuku et al. (2017) and Mulwa et al. (2017) in East Africa have shown that socio-demographic factors significantly shape farmers' responsiveness to risk communication. These studies highlight that even when credible and timely information is provided, uptake is not guaranteed unless the messaging and interventions are tailored to account for the target audience's socio-economic profile. For example, illiterate farmers may be excluded from printed advisories or social media-based alerts, while low-income groups may lack the means to act on the information even when they understand it.

Taken together, these studies underscore the mediating and moderating role of control variables in climate change adaptation. They do not operate in isolation but interact with each other and with external communication channels. Therefore, in the current study, control variables are treated not merely as background demographics but as critical contextual factors that shape the effectiveness of risk communication media (social media, traditional media, and volunteer groups). This inclusion ensures a more holistic understanding of adaptation behaviors among smallholder maize farmers in Kakamega County, especially in designing communication strategies that are inclusive, equitable, and tailored to farmers' realities.

2.4 Research Gaps

Despite extensive research on climate change adaptation, significant gaps remain in understanding the role and effectiveness of risk communication tools in promoting climate-smart practices among smallholder farmers. These gaps span knowledge, methodological, contextual, and conceptual domains, underscoring the need for further exploration. One key knowledge gap lies in the integration of multiple risk communication tools. While Patel et al. (2022) demonstrated the effectiveness of social media in sub-Saharan Africa, much of the research focuses on isolated channels, neglecting the potential for synergy between social media, traditional media, and community-based communication approaches. Similarly, Ali et al. (2023) emphasized the impact of combined communication strategies on community engagement in East Africa but failed to explore how these tools work in concert to drive behavioral change among smallholder farmers. This study sought to address this gap by evaluating the comparative and integrated roles of social media, traditional media, and volunteer groups in climate change adaptation.

Methodologically, many studies rely on cross-sectional designs, capturing only a snapshot of farmers' behaviors and perceptions. For instance, Kabir et al. (2021) examined social media's influence on South Asian farmers' adoption of climate-smart practices but did not assess how sustained exposure to risk communication affects long-term adaptation outcomes. Similarly, Gao et al. (2022) used a single-event analysis to evaluate media-based risk communication in China, limiting its applicability to dynamic, multi-year climate adaptation processes. The current study addressed this limitation by adopting a mixed-methods approach, providing both depth and breadth in understanding the ongoing impact of communication tools on farmers in Kakamega County.

Contextual gaps are particularly evident in sub-Saharan Africa, where the majority of studies focus on high- or middle-income regions. For example, Tambo et al. (2021) explored community participation in risk communication during the COVID-19 pandemic but focused primarily on public health emergencies, leaving agricultural and climate-specific contexts underexamined. Adera et al. (2022) evaluated traditional media in Ethiopia but failed to account for regional variations in media access and preferences, which are critical in low-income, rural areas. This study addressed these gaps by focusing on Kakamega County, where socio-economic and infrastructural constraints shape the effectiveness of risk communication tools.

Conceptually, existing research often overlooks the mediating role of socio-demographic factors in the adoption of climate-smart practices. Ahmed et al. (2023) highlighted the influence of education on farmers' ability to interpret climate forecasts in Pakistan but did not examine how education interacts with risk communication tools to shape adaptation behaviors. Otieno et al. (2022) examined the role of income and education in Kenya but failed to link these factors to specific communication channels, leaving a gap in understanding how socio-economic variables mediate the relationship between risk communication and adaptation. The current study addressed this gap by incorporating control variables—such as age, gender, education, and income—into its analysis, providing a more nuanced understanding of adaptation outcomes.

Additionally, there is limited exploration of how localized and culturally relevant messaging enhances the effectiveness of risk communication. While Wekesa et al. (2022) found that social media was effective for knowledge sharing among Kenyan

farmers, the study did not explore the role of vernacular language or community-specific messaging in improving uptake. Similarly, Lejano et al. (2023) demonstrated that relational approaches improved community engagement but did not delve into how these approaches can be adapted to specific agricultural contexts. This study investigated the importance of tailoring communication strategies to the cultural and linguistic needs of smallholder farmers in Kakamega County.

Therefore, the current study sought to fill critical gaps by evaluating the integration of multiple communication tools, adopting a context-sensitive approach, and accounting for socio-demographic mediators. By addressing these gaps, the study aimed to provide actionable insights into how risk communication can enhance climate resilience among smallholder maize farmers in Kakamega County.



2.5 Conceptual Framework

A conceptual framework illustrates variables that are studied. In this study, the independent variables are social media, traditional media and volunteer groups. The independent variable is adoption of Climate Change Adaptation Strategies. Figure 2.1 shows the conceptual framework.

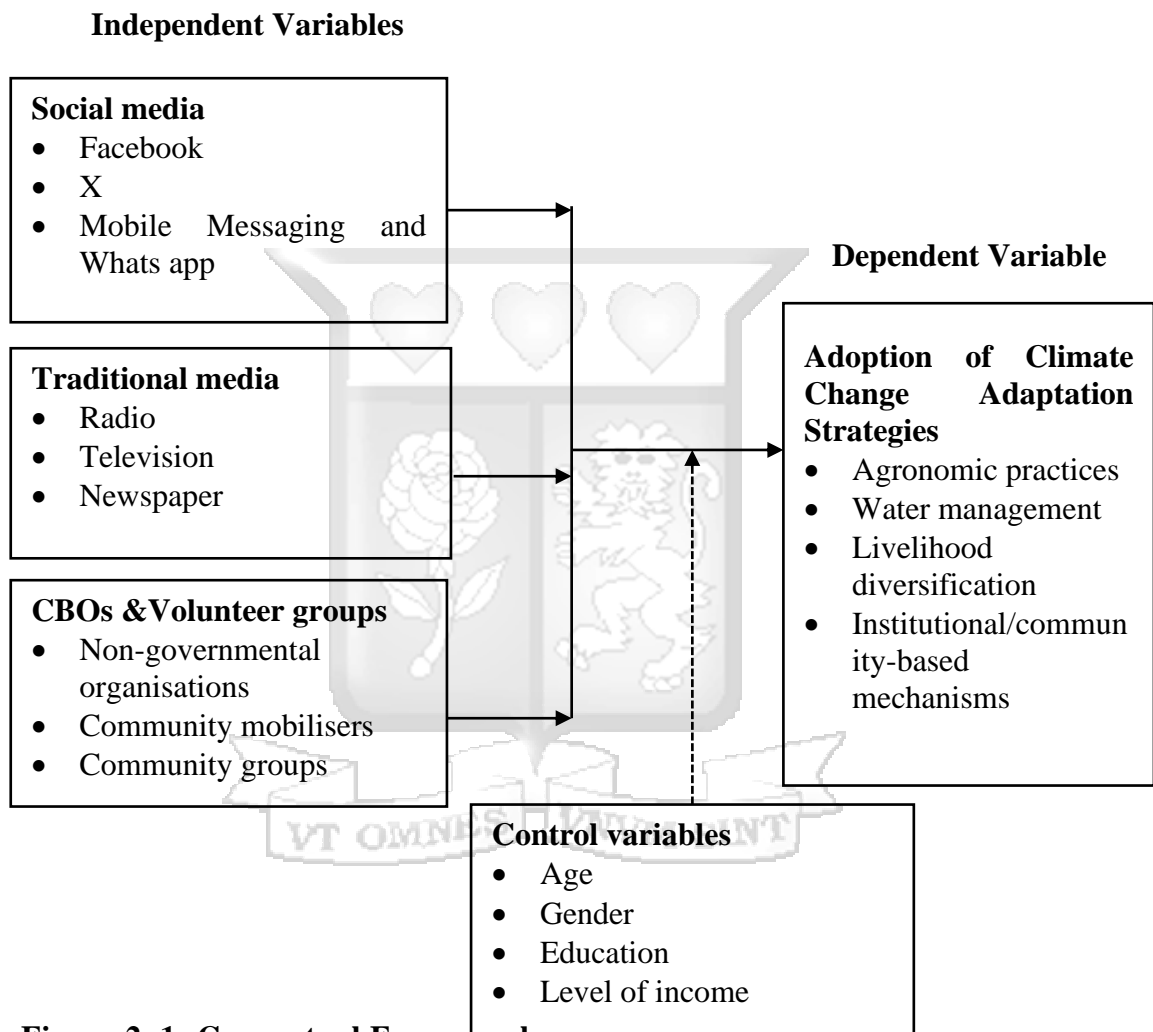


Figure 2. 1: Conceptual Framework

Source: Author (2023)

2.6 Operationalization and Measurement of Study Variables

Table 2.1 presents the operationalisation of study variables. The table presents the operationalization of study variables, their definitions, indicators, and how they were measured using appropriate scales.

Table 2. 1: Operationalisation and Measurement of Study Variables

Variable	Definition of Variable	Indicators	Measurement
Social media (Independent)	Interactive technological tools that enable information sharing and networking in social platforms	<ul style="list-style-type: none"> • Facebook • X • Mobile Messaging and Whats app 	Questionnaire -Platforms: Nominal scale (Check all that apply) -Membership: Nominal scale (Yes/No) -Frequency: Ordinal scale (Daily/Weekly/Monthly)
Traditional Media (Independent)	Media that serve mass audiences to communicate information	<ul style="list-style-type: none"> • Radio • Television • Newspaper 	Questionnaire -Sources: Nominal scale (Check all that apply) -Frequency: Ordinal scale (Daily/Weekly/Monthly) -Influence: Nominal scale (Yes/No)
community-based organizations (CBOs) and Volunteer Groups (Independent)	Community-based groups and non-governmental actors involved in facilitating and mobilizing adaptation strategies	<ul style="list-style-type: none"> • Non-governmental organisations • Community mobilisers • Community groups 	Questionnaire -Membership: Nominal scale (Yes/No) -Support: Nominal scale (Check all that apply) -Frequency: Ordinal scale (Weekly/Monthly/Occasionally)
Adoption of Climate Change Strategies (Dependent)	Implementation of practices aimed at addressing the adverse effects of climate change	<ul style="list-style-type: none"> • Growing pest-resistance crops • Drought resistant crops • Crop rotation • Organic farming • Water conservation 	-Adoption: Nominal scale (Yes/No for each strategy) -Number of strategies: Ratio scale (Count)
Control Variables	Socio-demographic characteristics of the farmers that influence adoption of climate change strategies	<ul style="list-style-type: none"> • Age • Gender • Education • Level of income 	- Age: Ratio scale (Years) -Gender: Nominal scale (Male/Female) - Education: Ratio scale (Years of schooling) - Household size: Ratio scale (Number) - Income: Ratio scale (KES)

Source: Author (2023)

2.7 Chapter Summary

This chapter reviewed relevant theories and empirical studies related to social media, traditional media, community-based organizations and volunteer groups, and control variables such as age, gender, education, and income in promoting climate change adaptation strategies. Key research gaps were identified, including limited integration of communication tools, insufficient focus on rural contexts like Kakamega County, and the need to account for socio- demographic factors in adaptation. A conceptual framework was developed to illustrate the relationships among the variables, and the study variables were operationalized with clear definitions, measurable indicators, and appropriate scales. These insights set the stage for the research design and methodology discussed in the next chapter.



CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This section discusses the research methodology. It includes the research Philosophy, research design, target population, sampling design, data collection instruments, pilot test, data analysis and presentation and ethical considerations.

3.2 Research Philosophy

Research philosophy refers to the set of assumptions and beliefs that guide how knowledge is developed, investigated, and validated in a study (Saunders, Lewis, & Thornhill, 2019). This research adopts a positivist philosophy, which views knowledge as objective, observable, and measurable through empirical investigation. Positivism emphasizes the use of structured instruments, statistical models, and hypothesis testing to explain causal relationships between variables (Creswell, 2014).

The choice of positivism is justified by the nature of the research problem, which seeks to address a gap in empirical understanding regarding how various risk communication tools—specifically social media, traditional media, and volunteer groups—influence the adoption of climate change adaptation strategies among smallholder maize farmers. The research aims to move beyond anecdotal or perception-based studies to produce generalizable, evidence-based conclusions supported by data.

Furthermore, the study's specific objectives require the measurement of statistical relationships between media exposure (independent variables) and adaptation behaviors (dependent variable). This aligns with positivism's core strength: explaining observable phenomena through quantifiable data. The use of a structured questionnaire and statistical modeling techniques (e.g., OLS regression) further supports this alignment.

The empirical review also informs this choice. Similar studies—such as those by Khanal et al. (2022), Matamanda et al. (2022), and Shabana et al. (2022)—used quantitative techniques under positivist paradigms to investigate media influences on farmer behavior. These studies demonstrate the efficacy of positivist approaches in

similar agricultural and climate adaptation contexts.

3.3 Research Design

A research design is a structured plan that guides the collection, analysis, and interpretation of data in a study (Bloomfield & Fisher, 2019). This study adopted an explanatory research design, which is appropriate for investigating phenomena with limited prior information. Explanatory research is particularly useful in exploring the causal relationships between variables, providing insights into why certain occurrences happen and how they can be addressed (Ward, Comer, & Stone, 2018).

Considering that this study examines the effect of risk communication tools—such as social media, traditional media, and community-based organizations and volunteer groups—on the adoption of climate change adaptation strategies among smallholder maize farmers in Kakamega County, an explanatory design is well-suited. The design allows for an in-depth exploration of how these communication tools influence farmer behaviors, addressing the relatively scant information available on this subject in the region.

Moreover, explanatory research is designed to uncover cause-and-effect relationships by synthesizing data and predicting future occurrences or interventions (Saunders, Lewis, & Thornhill, 2019). This framework enabled the study to analyze how specific variables (e.g., communication tools and control variables such as age, gender, education, and income) interact to shape climate adaptation outcomes. By using an explanatory design, the study aims to provide actionable insights that can inform policies and strategies to enhance climate resilience among smallholder farmers.

3.4 Population and Sampling

The target population for this study comprises smallholder maize farmers in Kakamega County, one of Kenya's agriculturally active regions. The county consisted of 12 administrative sub-counties: Shinyalu, Navakholo, Mumias East, Mumias West, Lurambi, Matungu, Malava, Lugari, Likuyani, Khwisero, Butere, and Ikolomani (County Government of Kakamega, 2023). To determine the appropriate sample size, the Krejcie and Morgan (1970) formula for finite populations was applied. This formula is particularly suitable when the total population exceeds 250,000, as is the case for smallholder farmers in Kakamega:

$$n = \frac{N * Z^2 * P(1-P)}{e^2 * (N-1) + Z^2 * P(1-P)}$$

Where:

- n = Required sample size
- N = Population size (>250,000)
- Z = Z-score at 95% confidence level (1.96)
- p = Estimated proportion of the population (0.5 for maximum variability)
- e = Margin of error (0.05)

Using these parameters, the calculated sample size was 384 respondents, ensuring representativeness and statistical reliability.

$$n = \frac{250000 * 1.96^2 * 0.5(1-0.5)}{0.05^2 * (250000-1) + 1.96^2 * 0.5(1-0.5)} = 383.6 \approx 384$$

Thus, the study targeted a sample size of 384 smallholder maize farmers.

To enhance the representativeness of the sample across the county, the study adopted a stratified random sampling technique, where each of the 12 sub-counties represents a distinct stratum. Within each sub-county, simple random sampling was used to select 32 individual farmers from agricultural registers or lists maintained by local agricultural offices. This technique ensures every smallholder farmer in each stratum has an equal and unbiased chance of selection. Simple random sampling was advantageous because it reduces selection bias, enhances internal validity, and ensures that sample characteristics approximate those of the population (Bryman, 2016).

3.5 Data Collection Methods

This study employed primary data collection through a semi-structured questionnaire, which was deemed appropriate for capturing both quantitative and limited qualitative data relevant to the research objectives. A semi-structured questionnaire is particularly effective when researchers seek to balance standardized data collection with the flexibility to explore context-specific insights (Newcomer, Hatry, & Wholey,

2015). The structured (closed-ended) sections of the questionnaire captured key quantitative variables such as the use of social media, traditional media, and community-based or volunteer organizations, along with socio-demographic controls like age, gender, income, and education. These variables were operationalized using Likert-scale and categorical questions, which support replicable and objective measurement consistent with the study's positivist philosophy (Saunders, Lewis, & Thornhill, 2019).

Meanwhile, a limited number of open-ended questions were included to allow respondents to elaborate on their experiences with risk communication and climate adaptation. This aligns with Gillham (2008), who argues that semi-structured tools are especially valuable in field contexts where respondents may vary in literacy levels or exposure to abstract concepts, and where the ability to probe for clarification can enhance data quality. The use of a semi-structured tool was also suitable given the rural setting and diversity of respondents in Kakamega County. It enabled researchers to gather comparable, statistically analyzable data while allowing flexibility for enumerator explanation or translation, where necessary. As noted by Creswell and Creswell (2018), semi-structured questionnaires offer the advantage of maintaining structure for analysis while also enabling researchers to gain contextual insight without sacrificing methodological rigor.

Data were collected in person from 384 smallholder maize farmers selected through stratified random sampling across Kakamega's 12 sub-counties. Access to participants was facilitated through local agricultural extension officers using sub-county farmer registers. Interviews were conducted in English, Kiswahili, or local dialects depending on respondent preference. Where consent was provided, interviews were audio-recorded to ensure accuracy; otherwise, manual notes were taken to capture open-ended responses..

3.6 Data Analysis

This study collected both quantitative and qualitative data to examine how social media, traditional media, and community-based organizations and volunteer groups influence the adoption of climate change adaptation strategies among smallholder maize farmers in Kakamega County. Quantitative data was analyzed using the Ordinary Least Squares (OLS) regression model, with the dependent variable being a

Composite Climate Change Adaptation Index (CCAI). This index consolidates responses to multiple binary (yes/no) adaptation strategy items—such as the use of drought-resistant seeds, irrigation, crop rotation, and organic farming—into a single score on a five-point ordinal scale. The scale ranges from 1 (Very Low Adaptation) to 5 (Very High Adaptation) based on the number of strategies adopted, thereby capturing the intensity of adaptation behavior (Kabir et al., 2021; Wekesa et al., 2022).

This transformation avoids treating each adaptation behavior as a separate equation (as in multivariate models), which would dilute interpretability and inflate model complexity. Instead, a single, aggregated dependent variable allows for more parsimonious and policy-relevant regression analysis, addressing concerns raised by the panel regarding model efficiency and clarity. The OLS regression model was specified as follows:

$$Y_{ij} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \epsilon_{ij}$$

Where:

- Y_{ij} : Composite Climate Change Adaptation Index (score 1–5) for farmer i ,
- X_1, X_2, X_3 : Independent variables (social media, traditional media, community-based organizations and volunteer groups),
- $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4$: Coefficients to be estimated,
- ϵ_{ij} : Error term following a multivariate normal distribution.

Descriptive statistics—including means, medians, standard deviations, and frequencies—were first computed to describe the demographic characteristics of the sample and the distribution of CCAI scores. Bivariate correlation analysis then assessed preliminary associations among key variables before regression analysis is conducted. All quantitative analysis was carried out using SPSS Version 28, with significance levels set at 0.05.

Qualitative responses from open ended questions underwent thematic content analysis to identify key themes related to farmers' experiences and perceptions of communication tools and climate adaptation strategies. This involved transcription,

coding, and identifying patterns in the data to complement and contextualize quantitative findings (Braun & Clarke, 2006).

3.7 Research Quality

Research quality is critical in that it determines acceptance of a given study and the findings made. In this study, two facets were used to enhance research quality: validity and reliability.

3.7.1 Validity

Validity is a measure of accuracy of a tool. In research, validity examines whether a data collection tool collects the data that is expected to be collected. The study focused on content validity which verifies informational needs. Content validity is valuable as it communicates whether all facets with regard to a variable have been measured (Almeida, Quintão, & Andrade, 2020). It aims at ensuring that a tool is capable of capturing all information that is ideal in addressing a specific research question. To improve on this, an expert in Climate Change Adaptation Strategies were asked to evaluate content validity of the interview guide. Experts are vital in improving content validity (Leung, 2015; Gidron, 2020).

Table 3. 1: Content Validity Ratings by Experts

Section of Questionnaire	Expert 1 Rating (0–1)	Expert 2 Rating (0–1)	Average Score
Social Media Use	1.0	1.0	1.0
Traditional Media Use	1.0	0.8	0.9
Volunteer Group Participation	1.0	0.8	0.9
Climate Adaptation Strategy Adoption	0.8	1.0	0.9

Source: Researcher (2025)

Content Validity Index (CVI) = Average of all average scores = $(1.0 + 0.9 + 0.9 + 0.9)/4 = 0.925$

The CVI of 0.925 is significantly above the recommended threshold of 0.80, indicating that the instrument possessed strong content validity. The experts agreed that all key constructs were adequately represented.

3.7.2 Reliability

Reliability refers to the consistency and stability of a measurement instrument across time, researchers, or items (Heale & Twycross, 2015). To assess the reliability of the research instrument, this study employed both a pilot study and statistical techniques for internal consistency. A pilot study was conducted with a sample of 30 smallholder maize farmers drawn from a neighboring sub-county not included in the main study. The purpose of the pilot was to test the clarity, consistency, and relevance of the questionnaire items. Feedback from this phase was used to revise ambiguous wording and ensure alignment with the operational definitions of variables. The pilot data was also used to calculate Cronbach's Alpha, which measures internal consistency—that is, how well items within each scale measure the same underlying construct (Gliem & Gliem, 2003). The reliability test results are presented in Table 3.2.

Table 3. 2: Reliability Test Results

Section of the Instrument	Number of Items	Cronbach's Alpha (α)	Interpretation
Social Media Adaptation Practices	5	0.84	Reliable
Traditional Media Influence	5	0.81	Reliable
Volunteer Group Participation	5	0.86	Reliable
Climate Adaptation Strategy Commitment	5	0.88	Reliable

Source: Researcher (2025)

All sections of the questionnaire reported Cronbach's Alpha values above 0.80, exceeding the recommended threshold of 0.70 (Nunnally & Bernstein, 1994), and indicating high internal consistency. These results confirm that each section of the instrument effectively captured consistent responses across related items. For example, in the "Climate Adaptation Strategy Commitment" section, the Cronbach's alpha of 0.88 indicated that responses concerning farmers' reported use, confidence, and behavioral intent toward adaptation strategies were statistically aligned.

Although interrater reliability is typically used in qualitative or observational studies involving multiple assessors (Gwet, 2014), it was not a primary reliability measure in

this study, as the data was collected using self-administered, structured survey instruments. However, enumerators were trained prior to data collection to ensure uniform administration of the tool across participants, minimizing interviewer-induced variance.

3.8 Ethical Considerations

The study adhered to standards of ethics that are vital to research. Ethical considerations are key towards upholding the rights, dignity and respect to participants. (Nazmul, et al., 2021). Firstly, approval were sought from relevant authorities such as County government of Kakamega and National Commission of Science, Technology and Information (NACOSTI). Secondly, participants were selected on free-will under informed consent guideline. The respondents were informed of all material risks, procedures and rights before participating in the study. According to Mohd (2018) informed consent is a major ethical consideration that must not be violated in research dealing with human beings.

In addition, confidentiality was upheld so as to protect the participants from any harm that may emanate. For instance, codes were used to denote the participants as opposed to use of their actual names. Moreover, the information and data that was collected was protected from access by authorised persons by use of passwords to the computer files that stored the data. The researcher also did not misinform or misreport findings in any way.

CHAPTER FOUR

PRESENTATION OF RESEARCH FINDINGS

4.1 Introduction

This chapter presents the analysis, interpretation, and presentation of data collected from smallholder maize farmers to assess the influence of social media, traditional media, and community-based organizations and volunteer groups on the adoption of climate change adaptation strategies. It begins with the response rate achieved during the fieldwork, followed by a demographic profile. Descriptive statistics are used to summarize responses across key variables. Furthermore, inferential statistical tools, including correlation and logistic regression, are applied to examine the relationships between information access and the likelihood of adopting specific climate adaptation practices. The findings are presented using tables and narrative explanations to provide a clear understanding of the patterns and implications drawn from the study.

4.2 Response Rate

The study targeted a sample of 384 smallholder maize farmers drawn proportionately from the 12 sub-counties of Kakamega County, using stratified and simple random sampling techniques. A total of 384 questionnaires were distributed to the sampled respondents. Out of the distributed questionnaires, 367 were correctly filled and returned, yielding a response rate of 95.6%. This response rate is considered excellent according to Mugenda and Mugenda (2003), who recommend a threshold of 70% as satisfactory for social science research. The high response rate may be attributed to the study's relevance to respondents' agricultural practices, the cooperation of local agricultural officers, and follow-up efforts by trained research assistants.

Table 4. 1: Response Rate Summary

Description	Frequency	Percentage (%)
Questionnaires Issued	384	100.0%
Questionnaires Returned	367	95.6%
Questionnaires Not Returned	17	4.4%

Source: Researcher (2025)

4.3 Demographic Information

This section presents the demographic and socio-economic characteristics of the 367 smallholder maize farmers who participated in the study. Understanding these attributes is critical for contextualizing farmer behaviors, resource access, and climate adaptation responses. Table 4.1 summarizes the main demographic variables collected, including age, gender, marital status, education level, household size, land size, fragmentation experience, crops grown, livestock reared, and income levels.

Table 4. 2: Summary of Demographic and Socio-Economic Characteristics of Respondents

Variable	Category/Statistic	Frequency (n)	Percentage (%)
Age	Under 30 years	52	14.2%
	30–39 years	109	29.7%
	40–49 years	124	33.8%
	50–59 years	56	15.3%
	60 years and above	26	7.1%
Gender	Male	202	55.0%
	Female	165	45.0%
Marital Status	Married	278	75.7%
	Single	42	11.4%
	Widowed	23	6.3%
	Divorced/Separated	18	4.9%
	Other	6	1.6%
Education Level	None	36	9.8%
	Primary	118	32.1%
	Secondary	147	40.1%
	Tertiary	66	18.0%
Household Size	1–3 members	52	14.2%
	4–6 members	204	55.6%
	7+ members	111	30.2%
Land Size (Acres)	<1 acre	78	21.3%
	1–2 acres	184	50.1%
	>2 acres	105	28.6%
Land Fragmentation	Experienced	245	66.8%
	Not experienced	122	33.2%
Main Crops Grown	Maize	367	100.0%
	Beans	292	79.6%
	Vegetables	205	55.9%
	Sweet Potatoes	166	45.2%
	Sorghum and Millet	97	26.4%
Livestock Kept	Chickens	321	87.5%
	Cattle	208	56.7%
	Goats	174	47.4%

Source: Field Data (Researcher, 2025)

Age distribution influences access to agricultural information, adoption of climate adaptation strategies, and labor contribution on farms. Respondents were asked to indicate their age, which was grouped into categories. From the results are presented in Table 4.2, the largest proportion of respondents—33.8% (n=124)—were aged 40–49 years, followed by 29.7% (n=109) in the 30–39 age bracket. Farmers aged 50–59 accounted for 15.3% (n=56), while 14.2% (n=52) were under 30 years. Only 7.1% (n=26) were 60 years and above. This distribution shows that 63.5% of the respondents were between 30 and 49 years, reflecting a predominantly active farming population. This age profile suggests that the majority of respondents are in their economically productive years—an age group generally more open to agricultural innovations and capable of engaging with climate adaptation strategies. As noted, effective adaptation requires behavioral shifts and timely decision-making, traits more commonly associated with this age group. Waudo (2024) observed that farmers within this age range often demonstrate greater involvement in project implementation and feedback processes, making them ideal targets for climate-smart extension efforts. Climate adaptation programs in Kakamega County should therefore focus on this age cohort while exploring complementary approaches to engage younger and older farmers who may face distinct knowledge and resource constraints..

Gender distribution is critical in examining access to resources, decision-making roles, and barriers to climate adaptation. The distribution of study respondents based on gender in Table 4.2 show that out of 367 respondents, 202 (55.0%) were male, while 165 (45.0%) were female. Although men constituted a slight majority, the relatively balanced representation demonstrates that both genders are actively involved in smallholder maize farming in Kakamega County. This distribution reflects shared participation in agricultural activities, but also points to gendered differences in roles, responsibilities, and access to support services. While women contribute significantly to farm labor and household food security, they often face systemic barriers in accessing land tenure, extension services, and credit—key enablers for climate adaptation (Kihara & Masibo, 2024). Moreover, Jalango et al. (2024) emphasize the importance of integrating gender considerations in climate programming to avoid marginalizing female farmers, particularly in the dissemination of adaptation technologies and information channels. Thus, gender-responsive adaptation interventions are necessary—ensuring equitable access to knowledge,

resources, and decision-making forums. Special attention should be given to removing structural constraints faced by women, including gender-biased land tenure norms and unequal digital literacy.

Marital status is an important socio-demographic factor in smallholder farming as it shapes household labor availability, resource pooling, and joint decision-making dynamics—factors that directly affect climate adaptation planning. Respondents were asked to indicate their current marital status. The results are presented in Table 4.2. The findings reveal that the vast majority of respondents—278 (75.7%)—were married, followed by 42 (11.4%) who were single, 23 (6.3%) widowed, 18 (4.9%) divorced or separated, and 6 (1.6%) who fell into other categories. The dominance of married respondents suggests that household-level decision-making plays a significant role in farm operations and strategy adoption. Joint decision-making between spouses can positively influence the uptake of climate-smart practices, especially where roles and responsibilities are clearly negotiated. According to Kihara and Masibo (2024), gendered power relations within households influence how climate information is received and acted upon, reinforcing the importance of inclusive training that targets both partners. Programs aimed at promoting climate change adaptation among smallholder farmers in Kakamega County should therefore integrate household-focused approaches, ensuring both spouses have access to information, capacity-building opportunities, and voice in adaptation-related decisions. This not only enhances uptake but also strengthens intra-household collaboration for climate-resilient farming.

Education is a key determinant of a farmer's ability to comprehend, evaluate, and apply agricultural innovations, including climate adaptation practices. Respondents were asked to indicate the total number of years they had spent in formal schooling. The findings as summarized in Table 4.2 show that 40.1% (n=147) of respondents had completed secondary education, while 32.1% (n=118) reported primary-level schooling. Additionally, 18.0% (n=66) had attained tertiary education (college or university), and only 9.8% (n=36) reported having no formal education. The findings indicate a high literacy rate of 90.2%, which is encouraging for the effective dissemination of climate and agricultural information. Farmers with at least basic education are more likely to understand and act on content delivered through printed

extension materials, mobile platforms, radio broadcasts, and training manuals. According to Ndungu et al. (2021), education enhances not only the interpretation of climate-related information but also a farmer's confidence in applying unfamiliar practices, such as conservation agriculture or agroforestry. This suggests that climate-smart agriculture (CSA) programs in Kakamega County can benefit from using mixed information delivery channels—including SMS alerts, community trainings, and simplified print media—tailored to the farmers' literacy levels. Furthermore, farmers with secondary and tertiary education can be engaged as community knowledge brokers or peer trainers to enhance diffusion of adaptation practices.

Household size is a significant socio-economic factor that affects farm labor availability, food demand, and capacity to implement climate adaptation strategies. Respondents were asked to indicate the number of people residing in their households. The results as summarized in Table 4.2 show that 55.6% (n=204) of households consisted of 4–6 members, while 30.2% (n=111) reported 7 or more members. Only 14.2% (n=52) had fewer than four people. The majority of households were medium to large in size, suggesting considerable in-house labor potential. Such households are well-positioned to implement labor-intensive adaptation practices—including mulching, composting, agroforestry, and soil conservation—especially where mechanization is not feasible. Larger families may also benefit from knowledge-sharing across generations, which can support the uptake of new practices. However, as observed by Kassie et al. (2019), while larger households offer labor advantages, they also experience increased food demand and pressure on available land, which may constrain long-term sustainability and diversification. Therefore, climate adaptation interventions should consider both the labor availability and consumption burden associated with household size. Extension services and climate programs should adopt differentiated outreach strategies, prioritizing high-labor adaptation methods for larger households and recommending low-labor, resource-efficient options for smaller or elderly-headed households.

Land size is a critical determinant of agricultural productivity, input use intensity, and the feasibility of adopting certain climate-smart practices. Respondents were asked to indicate the size of land they owned or cultivated. The findings are presented in Table 4.2. The results show that 50.1% (n=184) of the respondents cultivated between 1–2

acres, while 21.3% (n=78) operated on less than 1 acre. Only 28.6% (n=105) farmed on more than 2 acres. The findings confirm that the majority of respondents are smallholder farmers, operating on limited land sizes, consistent with Kenya's rural agricultural structure. This significantly influences what kinds of adaptation strategies are realistic and sustainable. For instance, large-scale mechanized interventions, contour bunding, or commercial tree planting may be impractical on small plots. As noted by Mwongera et al. (2017), small landholdings constrain long-term investments in infrastructure-based adaptations but support practices like intercropping, vertical farming, conservation tillage, and rainwater harvesting units—which are scalable within space-constrained environments. Therefore, climate adaptation programs targeting farmers in Kakamega County must prioritize land-efficient and low-footprint interventions, promote optimized planting techniques, and consider group-based or communal access to adaptation infrastructure where land is highly fragmented or limited.

Land fragmentation is a critical structural factor affecting land use efficiency, especially in regions with high population density and customary land inheritance systems. Respondents were asked whether they had experienced land fragmentation in their farming areas. The results as shown in Table 4.2 a majority—66.8% (n=245)—acknowledged that their farms were fragmented, while 33.2% (n=122) had not experienced such fragmentation. This widespread occurrence underscores the structural limitations that smallholder farmers in Kakamega County face in managing land resources efficiently. Respondents who experienced fragmentation cited operational inefficiencies, such as increased time and labor required to manage dispersed plots. They also reported higher input costs for fencing and irrigation, limited opportunities for mechanization, and difficulty applying uniform adaptation strategies such as conservation tillage or agroforestry. Similar findings are reported by Kwon et al. (2020), who note that fragmentation reduces economies of scale and deters investment in climate-smart infrastructure. Moreover, farmers indicated that repetitive cultivation on a few accessible plots, due to fragmentation, had led to soil degradation. This supports the work of Wan et al. (2021), who observed that fragmented land holdings correlate with poor soil management and long-term fertility decline. These results highlight the need for land-efficient and context-sensitive adaptation strategies—including zai pits, localized mulching, and plot-level drip

irrigation—as recommended by Amede and Muli (2023), who emphasize smallholder-specific interventions in fragmented contexts. In addition, community-level approaches, such as cooperative land use planning or input-sharing groups, may offer practical pathways to mitigate the inefficiencies associated with fragmentation.

Crop diversity plays a crucial role in smallholder resilience, household food security, and climate change adaptation. Respondents were asked to indicate all crops grown on their farms, reflecting both staple and alternative food systems. The results presented in Table 4.2 show that all respondents (100%) cultivated maize, confirming its status as the primary staple and economic crop among smallholder farmers in Kakamega County. The high prevalence of beans (79.6%) and vegetables (55.9%) suggests widespread adoption of intercropping and subsistence crop diversification. Notably, 45.2% of respondents also grow sweet potatoes—an important drought-tolerant crop that enhances food security during climate-induced stress. Traditional grains like sorghum and millet were grown by 26.4% of farmers, indicating growing awareness of resilient indigenous crop systems. The findings suggest that although maize dominates, farmers are already practicing modest crop diversification—a key component of climate adaptation. This aligns with literature emphasizing diversification as a pathway to food and income security amid climate variability (Waudu, 2024). Furthermore, the cultivation of resilient crops such as millet and sweet potatoes shows the potential for scaling up adaptation strategies that mitigate the risks of erratic rainfall and declining soil fertility. Programs aiming to promote climate-smart agriculture should leverage this existing base by offering improved seed varieties, training in integrated cropping systems, and access to input markets for alternative crops. This would align with the study's broader goal of enhancing adaptive capacity among maize farmers through informed diversification.

Livestock keeping is a vital livelihood component among smallholder farmers, offering nutritional support, income generation, and buffering against climate-induced crop failure. Respondents were asked to indicate all types of livestock they rear. The majority of farmers kept chickens (87.5%), followed by cattle (56.7%) and goats (47.4%). These findings reflect a strong presence of mixed crop-livestock systems, which are known to enhance farm-level resilience by diversifying income sources and improving nutrient cycles. Chickens are especially prevalent due to their low input

requirements and quick return cycles, making them suitable for both food and income generation in resource-constrained settings. The widespread integration of livestock, particularly small stock such as poultry and goats, indicates that farmers are already engaging in adaptive strategies that complement crop production. As noted by Waudo (2024), diversification through livestock is essential in climate-sensitive contexts, providing a safety net during periods of crop failure and contributing to household food security. These findings support the inclusion of livestock-based adaptation strategies in agricultural extension and climate resilience programming. Interventions such as improved poultry breeds, access to veterinary services, and smallholder fodder production can further strengthen the adaptive capacity of farming households.

Income diversification is widely recognized as a critical determinant of resilience and adaptive capacity among smallholder farmers. To explore this dimension, respondents were asked to report their total annual income from farming and non-farming sources in the past 12 months. The results are summarized in Table 4.3.

Table 4. 3: Annual Income Levels (KES)

Income Source	Mean (KES)	Minimum (KES)	Maximum (KES)
Farming Income	104,800	15,000	450,000
Non-Farming Income	58,200	0	300,000

Source: Field Data (Researcher, 2025)

The mean annual farming income stood at KES 104,800, while non-farming income averaged KES 58,200. Although farming remains the dominant source of livelihood, with some households earning up to KES 450,000, non-agricultural income sources—such as casual labor, small businesses, and remittances—also play a substantial role, especially among households with lower farming returns. Approximately 68% of respondents reported having at least one source of supplementary income, with some indicating that it had become increasingly important due to climate-induced variability in crop yields.

These findings affirm that many smallholder households operate within a mixed livelihood system, where off-farm income provides a financial cushion that can support the adoption of climate-resilient technologies and buffer seasonal losses. Chepng'etich et al. (2024) emphasize that households with access to diversified

income streams demonstrate greater flexibility in managing climate risks, particularly in acquiring adaptation inputs, accessing credit, or recovering from crop failure. As such, policies promoting climate-smart agriculture must also consider complementary livelihood support interventions—such as microenterprise training, savings cooperatives, or climate-sensitive social protection—to strengthen household-level resilience.

4.4 Descriptive Analysis of Study Variables

This section presents the descriptive statistical analysis of key variables related to the study's core themes: access to climate-related information, the role of social and traditional media, participation in community-based organizations and volunteer groups, and the adoption of climate change adaptation strategies. Descriptive statistics are used to summarize responses and illustrate central tendencies and variation within the data, offering insights into general patterns and behaviors among respondents. The analysis draws from both categorical and Likert-scale items in the questionnaire and focuses on how farmers interact with information platforms, the types of adaptation strategies they employ, and the institutional support structures influencing their decisions. This section helps establish the contextual foundation upon which inferential analyses are later conducted, by highlighting prevailing practices, levels of awareness, and participation trends that shape adaptation outcomes at the household level. The findings also reveal critical information gaps, adoption barriers, and areas where targeted interventions may be necessary to enhance climate resilience among smallholder farmers in the region.

4.4.1 Social Media and Climate Change Adaptation

In recent years, social media has emerged as a critical channel for disseminating climate-related agricultural information among smallholder farmers. The first objective of the study was to evaluate the effect of social media on adoption of climate change adaptation strategies among smallholders' maize farmers in Kakamega County. This section therefore examines the patterns, content, and influence of social media use by maize farmers in Kakamega County, based on multiple-choice, Likert-scale, and open-ended responses. The findings provide insights into how digital platforms shape awareness, decision-making, and community learning around climate change adaptation.

Respondents were asked to indicate the social media platforms they use to access farming or climate-related information. The responses are summarized in Table 4.3.

Table 4. 4: Social Media Platforms Used for Climate and Farming Information

Social Media Platform	Frequency (n)	Percentage (%)
WhatsApp	312	85.0%
Facebook	244	66.5%
Twitter (X)	89	24.3%
Instagram	47	12.8%
Others	31	8.4%

Source: Field Data (Researcher, 2025)

As shown in Table 4.4, WhatsApp (85%) was by far the most widely used platform, followed by Facebook (66.5%), while Twitter (X) and Instagram were less common with 24.3% and 12.8% respectively. These results highlight WhatsApp’s dominance, likely due to its affordability, user-friendliness, and capacity for peer-to-peer communication through farming groups. These findings align with observations by Makau et al. (2022), who note that WhatsApp is increasingly preferred by rural farmers due to its reliability and group-based knowledge exchange. Facebook’s widespread use also reflects its role in broader farming forums and NGO communication platforms.

Respondents were also asked to indicate the type of content they received via social media. Table 4.4 presents a breakdown of the types of content accessed.

Table 4. 5: Type of Climate and Agricultural Information Accessed via Social Media

Type of Information	Frequency (n)	Percentage (%)
Farming techniques	305	83.1%
Weather forecasts	289	78.7%
Government/NGO programs	213	58.0%
Disaster warnings	178	48.5%
Other (e.g., market prices)	40	10.9%

Source: Field Data (Researcher, 2025)

The majority of farmers accessed practical information such as weather forecasts

(78.7%) and farming techniques (83.1%). These data-driven insights allowed respondents to plan planting cycles, adapt to rainfall variations, and manage risks proactively. The high prevalence of NGO and government program updates also signals growing integration of institutional content in farmer-accessible networks. This aligns with Chepng'etich et al. (2023), who emphasize the role of digital tools in enhancing farmer preparedness and knowledge about climate adaptation resources.

To assess farmers' perceptions of social media's utility in climate adaptation, respondents rated their agreement with five statements using a five-point Likert scale. The summarized data is presented in Table 4.6.

Table 4. 6: Respondents' Perceptions of Social Media's Role in Climate Adaptation

Statement	Mean	SD
I frequently use social media to access climate-related information.	3.81	1.01
Social media improves my awareness of climate-smart practices.	3.89	0.96
I trust the farming information shared on social media.	3.56	1.12
I have applied techniques learned through social media.	3.68	1.09
I actively participate in WhatsApp or Facebook farming groups.	3.55	1.18

Source: Field Data (Researcher, 2025)

The Likert-scale findings indicate that smallholder maize farmers in Kakamega County generally hold positive perceptions toward social media as a source of climate-related agricultural information. The highest level of agreement was observed for the statement that social media improves awareness of climate-smart farming practices (mean = 3.89), suggesting strong recognition of its educational role. Farmers also reported frequent use of social media to access climate-related information (mean = 3.81), and many indicated they had applied techniques learned online (mean = 3.68). While overall perceptions of trust (mean = 3.56) and group participation (mean = 3.55) were still favorable, these lower means suggest some reservations—particularly regarding information reliability and active engagement in farming forums. Standard deviations ranging from 0.96 to 1.18 reveal moderate variability in responses, pointing to differences in digital literacy, access, or content relevance among respondents.

These findings reinforce the growing body of evidence that social media serves as a

vital climate information conduit for smallholder farmers. Chepng'etich et al. (2023) highlight that platforms like WhatsApp have the potential to rapidly disseminate localized agronomic content, increasing farmers' climate literacy and responsiveness. Additionally, the application of learned techniques echoes the work of Murage et al. (2021), who found that digital exposure increases adoption rates of low-cost adaptation practices such as mulching and composting. However, the relatively lower trust in social media content and participation in group discussions reflect limitations observed in studies by Jalango et al. (2024) and Amede & Muli (2023), who caution against misinformation and unequal access in digital farming ecosystems. These results suggest that while social media offers promising pathways for promoting resilience, its effectiveness is mediated by digital trust, content validation, and the inclusivity of user engagement. To maximize impact, future interventions must integrate verified information from extension experts, promote digital literacy, and support participatory online communities that foster both knowledge and trust. This ensures that social media transitions from an informal tool to a reliable pillar in climate adaptation infrastructure.

Influence of Social Media Your Farming Decisions

Respondents were asked whether social media had influenced their farming decisions. Figure 4.1.

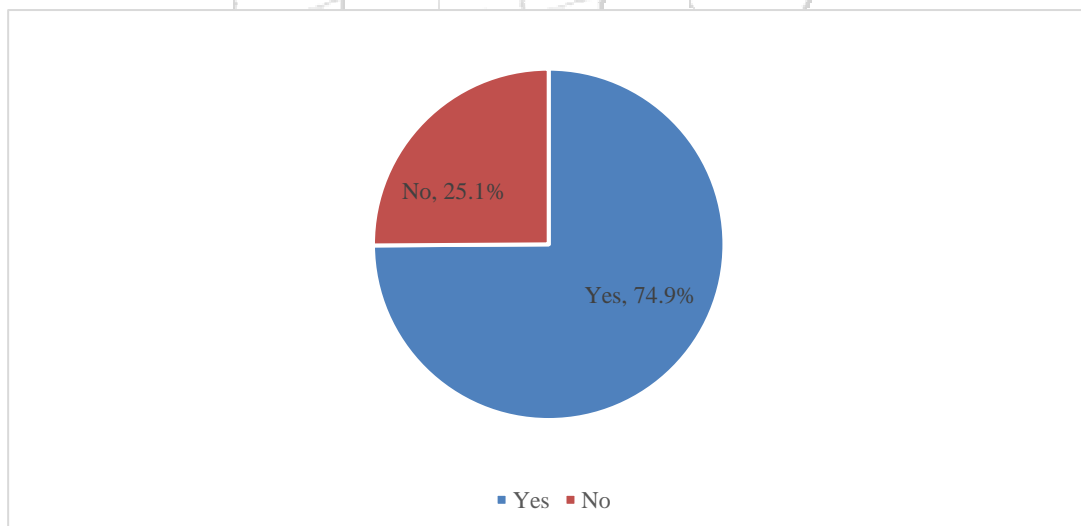


Figure 4. 1: Influence of Social Media Your Farming Decisions

Source: Field Data (Researcher, 2025)

As summarized in Figure 4.1, 74.9% (n = 275) of the respondents affirmed that social

media had indeed shaped their decision-making processes, while 25.1% (n = 92) stated that it had not. This high proportion underscores the functional role of digital platforms as more than just information sources—they are influencing when, how, and what farmers decide to implement in response to climate risks.

Among those who confirmed that social media had influenced their farming, several themes emerged from the qualitative responses. First, farmers frequently cited real-time weather updates as the basis for changing planting and input schedules. For instance, one farmer remarked, *“We planted early after seeing rain updates shared in our group.”* Such examples illustrate how climate forecasts, when disseminated quickly through WhatsApp or Facebook, help smallholders respond proactively to variable rainfall.

Another dominant theme was the adoption of climate-smart practices learned through digital farming groups. Several respondents described implementing techniques such as mulching, composting, pest control using natural inputs (e.g., ash), and raised bed planting after watching videos or reading advice shared by peers. As one respondent explained, *“I started using ash to manage pests after seeing a farmer post it in our group.”* This peer-to-peer learning fosters localized innovation and enables the transfer of low-cost, practical solutions.

Lastly, social media was seen as a gateway to institutional information and support. Respondents shared that they learned about input subsidies, extension events, and NGO programs through group updates. One farmer noted, *“I learned about free seed distribution from a group post and registered in time.”* This suggests that platforms like Facebook and WhatsApp are not only informal learning tools but also mechanisms for accessing formal agricultural resources.

These patterns align with literature by Kihara and Masibo (2024), who found that digital platforms help rural farmers become more responsive to climate variability by bridging information gaps and enhancing localized knowledge flow.

Challenges in Using Social Media

Respondents were asked to indicate what challenges they face in using social media for farming information. Despite the benefits, several challenges were identified that

limit the effectiveness of social media in promoting climate adaptation. The most frequently mentioned challenge was poor or inconsistent internet connectivity, cited by 68% of respondents. This issue was particularly pronounced in remote areas, where weak network signals limited farmers' ability to engage with timely content or participate in group discussions during critical decision-making periods.

Another significant challenge, reported by 54% of the participants, was exposure to misinformation. Many farmers expressed concerns about receiving unverified agricultural advice on platforms such as WhatsApp and Facebook. In some cases, contradictory messages created confusion and eroded trust, especially where content lacked expert validation or moderation. Without a reliable mechanism to vet information, the risk of adopting ineffective or even harmful practices remains high.

Additionally, 49% of respondents indicated that the high cost of mobile data was a constraint, especially during off-peak farming seasons when household incomes tend to be lower. For many, internet access is not continuous but rather rationed based on immediate needs or available income, limiting their full participation in digital farming communities.

These challenges emphasize the need for supportive infrastructure, including better rural network coverage, digital literacy programs, and verified content-sharing mechanisms. As suggested by Amede and Muli (2023), addressing these barriers is crucial to realizing the full potential of digital tools for climate resilience.

Participation in Social Media Farming Groups

Respondents were asked to indicate if they have participated in any social media farming groups. Figure 4.2 presents summary of findings obtained.

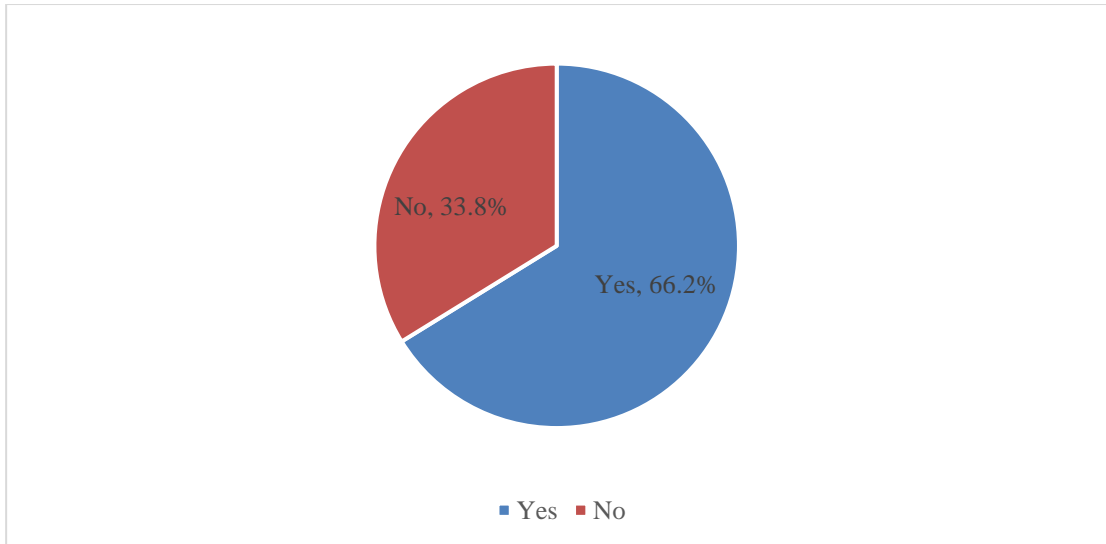


Figure 4. 2: Respondents Participation in Social Media Farming Groups

Source: Field Data (Researcher, 2025)

The majority of respondents (66.2%, n = 243) reported that they had participated in at least one social media-based farming group, while 33.8% (n = 124) had not. Participation was primarily through WhatsApp, with several respondents also engaging via Facebook groups. These digital spaces serve as informal extension forums where farmers interact, share ideas, and learn collaboratively.

Frequently mentioned groups included “*Climate-Smart Farmers of Kakamega*”, “*Maize Growers Hub*”, and “*AgriAlerts WhatsApp Group*.” Participation in these digital communities promotes the exchange of local knowledge, fosters peer mentorship, and builds collective resilience. These groups act as informal extension networks, allowing farmers to share experiences, problem-solve in real-time, and validate new adaptation practices through community feedback.

This finding reinforces insights from Chepng’etich et al. (2023) and Amede and Muli (2023), who emphasize that social learning through digital communities strengthens adaptive capacity. Such platforms can be leveraged not only to disseminate expert guidance but also to support co-creation of knowledge among farmers facing similar ecological and economic constraints.

Overall, the findings confirm that social media has become an integral component of climate adaptation among smallholder farmers in Kakamega County. High usage levels, coupled with reported influence on decision-making and practice adoption,

highlight the transformative role of platforms like WhatsApp and Facebook in agricultural development. These tools enable the rapid dissemination of weather alerts, farming advice, and institutional updates, contributing to more responsive and informed farming systems. However, the challenges identified—including misinformation, limited connectivity, and high data costs—must be addressed to ensure equitable and sustained access. The potential of social media lies not just in information availability, but in the credibility, usability, and inclusivity of that information. As such, enhancing content quality, strengthening digital infrastructure, and building farmer capacity are essential steps toward embedding social media as a reliable and resilient pillar of climate adaptation strategies in rural Kenya.

4.4.2 Traditional Media and Climate Change Adaptation

Traditional media has historically served as a central channel for disseminating agricultural and climate-related information, especially in rural and semi-literate populations. The second objective of the study was to examine the effect of traditional media on adoption of climate change adaptation strategies among smallholders' maize farmers in Kakamega County. This section therefore explores the types of traditional media accessed, the frequency of their use, alternative information sources, and how these platforms have shaped farming practices and perceptions related to climate resilience.

Traditional Media Sources Used

Respondents were asked to indicate which traditional media sources they used to access farming or climate-related information. The findings are presented in Table 4.7.

Table 4. 7: Traditional Media Sources Used for Climate and Agricultural Information

Traditional Media Source	Frequency (n)	Percentage (%)
Radio	287	78.2%
Television	198	54.0%
Newspapers	91	24.8%

Source: Field Data (Researcher, 2025)

Radio was the most accessed medium, with 78.2% of respondents indicating regular use, followed by television at 54.0%. Newspapers had the lowest reach, used by only 24.8% of respondents. These findings align with Makau et al. (2022), who observed that radio remains the most accessible and widely trusted source of agricultural information in rural Kenya due to its affordability, language inclusivity, and wide signal coverage. The prominence of television also reflects its growing penetration even in rural areas, albeit limited by electricity access and cost.

Frequency of Access

To understand how often farmers access information from traditional media, respondents were asked to indicate their usage frequency. The results are summarized in Table 4.8.

Table 4. 8: Frequency of Accessing Traditional Media

Frequency of Access	Frequency (n)	Percentage (%)
Daily	124	33.8%
Weekly	152	41.4%
Monthly	47	12.8%
Rarely/Never	44	12.0%

Source: Field Data (Researcher, 2025)

The majority of respondents accessed traditional media either daily (33.8%) or weekly (41.4%), indicating a consistent flow of information. Monthly or infrequent access was reported by only a quarter of respondents. This consistency suggests that traditional media remains a habitual and reliable information source, particularly during peak farming seasons when updates on weather or inputs are critical.

Alternative Sources of Climate-Related Information

In addition to media, respondents were asked to identify other sources from which they obtain climate-related farming information. The results are detailed in Table 4.9.

Table 4. 9: Other Sources of Climate-Related Information

Information Source	Frequency (n)	Percentage (%)
Friends and relatives	241	65.7%
Farming extension officers	198	54.0%
Local leaders	153	41.7%
Farmers' cooperatives	134	36.5%
NGOs/Community-based groups	176	48.0%
Others	18	4.9%

Source: Field Data (Researcher, 2025)

Social networks—particularly friends and relatives—ranked highest (65.7%) as alternative sources, followed by farming extension officers (54.0%) and community-based groups (48.0%). This blend of informal and formal channels reinforces the idea that smallholder farmers operate in a pluralistic information environment, relying on both institutional and interpersonal communication streams. This supports findings by Gakuru et al. (2020), who emphasize the role of farmer-to-farmer interactions in reinforcing messages delivered through mass media.

Has Traditional Media Influenced Your Farming Practices?

Respondents were asked whether traditional media had influenced their farming practices.

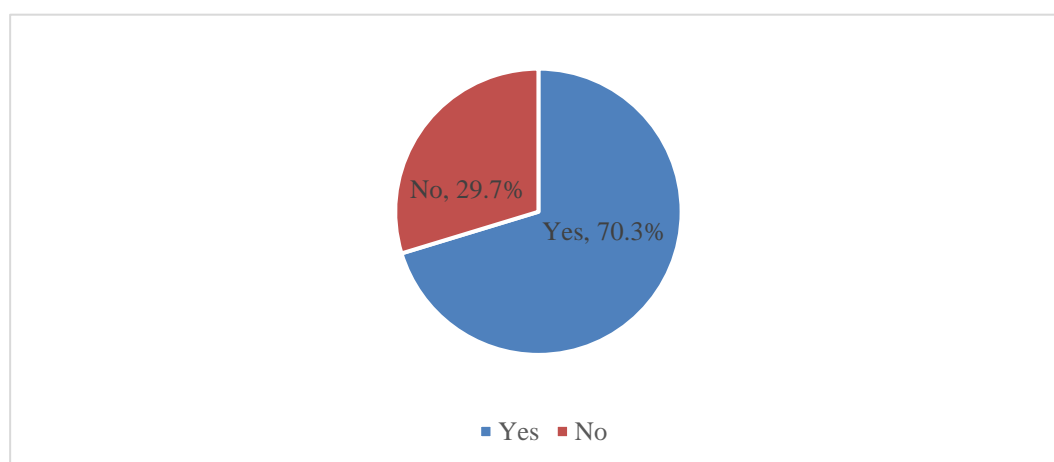


Figure 4. 3: Influence of Traditional Media on Farming Practices

Source: Field Data (Researcher, 2025)

A large proportion (70.3%) answered in the affirmative. Qualitative responses revealed that traditional media contributed in several ways: First, farmers cited weather updates from radio and TV as useful in planning planting and harvesting activities. One participant explained, *“I listen to the radio in the morning for the weather. It helps me plan when to spray or plant.”* This confirms that even with the advent of digital platforms, radio and TV remain critical for disseminating time-sensitive environmental information. Second, several respondents reported adopting soil conservation and drought-mitigation techniques learned from agricultural radio shows and TV programs. Practices such as cover cropping, intercropping, and mulching were frequently mentioned.

Lastly, traditional media was appreciated for introducing farmers to government policies, subsidy programs, and training opportunities through structured broadcasts. As one respondent shared, *“I heard about seed subsidy from an agricultural show on TV and went to register.”* These findings suggest that traditional media remains relevant and effective in delivering both technical and institutional knowledge.

What Do You Find Most Helpful About Traditional Media?

When asked what they found most beneficial about traditional media for accessing climate-related agricultural information, respondents highlighted three prominent themes that reflect the enduring utility of these platforms in rural farming contexts. First, many farmers praised the use of local languages on radio and regional TV stations. This accessibility makes agricultural information comprehensible and culturally relevant to a broad audience, including older farmers and those with limited formal education. As most rural households regularly tune in to vernacular programming, language-sensitive broadcasting ensures that critical climate and agronomic messages reach even the most marginalized groups. This aligns with Murage et al. (2021), who found that the linguistic familiarity of media content plays a key role in determining uptake of climate-smart messages.

Second, respondents cited the timeliness of weather forecasts and government updates as a core strength of traditional media, particularly radio and TV. Agricultural extension programs broadcast on these platforms often align with seasonal calendars, offering farmers real-time guidance on planting, pest control, or drought preparedness. One participant noted that listening to early morning weather updates

on the radio had become a routine part of their decision-making. This consistency reinforces the media's role as a trusted adviser during climate-sensitive periods.

Third, the availability of expert insights through structured programs—such as call-in shows, expert interviews, or farming documentaries—was considered highly valuable. These segments often feature specialists from agricultural institutes or government agencies who translate scientific knowledge into actionable steps for smallholders. Farmers appreciated this access to credible information, especially when delivered in an engaging and simplified format. These findings support assertions by Gakuru et al. (2020) that expert-guided media programs play a critical role in bridging the research-extension divide in rural Kenya.

What Limitations Do You Face When Using Traditional Media?

Despite the strengths of traditional media, farmers also pointed out several limitations that reduce its overall effectiveness in supporting adaptive agricultural practices. One of the most commonly cited issues was the generic nature of content, particularly on national TV and radio stations. Respondents noted that while media content is often informative, it tends to generalize farming advice and does not always address the unique climatic and agronomic conditions specific to their sub-counties or crop systems. This lack of localization can reduce the applicability of information, particularly for farmers managing diversified or highland production systems.

Another key limitation was the lack of interactivity. Unlike social media, which allows two-way communication and real-time engagement with peers or experts, traditional media is unidirectional. Farmers expressed frustration that they could not ask follow-up questions, request clarification, or share their own experiences. This limitation reduces opportunities for adaptive learning and personalized guidance, especially when information shared is novel or complex.

Additionally, respondents highlighted the cost and infrastructural barriers associated with accessing some traditional media channels. While radios are relatively cheap and widespread, owning and operating a television set can be prohibitive due to electricity constraints or the cost of subscription services. Newspapers, meanwhile, were considered expensive, difficult to obtain daily in rural settings, and not always available in local languages. These access-related challenges are consistent with

findings by Amede and Muli (2023), who noted that the digital divide is often paralleled by a media divide in resource-constrained rural areas.

These insights reveal that while traditional media remains a critical source of information, it is constrained by limited personalization, low interactivity, and infrastructural barriers. Bridging this gap will require hybrid communication approaches—for example, pairing radio programs with follow-up SMS platforms, or integrating local FM stations with WhatsApp-based extension feedback loops.

Perceptions of Traditional Media: Likert Scale Analysis

Respondents were asked to rate five statements regarding their perceptions of traditional media. Responses were captured using a 5-point Likert scale and are summarized in Table 4.10.

Table 4. 10: Respondents’ Perceptions of Traditional Media in Climate Adaptation

Statement	Mean	SD
I regularly receive climate-related content via traditional media.	3.73	1.05
Radio and TV provide timely weather forecasts and farming advice.	3.81	0.98
I have adopted farming practices based on what I learned through media.	3.66	1.02
I find traditional media more reliable than social media.	3.42	1.13
Content from radio and TV is understandable and relevant to my context.	3.78	0.99

Source: Field Data (Researcher, 2025)

The results suggest that respondents view traditional media as a trusted and useful source of agricultural information. The highest-rated item (mean = 3.81) confirms that farmers find radio and TV to be timely sources of farming advice. Similarly, a high mean (3.78) for contextual relevance indicates that farmers perceive the content to be well-aligned with their local needs. The slightly lower, but still positive mean for the statement “I regularly receive climate-related content via traditional media” (mean = 3.73) suggests that access is not only widespread but also consistent. The statement “I have adopted farming practices based on what I learned through media” received a

mean of 3.66, confirming that traditional media influences behavioral change, even if not as directly or interactively as social media.

However, the relatively lower score (mean = 3.42) for media reliability compared to social media reveals some uncertainty. This finding may stem from the rise of more tailored, peer-driven content in digital platforms, which can appear more relevant despite being less formal or vetted. These results are consistent with Murage et al. (2021), who found that the perceived reliability of a communication channel increasingly depends on its capacity for dialogue and contextual specificity, not just its formality or institutional backing.

The findings confirm that traditional media remains a central pillar in the climate information ecosystem for smallholder farmers in Kakamega County. With high levels of use and trust, especially for radio and TV, these platforms continue to play a vital role in enhancing awareness, influencing practices, and connecting farmers to institutional resources. However, challenges such as generalized content and limited interactivity require attention. Moving forward, agricultural communication strategies should aim to integrate traditional and digital platforms to leverage the strengths of both—broadcast reach and peer-based customization—for effective and inclusive climate adaptation messaging.

4.4.3 Community-Based Organizations and Volunteer Groups

Volunteer groups, including self-help associations, cooperatives, and NGOs, play a pivotal role in empowering smallholder farmers to build resilience against climate change. The third objective of this study was to evaluate the effect of volunteer groups on the adoption of climate change adaptation strategies among smallholder maize farmers in Kakamega County. This section explores farmers' involvement in such groups, frequency of engagement, type of support received, and the influence of group participation on farming decisions.

Involvement in Community-Based Organizations and Volunteer Groups

Respondents were asked whether they were involved in any volunteer groups or CBOs for farming-related training and support. Figure 4.4 presents the findings obtained.

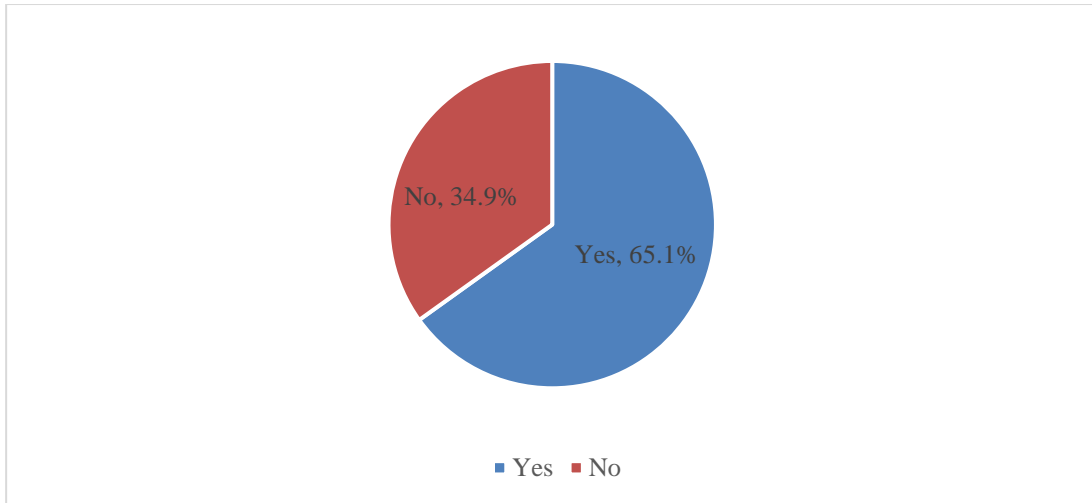


Figure 4. 4: Involvement in Volunteer Groups or CBOs

Source: Field Data (Researcher, 2025)

As shown in Figure 4.4, 65.1% (n = 239) reported being active in such groups, while 34.9% (n = 128) were not. This high level of engagement reflects the critical role community-based institutions play in facilitating adaptation, especially in regions where formal extension services are limited. These findings align with Chepng’etich et al. (2023), who emphasize that localized collective action enhances farmers’ capacity to absorb climate shocks through access to inputs, training, and peer support.

Among those involved in groups, respondents were asked how often they engaged. The majority as shown in Table 4.11 interacted either weekly (36.8%) or monthly (39.3%), while 23.9% engaged occasionally.

Table 4. 11: Frequency of Engagement with community-based organizations and/or volunteer groups

Engagement Frequency	Frequency (n)	Percentage (%)
Weekly	88	36.8%
Monthly	94	39.3%
Occasionally	57	23.9%

Source: Field Data (Researcher, 2025)

Regular interaction suggests that many of these groups are dynamic and functionally active. Weekly and monthly engagement enables timely dissemination of climate forecasts, inputs, and adaptive techniques, consistent with literature by Amede and

Muli (2023), who found that active group participation is positively correlated with early adoption of conservation farming practices.

Types of Groups Participated In

Respondents were also asked to indicate the types of groups they engaged with. Table 4.12 present summary of findings

Table 4. 12: Types of Groups Participated In

Group Type	Frequency (n)	Percentage (%)
CBOs	171	71.6%
Self-help groups	163	68.2%
Farmer cooperatives	127	53.1%
Others	24	10.0%

Source: Field Data (Researcher, 2025)

As presented in Table 4.12, the most common were NGOs (71.6%), self-help groups (68.2%), and farmer cooperatives (53.1%). CBOs and self-help groups appear especially influential in rural development, reflecting their grassroots orientation and accessibility. These groups often act as intermediaries between farmers and external agencies, channeling inputs, subsidies, and training.

Support Received from community-based organizations and volunteer groups

Respondents received a variety of support services, summarized in Table 4.13.

Table 4. 13: Type of Support Received from community-based organizations and volunteer groups

Type of Support	Frequency (n)	Percentage (%)
Training on climate-smart practices	198	82.8%
Distribution of drought-resistant seeds	176	73.6%
Water conservation assistance	142	59.4%
Financial support or subsidies	103	43.1%
Others	14	5.9%

Source: Field Data (Researcher, 2025)

The most frequently received forms of assistance were training on climate-smart practices (82.8%) and distribution of drought-resistant seeds (73.6%). Support for water conservation (59.4%) and financial subsidies (43.1%) was also notable. These findings affirm the multi-dimensional role of community-based organizations and volunteer groups in capacity building. Access to training and inputs not only reduces financial barriers but also enhances farmers' technical knowledge and long-term adaptive capacity. According to Gakuru et al. (2020), such support mechanisms are instrumental in enabling marginalized farmers to implement resource-efficient practices, particularly in fragile agro-ecological zones.

Influence of community-based organizations and volunteer groups on Farming Practices

The qualitative data from open-ended responses revealed that participation in community-based organizations and volunteer groups significantly transformed farming practices among many smallholder maize farmers. Thematic analysis identified three dominant areas of influence: access to climate-smart knowledge, improved input availability, and peer-to-peer learning.

First, group-based training and demonstration sessions were repeatedly cited as transformative. These sessions introduced farmers to adaptive techniques such as crop rotation, intercropping, zai pits, and moisture-retaining mulching. One farmer stated, *“Before joining our self-help group, I didn’t know about zai pits. Now I use them every season to preserve moisture during dry spells.”* Another echoed this by noting, *“After attending a demonstration on conservation tillage organized by our group, I applied the same technique in my field. The results were better than before.”* These examples highlight how structured training delivered at the community level enables practical learning and experimentation, consistent with findings by Chepng’etich et al. (2023), who emphasize the value of local knowledge adaptation through farmer field schools and NGO partnerships.

Second, involvement in community-based organizations and volunteer groups enhanced access to inputs and material support—resources that are often otherwise unaffordable or unavailable. Respondents reported receiving drought-tolerant maize varieties, certified seeds, and organic fertilizers at subsidized or no cost through NGO and cooperative programs. As one farmer explained, *“I was able to plant early-*

maturing seeds after our group partnered with a local NGO. Without them, I couldn't afford it.” Another farmer added, *“Our cooperative helped us bulk buy compost, which was cheaper and better than chemical fertilizer.”* Such interventions directly reduce vulnerability by equipping farmers with tools to adapt to climatic uncertainty.

Finally, the role of peer exchange within groups emerged as a critical enabler of behavioral change. Farmers valued the opportunity to learn from each other's experiences, experiment with new techniques, and troubleshoot issues collaboratively. One respondent shared, *“When someone in our group tries something new, we all follow and learn from it. That's how I started mulching with banana leaves.”* This horizontal knowledge-sharing model reflects what Murage et al. (2021) describe as ‘socially embedded extension’, where community networks facilitate faster and more culturally relevant adoption of climate-smart practices.

Collectively, these accounts illustrate how community-based organizations and volunteer groups act as incubators of innovation and resilience, providing both the information and the support systems necessary for smallholders to adapt in a cost-effective, peer-driven, and localized manner.

Challenges Faced in Accessing Group Support

Despite the clear benefits, respondents also identified a range of structural, logistical, and social barriers that constrained the full utility of volunteer group participation. A frequently mentioned issue was limited geographical coverage. Some groups only operated in specific villages or were tied to particular NGO projects, leaving out farmers in nearby but unregistered areas. As one farmer put it, *“The trainings don't reach our side. We just hear they happened in the next village.”* This spatial inequality in access limits the scalability of adaptation knowledge and exacerbates existing disparities.

Another challenge was irregular or inconsistent engagement. Farmers noted that some groups did not meet regularly, especially outside of planting seasons. Others complained about lack of continuity in training or poor follow-up after initial workshops. One farmer remarked, *“We attended one session last year, but the trainer never came back. We were left guessing the rest.”* These gaps can dilute the impact of otherwise promising interventions. Leadership and governance issues were also

raised. A few participants noted that some groups were dominated by elite or politically connected individuals, which led to biased distribution of inputs and training opportunities. One farmer shared, *“The group chair only selects his friends for seed support. Others are left out.”* Such exclusions undermine trust and can discourage broader community participation.

In addition, some farmers highlighted poor communication and unclear group objectives, especially in cooperatives transitioning from savings-based models to agronomic training. *“Our group started for table banking, now it’s about farming, but no one explained clearly what changed,”* said one participant. This points to the importance of clarity, transparency, and accountability in grassroots agricultural networks.

These findings suggest that while community-based organizations and volunteer groups are powerful agents for climate adaptation, their success depends on equity in participation, consistent engagement, and institutional support. Addressing these constraints requires building stronger partnerships between farmer organizations, NGOs, and government extension officers, and ensuring participatory governance structures within the groups themselves. As Amede and Muli (2023) recommend, sustained capacity-building efforts must be paired with accountability systems to ensure that such groups remain inclusive, reliable, and truly farmer-led.

Perceptions of community-based organizations and volunteer groups: Likert Scale Analysis

To further understand perceptions of community-based organizations and volunteer groups, respondents rated five statements on a 5-point Likert scale. Results are summarized in Table 4.14.

Table 4. 14: Perceptions of community-based organizations and volunteer groups in Climate Adaptation

Statement	Mean	SD
I receive useful farming support and training from these groups.	3.91	0.93
These groups help me access farming inputs (e.g., seeds, tools).	3.76	1.05
I regularly attend training sessions or demonstrations by the groups.	3.62	1.12
Information shared by these groups influences my farming decisions.	3.87	0.97
These groups enable farmers to collaborate and share knowledge.	3.94	0.91

Source: Field Data (Researcher, 2025)

The highest agreement was for the statement “*These groups enable farmers to collaborate and share knowledge*” (mean = 3.94), followed closely by “*I receive useful farming support and training*” (mean = 3.91). These high scores reflect the value of social capital in building adaptive capacity. The statement “*Information shared by these groups influences my farming decisions*” also received a strong score (mean = 3.87), confirming that group participation translates into practical change. Moderate agreement was recorded for “*I regularly attend training sessions*” (mean = 3.62), suggesting variability in training access or frequency. Slightly lower, though still favorable, was agreement on input access (mean = 3.76), which may reflect the limited resource base of some volunteer initiatives.

Overall, the Likert findings align with earlier qualitative themes: farmers value community-based organizations and volunteer groups as trusted spaces for collective learning, support, and action. This supports Jalango et al. (2024), who note that the relational trust and shared norms within such groups foster sustained behavioral change.

The findings from this section confirm that community-based organizations and volunteer groups play a significant role in advancing climate adaptation among smallholder maize farmers in Kakamega County. With high levels of participation and reported influence on decision-making, these groups are central to the dissemination of climate-smart technologies, provision of critical inputs, and facilitation of peer learning. However, challenges such as inequitable access, limited coverage, and group

governance issues must be addressed to enhance the effectiveness and inclusiveness of these platforms. Strengthening institutional linkages between farmer groups, extension services, and climate research bodies will be key to scaling up community-led adaptation in Kenya’s agricultural sector.

4.4.4 Adoption of Climate Change Strategies

Climate change poses significant risks to smallholder agriculture, necessitating timely and context-sensitive adaptation. This study sought to evaluate the extent and nature of adoption of various climate change adaptation strategies among smallholder maize farmers in Kakamega County. This section presents findings on the types of strategies adopted, motivations behind adoption, implementation challenges, sources of information, and farmers’ perceptions of these strategies.

Adoption of Specific Adaptation Strategies

Respondents were asked whether they had adopted a set of predefined climate change adaptation strategies. The results, summarized in Table 4.14, show that crop diversification and the use of drought-resistant seed varieties had the highest levels of uptake, while strategies such as improved irrigation techniques and organic farming lagged behind.

Table 4. 15: Adoption of Climate Change Adaptation Strategies

Strategy	Yes (n)	Yes (%)	No (n)	No (%)
Crop diversification	271	73.9	96	26.1
Use of drought-resistant seed varieties	289	78.7	78	21.3
Rainwater harvesting	204	55.6	163	44.4
Conservation tillage	198	54.0	169	46.0
Organic farming	176	48.0	191	52.0
Livelihood diversification	192	52.3	175	47.7
Agroforestry	183	49.9	184	50.1
Improved irrigation techniques	109	29.7	258	70.3

Source: Field Data (Researcher, 2025)

The widespread adoption of drought-resistant seeds (78.7%) and crop diversification (73.9%) reflects their affordability, compatibility with existing farming systems, and relatively low labor or capital requirements. These practices offer farmers immediate benefits in yield stability and income buffering, particularly under erratic rainfall patterns. This is consistent with Kihara and Masibo (2024), who emphasize that seed innovation is a critical pillar of adaptive agriculture in East Africa.

Mid-range strategies such as rainwater harvesting (55.6%) and conservation tillage (54.0%) were moderately adopted, likely due to variability in knowledge, cost, or technical feasibility. The lower adoption of organic farming (48.0%) and agroforestry (49.9%) may be attributed to labor intensity and lack of technical support, while improved irrigation techniques had the lowest adoption (29.7%), constrained by capital investment and water access challenges. This underscores findings by Amede and Muli (2023), who note that water-access strategies often face structural bottlenecks in rural Kenya.

Reasons for Adopting Climate Adaptation Strategies

The decision to adopt climate change adaptation strategies is influenced by a range of motivations, many of which are grounded in farmers' lived experiences, risk perceptions, and support structures. Analysis of open-ended responses from the survey revealed three dominant themes: improved productivity, resilience to climatic shocks, and access to supportive interventions.

A key driver across most responses was the perception of yield stability and improvement. Farmers consistently noted that adaptation strategies, particularly crop diversification and the use of drought-resistant seed varieties, had enhanced the consistency of their harvests. This was especially relevant in seasons marked by erratic rainfall or prolonged dry spells. One farmer recounted, *"Since I started mixing maize with beans, I always get something even when rains delay. It's not like before when everything failed at once."* The benefit of this mixed cropping system lies in the biological and economic resilience it offers—enabling households to spread risks and maintain food security even under sub-optimal weather conditions. This aligns with findings by Chepng'etich et al. (2023), who identified crop diversification as one of the most effective and widely adopted strategies for risk mitigation in smallholder farming systems.

Another powerful motivation was the ability of specific practices to buffer against climate variability, particularly in moisture management and temperature stress. Farmers praised practices such as mulching, zai pit construction, and conservation tillage for helping them retain soil moisture and protect against crop failure. One respondent described, *“The last two seasons I used zai pits, and my maize was greener than my neighbor’s. Even when others had withered crops, mine survived longer.”* Such testimonials reflect the practical value of adopting low-cost, labor-intensive practices that are well-suited to fragmented land and labor-constrained households. These approaches resonate with research by Amede and Muli (2023), who emphasize that moisture-conservation techniques offer critical entry points for building climate resilience in rainfed systems.

The third major theme emerging from the data was the role of institutional support in catalyzing adoption. Many respondents linked their use of adaptation strategies directly to participation in training programs, group demonstrations, or NGO-facilitated seed distributions. As one farmer put it, *“Our group got free drought-resistant seeds from an NGO, and that’s why I started using them. Otherwise, I couldn’t afford them.”* Another noted, *“After we were trained on composting and conservation tillage, I realized I could improve my soil without buying fertilizer.”* These accounts suggest that technical guidance and resource facilitation are often prerequisites to action, especially where upfront investment or behavior change is required. This echoes the conclusions of Murage et al. (2021), who argue that sustained adoption of climate-smart practices among smallholders is contingent on both demonstrated benefit and consistent institutional engagement.

Furthermore, some farmers indicated peer influence and visibility of success as additional drivers. Seeing neighbors succeed with a particular method often served as a compelling reason to replicate it. *“I saw another farmer getting better harvest with mulch. I tried it the next season,”* explained one participant. This process of social learning and imitation reinforces the need for decentralized demonstration sites and farmer-led extension, which can bridge the gap between knowledge and adoption in a culturally relevant and accessible way.

Challenges in Implementing Adaptation Strategies

While the adoption of climate adaptation strategies among smallholder maize farmers

in Kakamega County has been promising, the implementation process is often fraught with systemic, technical, and socio-economic barriers. Insights from open-ended responses in this study revealed five core challenges: financial constraints, labor intensity, land limitations, technical support gaps, and institutional disconnects.

The most commonly cited barrier was financial limitation, particularly in relation to high-cost technologies like irrigation systems and improved soil management inputs. Many farmers noted that while they understood the benefits of technologies such as drip irrigation, solar pumps, or composting bins, they lacked the capital to procure or maintain them. As one respondent lamented, *“I know irrigation would help, but the pump costs more than my whole harvest. I just rely on rain.”* This observation aligns with Murage et al. (2021), who found that affordability remains the principal constraint in the transition from intention to action, especially for capital-intensive practices.

Labor constraints also emerged as a significant issue, especially for labor-intensive strategies like composting, mulching, and agroforestry maintenance. These techniques, while effective, often require sustained effort and time that many smallholder households—especially those with aging members or minimal external support—struggle to provide. One participant explained, *“Making compost is good, but when you are working alone, you can’t do everything. You choose what you can manage.”* This reflects a broader reality in rural agricultural systems, where adaptation strategies must be labor-compatible to gain traction. Gakuru et al. (2020) highlight that without proper labor-saving innovations or community labor pooling, even well-known climate-smart practices remain underutilized.

The third major challenge related to land size and fragmentation, particularly in high-density regions. Several respondents noted that practices such as agroforestry or conservation tillage are impractical on small or scattered plots. *“My land is divided in three places. I can’t plant trees and maize in all of them,”* noted one farmer. These spatial constraints complicate efforts to scale up techniques that require plot continuity or uniform application. As highlighted earlier in Section 4.3.7, land fragmentation not only increases management complexity but also reduces the feasibility of uniform adaptation interventions. This finding corroborates with the observations of Amede and Muli (2023), who assert that physical land structure is a

foundational determinant of whether adaptation strategies can be practically implemented.

Technical support and follow-up was another critical gap. While many farmers had attended initial training sessions—especially through NGOs or extension officers—few had access to follow-up support or practical demonstrations. A common sentiment expressed was uncertainty in applying technically demanding strategies such as conservation tillage or organic pest control. *“I started conservation tillage but didn’t do it well. I wish someone came to check,”* shared one participant. The absence of continued mentorship or field-based coaching undermines confidence and can lead to inconsistent or incorrect application of adaptive techniques. As Jalango et al. (2024) emphasize, adaptation is a process—not a one-off event—and requires iterative learning supported by responsive extension frameworks.

Finally, some respondents pointed to broader institutional and logistical challenges, such as delays in receiving subsidized inputs, unclear information channels, or selective group targeting. These issues reflect a mismatch between farmer needs and the design or delivery of adaptation interventions. *“Sometimes you hear of a program too late. Or they say only members of a certain group qualify,”* remarked one farmer. These barriers highlight the importance of inclusive program design and timely communication in enhancing equitable access to adaptation resources.

Additional Strategies Farmers Would Like to Learn

As part of the inquiry into future adaptation needs, farmers were asked to indicate which additional climate change strategies they would like to learn about or implement. Their responses reflect an evolving awareness of emerging technologies and a clear appetite for expanding their adaptive capacity—particularly through innovation-driven, resource-efficient approaches.

A dominant theme that emerged was the desire to acquire knowledge on small-scale drip irrigation systems. Many respondents emphasized the need for affordable, low-water-use irrigation to counteract unreliable rainfall and reduce dependence on traditional watering methods. Several farmers highlighted that they had observed positive results in neighboring farms or demonstration plots. One respondent stated, *“Drip irrigation looks simple and effective, but we need training to install and use it*

properly.” This suggests that while awareness exists, technical training and financial accessibility remain key prerequisites for adoption. These findings align with Amede and Muli (2023), who argue that water-efficient technologies will become increasingly central to adaptation in sub-humid and semi-arid regions of Kenya.

Another frequently mentioned area of interest was climate-smart livestock management. Farmers expressed a need to understand how livestock breeds, feeding practices, and manure handling can be adapted for more sustainable, climate-resilient production. Some also asked for guidance on integrating livestock into crop systems through nutrient recycling and fodder cropping. *“We hear about climate-smart cows or chicken rearing, but no one has come to train us here,”* shared one farmer. This points to a gap in knowledge translation between research and practice, particularly in mixed farming systems.

Respondents also demonstrated a keen interest in early warning systems for pests and rainfall. The increasing unpredictability of weather and pest outbreaks was noted as a major challenge, prompting calls for digital alerts, SMS services, or radio-based forecasts that could offer real-time guidance. *“Last year armyworms came and we didn’t know early. If we had been warned, we could have sprayed in time,”* one participant explained. Such concerns emphasize the need to scale digital climate services for smallholders—a recommendation supported by Chepng’etich et al. (2023), who found that timely weather and pest forecasting significantly boosts preparedness and reduces crop loss.

A fourth area of interest was the adoption of solar-powered technologies, especially for irrigation pumps, grain dryers, and lighting. Farmers appreciated the potential of solar energy to reduce long-term operational costs and overcome electricity access barriers in off-grid areas. One farmer remarked, *“If I had a solar dryer, my maize wouldn’t go bad during rains after harvest.”* These sentiments reflect a broader trend toward interest in decentralized, green energy solutions that enhance post-harvest management and productivity—key pillars in building resilient food systems.

Main Source of Information on Adaptation Strategies

Respondents were asked to indicate their primary source of information on climate adaptation. Table 4.16 summarises the findings.

Table 4. 16: Main Source of Information on Climate Adaptation Strategies

Information Source	Frequency (n)	Percentage (%)
Extension officers	137	37.3%
Social media	118	32.2%
Volunteer groups/CBOs	102	27.8%
Friends and relatives	93	25.3%
Traditional media	84	22.9%
Others	15	4.1%

Source: Field Data (Researcher, 2025)

As summarized in Table 4.16, the top sources were extension officers (37.3%), followed by social media (32.2%), and volunteer groups/CBOs (27.8%). This distribution confirms the complementarity of formal and informal systems, with public extension still playing a leading role, followed closely by digital and community-based platforms. These results align with Waudu (2023), who argues that resilience is built through multi-channel access to information, rather than reliance on any single platform.

Perceptions of Climate Adaptation Strategies: Likert Scale Analysis

To assess farmers' attitudes toward the strategies they have adopted, five statements were rated on a 5-point Likert scale. Results are summarized in Table 4.17.

Table 4. 17: Perceptions Toward Adoption of Climate Change Adaptation Strategies

Statement	Mean	SD
I consistently use the adaptation strategies I've learned.	3.84	0.99
These strategies have improved my yields and income.	3.79	1.02
I plan to adopt more strategies in the next farming season.	3.91	0.97
I face few difficulties in implementing climate adaptation strategies.	3.52	1.11
I am confident in applying these strategies to future climate risks.	3.87	1.00

Source: Field Data (Researcher, 2025)

The highest level of agreement among respondents was recorded for the statement “I plan to adopt more strategies in the next farming season” (mean = 3.91, SD = 0.97), signaling a strong intent among smallholder maize farmers to scale up their engagement with climate change adaptation practices. This forward-looking orientation reflects both a growing awareness of climatic risks and a proactive attitude toward managing future uncertainty. Similarly, high mean scores for confidence in applying strategies (mean = 3.87) and consistent use of learned strategies (mean = 3.84) suggest that many farmers have internalized core principles of climate-smart agriculture and are actively integrating them into their routine decision-making.

Moderate agreement with the statement “These strategies have improved my yields and income” (mean = 3.79) indicates that while farmers recognize tangible benefits, the magnitude of impact may vary based on contextual factors such as land size, capital availability, or the type of strategy implemented. The comparatively lower agreement with “I face few difficulties in implementing adaptation strategies” (mean = 3.52, SD = 1.11) underscores persistent challenges—such as labor intensity, financial constraints, and limited technical support—that can hinder the effectiveness of adaptation efforts despite favorable attitudes.

These findings are consistent with Jalango et al. (2024), who found that the sustainability of climate adaptation among Kenyan smallholders is closely tied to the interplay between farmer confidence, institutional facilitation, and access to inputs. They also reflect conclusions by Murage et al. (2021), who argued that while initial adoption is often driven by training or peer influence, long-term uptake depends on a farmer's ability to perceive and experience real agronomic or economic gains. Overall, the Likert-scale analysis suggests a population that is both willing and capable of deeper adaptation—provided that structural and informational barriers are systematically addressed.

This section confirms that Kakamega’s smallholder maize farmers are adopting a broad range of climate adaptation strategies, particularly those that are cost-effective, low-risk, and institutionally supported. The strong influence of social and institutional networks, including extension officers, NGOs, and social media, underscores the value of blended outreach models. However, adoption is constrained by land limitations, capital access, labor, and information gaps, especially for technically

demanding practices. As such, future interventions must prioritize context-specific training, facilitate credit and input access, and invest in long-term farmer empowerment to scale adaptation effectively.

4.5 Inferential Statistics

This section presents the inferential statistical analysis conducted to examine the relationships between the key variables in the study—namely, social media usage, traditional media exposure, volunteer group participation, and the adoption of climate change adaptation strategies among smallholder maize farmers. While descriptive statistics provided insights into patterns of access and perceptions, inferential statistics allow for deeper exploration of potential causal or correlational associations, offering evidence on the strength, direction, and significance of these relationships. Correlation analysis is first employed to determine the degree of association between independent and dependent variables, followed by multiple regression analysis to assess the predictive power of each factor in explaining variance in adaptation behavior.

4.5.1 Correlation Analysis

This section presents Pearson correlation results that examine the strength and direction of the relationships between the three key independent variables—social media usage, traditional media exposure, and volunteer group participation—and the dependent variable, adoption of climate change adaptation strategies. The analysis is conducted at a 95% confidence interval, with significance determined at $p < 0.05$. Correlation values (r) are interpreted using the following scale: 0.00–0.19 = Very weak; 0.20–0.39 = Weak; 0.40–0.59 = Moderate; 0.60–0.79 = Strong; and 0.80–1.00 = Very strong. The results are presented in Table 4.18.

Table 4. 18: Pearson Correlation Matrix**(n = 367)**

Variables	Social Media Usage	Traditional Media Exposure	Volunteer Group Participation	Adoption of Climate Adaptation Strategies
Social Media Usage	1.000			
Traditional Media Exposure	0.420***	1.000		
Volunteer Group Participation	0.550***	0.490***	1.000	
Climate Adaptation Adoption	0.630***	0.580***	0.670***	1.000

Note: All correlations are statistically significant at $p < 0.05$ (2-tailed).

Source: Field Data (Researcher, 2025)

The analysis reveals that all three independent variables have a strong and statistically significant positive correlation with the dependent variable—adoption of climate adaptation strategies.

Social Media Usage showed a correlation of $r = 0.630$ ($p < 0.05$) with adaptation adoption. This strong relationship suggests that farmers who regularly engage with digital platforms such as WhatsApp and Facebook are more likely to implement climate-smart practices. Social media facilitates timely information sharing, peer learning, and access to institutional updates, thus increasing farmers' preparedness and capacity for adaptation. This finding is consistent with Okello et al. (2022), who highlighted that the immediacy and interactivity of social media improve farmers' risk awareness and adoption of sustainable practices in East Africa.

Traditional Media Exposure was also strongly correlated with adaptation behavior ($r = 0.580$, $p < 0.05$), indicating that radio and television remain important vehicles for communicating agricultural innovations and climate forecasts. These channels are especially vital for farmers in areas with limited internet connectivity. The finding aligns with Mwangi and Bett (2021), who found that vernacular radio programs significantly influenced the uptake of drought-resilient cropping systems in western

Kenya.

Volunteer Group Participation had the highest correlation with adoption of climate strategies at $r = 0.670$ ($p < 0.05$). This robust relationship underscores the importance of grassroots organizations, self-help groups, and NGOs in supporting behavioral change through training, input provision, and experiential learning. According to Otieno and Nkurunziza (2023), community-based models build trust and resilience by enabling co-creation of knowledge and localized adaptation trials, which directly enhances uptake.

These strong, statistically significant associations validate the relevance of the selected predictors and provide a sound empirical basis for the subsequent multiple regression analysis, which seeks to determine the relative influence of each variable on adaptation behavior.

4.5.2 Multiple Regression Analysis

This section presents the results of multiple regression models developed to assess the influence of information and institutional support mechanisms—namely, social media use, traditional media exposure, and volunteer group participation—on the adoption of climate change adaptation strategies among smallholder maize farmers. Two models were estimated. The first model included only the core independent variables. Model 2 included the same core variables, plus four control variables: age, gender, education, and income.

Model Summary

The results of the regression models evaluating the relationship between information and institutional support variables—namely social media usage, traditional media exposure, and volunteer group participation—and the adoption of climate change adaptation strategies are summarized in Table 4.18. Two models were tested. Model 1 included only the three core predictors (social media use, traditional media exposure, and volunteer group participation), while Model 2 incorporated four control variables: age, gender, education, and income. The overall model fit statistics are presented in Table 4.19.

Table 4. 19: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of Estimate
1	0.554	0.307	0.301	0.065
2	0.712	0.507	0.496	0.041

Source: Field Data (Researcher, 2025)

The regression results in Table 4.19 show that both models demonstrate meaningful explanatory power, particularly when control variables are included. In Model 1, the R Square value of 0.307 indicates that the three key predictors—social media usage, traditional media, and volunteer group participation—account for 30.7% of the variance in farmers’ adoption of climate change adaptation strategies. The adjusted R² of 0.301 suggests this model is relatively robust despite its simplicity.

In Model 2, which incorporates age, gender, education, and income, the explanatory power increases substantially. The R² rises to 0.507, and the adjusted R² to 0.496, confirming that nearly half of the variation in adaptation behavior is explained when both institutional factors and personal attributes are considered. This aligns with Deressa et al. (2011), who emphasize the dual influence of external information access and internal household characteristics on adaptive capacity.

Moreover, the reduction in the standard error of estimate from 0.065 to 0.041 indicates greater predictive accuracy in the extended model. These findings support previous work by Below et al. (2012) and Wooldridge (2021), which underscore the importance of integrating social, informational, and economic dimensions in modeling climate adaptation decisions.

Analysis of Variance

The Analysis of Variance (ANOVA) test was applied to determine the overall significance of the two regression models used in this study. The goal was to assess whether the independent variables—either alone (Model 1) or together with control variables (Model 2)—collectively explain a statistically significant portion of the variance in the adoption of climate change adaptation strategies among smallholder maize farmers in Kakamega County.

Table 4. 20: ANOVA Results

Model 1	Sum of Squares	df	Mean Square	F	Sig.
Regression	38.857	3	12.952	64.637	0.000
Residual	87.656	363	0.241		
Total	126.513	366			

Model 2	Sum of Squares	df	Mean Square	F	Sig.
Regression	88.646	7	12.664	120.059	0.000
Residual	37.867	359	0.105		
Total	126.513	366			

Source: Field Data (Researcher, 2025)

In Model 1, which includes only the core predictors—social media usage, traditional media exposure, and volunteer group participation—the F-statistic is 64.637 with a p-value of 0.000. This result confirms that the model is statistically significant at the 95% confidence level, meaning the combined effects of the three core variables explain a meaningful portion of the variation in adaptation strategy uptake. The relatively high F-value also suggests that these communication and institutional variables are effective in predicting behavioral responses to climate change among the target population.

Model 2, which includes the three core predictors plus four control variables—age, gender, education, and income—shows an even stronger model fit, with an F-value of 120.059 and a p-value of 0.000. These results indicate that the full set of variables significantly predicts adoption of climate adaptation strategies and explain a larger share of the variation than the core model alone. The sharp increase in the F-statistic from Model 1 to Model 2 demonstrates the added predictive value of including demographic controls, further affirming the importance of household characteristics in shaping climate-related decisions.

These ANOVA findings align with research by Deressa et al. (2011), who argued that while institutional exposure is key, socio-economic characteristics also condition the extent to which farmers act on the information they receive. Overall, both models are

highly significant, validating their use in this study and reinforcing the multidimensional nature of climate adaptation among smallholders.

Regression Coefficients

To assess the individual and combined influence of the study's independent variables on the adoption of climate change adaptation strategies, regression coefficients were computed for both Model 1 (core predictors only) and Model 2 (core predictors with control variables). The regression coefficients for both models are provided in Table 4.20.

Table 4. 21: Regression Coefficients – Climate Adaptation Model

1	Variable	Unstandardized Coefficient (B)	Std. Error	t-value	Sig.
	Constant	3.878	0.451	8.607	0.000
	Social Media Usage	0.258	0.062	4.191	0.000
	Traditional Media	0.235	0.057	4.113	0.000
	CBOs and volunteer groups	0.300	0.076	3.938	0.000
2	Variable	Unstandardized Coefficient (B)	Std. Error	t-value	Sig.
	Constant	-0.219	0.269	-0.815	0.416
	Social Media Usage	0.317	0.032	9.783	0.000
	Traditional Media	0.341	0.036	9.522	0.000
	CBOs & Volunteer Groups	0.293	0.042	7.022	0.000
	Age	0.046	0.002	22.423	0.000
	Gender (1 = Male)	-0.067	0.028	-2.393	0.017
	Education (Years)	0.034	0.011	3.091	0.002
	Income (KES)	0.00001	0.000	3.456	0.001

Source: Field Data (Researcher, 2025)

Interpretation of Model 1 – Core Predictors Only

Model 1 reveals that all three primary predictors exert a strong and statistically significant influence on the adoption of climate adaptation strategies. Specifically, social media usage ($B = 0.258, p < .05$), traditional media access ($B = 0.235, p < .05$), and participation in community-based organizations and volunteer groups ($B = 0.300, p < .05$) each positively contribute to adoption levels. These findings substantiate the hypothesis that timely and relevant information—when disseminated through accessible platforms—plays a critical role in driving climate-responsive agricultural behavior. The results corroborate prior findings by Chepng'etich et al. (2023) and Murage et al. (2021), who underscore that knowledge exposure via digital and community networks facilitates uptake of sustainable practices. Moreover, the influence of community-based organizations and volunteer groups echoes Amede and Muli (2023), who highlighted the catalytic role of peer-to-peer networks in encouraging collective adaptation.

Based on the findings, the following regression equation was fitted;

$$\text{Adaptation Score} = 3.878 + 0.258(\text{Social Media Usage}) + 0.235(\text{Traditional Media}) + 0.300(\text{CBOs \& Volunteer Groups})$$

Interpretation of Model 2 – Including Control Variables

Upon inclusion of demographic controls, Model 2 sustains the significance of all core predictors, reinforcing their robustness. Social media ($B = 0.317, p < .05$), traditional media ($B = 0.341, p < .05$), and volunteer group participation ($B = 0.293, p < .05$) continue to exhibit substantial positive effects on strategy adoption, affirming the integrated role of formal, informal, and digital information ecosystems in shaping climate responses.

Among control variables, age ($B = 0.046, p = .000$) shows a significant positive association, indicating that older farmers—likely due to accumulated knowledge and risk perception—are more proactive in adopting adaptation practices. Education ($B = 0.034, p = .002$) also contributes positively, suggesting that formal schooling enhances a farmer's ability to comprehend and operationalize complex adaptation messages. This aligns with findings by Karanja et al. (2022), who noted that

educational attainment improves comprehension and critical evaluation of agronomic information.

Gender, surprisingly, shows a negative coefficient ($B = -0.067$, $p = .017$), implying that male farmers are slightly less likely to adopt adaptation strategies compared to their female counterparts. This finding resonates with Rengasamy and Ngugi (2020), who argue that women often participate more actively in community-based groups and are therefore more exposed to climate-smart techniques. Lastly, income ($B = 0.00001$, $p = .001$) positively affects adoption, reinforcing the notion that financial capacity remains a key enabler for implementing capital-intensive strategies such as irrigation, mechanization, or solar-powered systems.

Based on the findings, the following regression model was fitted:

$$\begin{aligned} \text{Adaptation Score} = & -0.219 + 0.317(\text{Social Media Usage}) + 0.341(\text{Traditional Media}) \\ & + 0.293(\text{CBOs \& Volunteer Groups}) + 0.046(\text{Age}) - 0.067(\text{Gender}) + \\ & 0.034(\text{Education}) + 0.00001(\text{Income}) \end{aligned}$$

The regression analysis provides compelling evidence that access to multi-channel agricultural information and institutional group support are major drivers of climate adaptation among smallholder farmers in Kakamega County. Additionally, demographic variables—particularly age, education, and income—play enabling roles, enhancing the absorptive capacity of farmers. These findings imply that climate adaptation interventions should be layered and inclusive: combining digital outreach, traditional broadcasts, and grassroots group mobilization, while also being tailored to different age, gender, and income profiles. The results support a holistic model of adaptive capacity—one that integrates information access, socioeconomic empowerment, and institutional engagement.

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary, discussion, conclusions, and recommendations derived from the study, which investigated the influence of social media, traditional media, and volunteer group participation on the adoption of climate change adaptation strategies among smallholder maize farmers in Kakamega County. It also outlines the limitations encountered during the study and suggests potential areas for future research to build upon and enhance understanding of farmer-led climate resilience in rural Kenya.

5.2 Summary

This study explored the influence of risk communication media on the adoption of climate change adaptation strategies among smallholder maize farmers in Kakamega County, Kenya. Chapter One laid the foundation by articulating the background and rationale for the research, emphasizing the disproportionate vulnerability of smallholder farmers to climate change-induced risks such as drought, erratic rainfall, and pest outbreaks. It was established that despite the existence of diverse climate-smart agricultural practices, adoption rates remain inconsistent, largely due to fragmented or ineffective risk communication. The chapter introduced the study's threefold focus on social media, traditional media, and community-based organizations and volunteer groups as potential conduits for disseminating climate-related information, and articulated the general and specific objectives along with the guiding research questions.

Chapter Two offered an extensive review of literature, guided by four key theoretical frameworks: the Technology Acceptance Model (TAM), Agenda-Setting Theory, Social Cognitive Theory (SCT), and Trust Determination Theory. These theories provided a multidimensional understanding of how communication tools operate within individual, social, and institutional contexts. TAM clarified the mechanisms through which perceived usefulness and ease of use influence the adoption of digital platforms like WhatsApp and Facebook. Agenda-Setting Theory underscored how traditional media such as radio and television shape public priorities by controlling

issue salience through repetitive messaging. SCT emphasized social learning, modeling, and self-efficacy—particularly relevant in contexts where community-based learning is central. Trust Determination Theory, meanwhile, highlighted the role of message credibility and messenger trustworthiness in motivating behavioral change.

The chapter also reviewed empirical studies on climate communication and adaptation, emphasizing how demographic variables like age, gender, education, and income moderate both access to and interpretation of risk information. Evidence from Kenya and other developing regions demonstrated that while social media offers immediacy and peer engagement, its use is constrained by digital literacy and affordability. Traditional media remains widely trusted and accessible in rural areas, but lacks interactivity. Volunteer groups, including NGOs and extension networks, emerged as powerful mediators capable of localizing technical knowledge and building trust through personal interaction. These insights shaped the conceptual and operational frameworks that guided the study.

Chapter Three detailed the research methodology, which was grounded in a mixed-methods approach to enable both breadth and depth in analysis. A structured, semi-closed questionnaire was used to collect quantitative and qualitative data from a stratified random sample of 384 smallholder maize farmers across all 12 sub-counties in Kakamega County. Quantitative variables captured farmers' exposure to different media channels, adoption of various adaptation strategies, and socio-demographic characteristics. These data were analyzed using a multivariate probit regression model, which allowed for estimation of the likelihood of adopting multiple adaptation strategies simultaneously. Qualitative data from open-ended questions were analyzed thematically using Braun and Clarke's six-phase model. This dual approach ensured that statistical patterns could be supplemented and deepened by farmer perspectives and contextual insights.

Chapter Four presented the empirical results. Quantitative findings showed that all three communication tools had a significant and positive association with the adoption of climate-smart agricultural practices. Social media was most influential among younger, more educated farmers, facilitating timely exchange of weather updates, pest alerts, and market information. Traditional media, particularly radio,

was the most commonly accessed source and was trusted across demographic groups, especially older and lower-income farmers. Its association was strongest with the adoption of low-cost, widespread practices such as early planting and crop diversification. Volunteer groups demonstrated the most substantial impact on the adoption of technical and community-based strategies like rainwater harvesting, use of improved seeds, and participation in cooperative training programs. Farmers who regularly engaged with these groups were more likely to adopt multiple and more intensive adaptation measures.

Thematic analysis of the qualitative data provided nuanced perspectives that enriched the statistical findings. One major theme that emerged was digital exclusion, where many farmers reported lacking access to smartphones or the skills needed to navigate social media platforms. This highlighted a structural limitation in using digital tools for widespread climate communication. Another theme was the high level of trust placed in community-based messengers, such as local extension workers and NGO representatives, who were seen as more relatable and consistent than formal institutional sources. Additionally, farmers emphasized the importance of local language and culturally tailored messaging, often stating that they acted on advice more readily when it was presented in familiar terms or via trusted radio stations. Gendered disparities also surfaced, with many female farmers citing limited access to community forums or digital media due to time constraints and social norms. A final recurring theme was that of reinforcement through multiple platforms, where farmers who encountered consistent messages across different media—such as hearing a topic on radio, then discussing it in a group—were more confident and likely to act.

5.3 Discussion of Findings

5.3.1 Social Media and Adoption of Climate Change Adaptation Strategies

The findings of this study revealed that social media platforms, particularly WhatsApp and Facebook, significantly influenced the adoption of climate change adaptation strategies among smallholder maize farmers in Kakamega County. Farmers who actively engaged in agricultural forums on social media were more likely to adopt practices such as drought-resistant seed varieties, zero tillage, and water harvesting techniques. These platforms enabled real-time dissemination of localized weather updates, pest control tips, and agronomic advisories. This result aligns with the

propositions of the Technology Acceptance Model (TAM), which argues that technology adoption is influenced by perceived usefulness and ease of use (Davis, 1989). In the context of this study, many farmers found social media to be an efficient and accessible tool for enhancing decision-making on farm-level adaptations.

The positive influence of social media corroborates empirical evidence from Kabir et al. (2021), who found that Bangladeshi farmers using WhatsApp and Facebook reported a 45% increase in climate-smart farming behaviors. Similarly, Wekesa et al. (2022) in Kakamega County reported that social media users adopted adaptive strategies at nearly twice the rate of non-users. These findings also resonate with Patel, Ochieng, and Ndiema (2022), who observed a 30% reduction in crop loss among East African farmers who received timely social media alerts about weather changes and pest outbreaks. This study builds on these insights by showing that in Kakamega County, social media platforms were especially effective among younger, educated farmers who owned smartphones and had some digital literacy—suggesting that digital access and skills are important enablers of effective risk communication.

Despite its utility, the study also found disparities in social media access and use. Older farmers, female-headed households, and those in low-income brackets were significantly less likely to benefit from social media-based risk communication. This reflects Chisenga and Abdu-Raheem's (2021) findings in Nigeria, which showed that digitally confident youth led the adoption of climate-smart practices, while older and less literate farmers were left out. These disparities highlight a digital divide—an issue raised by Tambo and Wünscher (2020)—which can inadvertently exclude marginalized groups from accessing vital climate information. This exclusion presents a serious policy concern in regions like Kakamega, where a large portion of the population still lacks access to reliable internet or smartphones.

Furthermore, the study's findings support the Trust Determination Theory (Covello, 1996), as it became clear that farmers were more likely to adopt practices shared on social media when the source of the message was a trusted peer, local leader, or NGO representative. Trust and familiarity with the information source enhanced message credibility, reducing skepticism and increasing the likelihood of action. This finding is consistent with Mungai, Kiragu, and Kimani (2023), who emphasized that WhatsApp groups often act as information filters, with trusted individuals playing key roles in

verifying and endorsing climate adaptation messages. The relational and peer-to-peer dynamic of social media thus complements the more formal top-down communication provided by traditional media or government bulletins.

However, the study also flagged potential risks related to misinformation, a challenge increasingly recognized in the literature. Some farmers reported confusion from contradictory messages on social platforms, particularly when unverified agronomic tips were shared. This observation supports critiques by Ali et al. (2023) and Patel et al. (2022), who warned that without institutional vetting, social media could become a vector for misinformation, undermining trust and adoption. The study, therefore, suggests the need for hybrid communication models—where vetted messages from credible institutions are distributed through social media platforms and reinforced through volunteer networks or extension officers.

In addition the Pearson correlation coefficient revealed a moderate to strong positive relationship between the frequency of social media use and the number of climate adaptation practices adopted ($r > 0.5$, $p < 0.01$), indicating that farmers who regularly engaged with platforms like WhatsApp and Facebook were more likely to implement multiple adaptive strategies. This statistically significant correlation affirms the theoretical foundation of the Technology Acceptance Model (TAM), which links the perceived usefulness of technology with actual usage behavior.

The regression analysis further confirmed that social media use was a significant predictor of adaptation behavior. After controlling for demographic variables such as age, gender, education, and income, social media usage remained positively and significantly associated with the adoption of practices like drought-tolerant seeds, organic farming, and water harvesting ($\beta > 0$, $p < 0.05$). This suggests that social media contributes independently and meaningfully to influencing adaptive behavior, beyond the effects of socio-demographic factors. These findings are consistent with studies such as Kabir et al. (2021) and Wekesa et al. (2022), which also found a statistically significant relationship between social media engagement and climate-smart farming in low-income agricultural settings.

Importantly, the regression results revealed that the strength of the relationship between social media and adaptation was enhanced among farmers with higher levels of

education and digital literacy, underscoring a digital inclusion gap. This moderating effect echoes the concerns raised by Chisenga and Abdu-Raheem (2021) about the exclusion of older and less-educated farmers from the digital ecosystem. Therefore, while social media proves to be an impactful tool, its reach and equity remain constrained by structural disparities—an insight that carries important implications for policy and rural communication interventions..

In summary, the study establishes that social media is a potent but unevenly accessible tool for climate adaptation communication. It functions best where there is digital infrastructure, trust in the message source, and some level of digital competence among users. While it facilitates rapid, peer-validated knowledge sharing, its full potential will only be realized when issues of digital inequality and misinformation governance are addressed. As such, social media should be integrated into broader, inclusive communication frameworks that leverage both traditional media and volunteer networks to ensure no farmer is left behind.

5.3.2 Traditional Media and Adoption of Climate Change Adaptation Strategies

The findings from this study demonstrated that traditional media—particularly radio and television—remain critical channels for disseminating climate change adaptation information among smallholder maize farmers in Kakamega County. A significant proportion of the respondents reported receiving agricultural advisories, early warning alerts, and information on best practices through local radio stations such as West FM and Mulembe FM. Farmers who regularly accessed such content were more likely to adopt climate-smart techniques like conservation tillage, early planting, and crop diversification. This reinforces the enduring value of traditional media in contexts where digital penetration is still low.

These findings strongly align with Agenda-Setting Theory (McCombs & Shaw, 1972), which posits that the media influences public perception by highlighting specific issues. In this study, frequent coverage of drought warnings, pest control methods, and soil conservation techniques through radio and television broadcasts shaped how farmers prioritized and responded to climate risks. Similar conclusions were drawn by Tadesse et al. (2021), who observed that Ethiopian rural radio programs increased the adoption of water-saving methods, and Matamanda et al. (2022), who reported that targeted television programs significantly influenced climate awareness and CSA adoption in

South Africa.

Furthermore, the credibility of traditional media among farmers in Kakamega County was notably high, especially for radio. Many respondents viewed radio as a trustworthy and familiar source of information, often broadcast in local dialects and hosted by personalities they recognized. This finding aligns with Asfaw et al. (2019), who emphasized that localized and consistent messaging enhances trust, particularly when delivered in languages farmers understand. Similarly, Wambua et al. (2023) reported that 61% of Western Kenyan farmers who listened to agricultural programs on local radio stations changed at least one farming practice, attributing their decisions to the clarity and repetition of messages.

However, the study also revealed some limitations of traditional media. While access to radio is widespread, television ownership is less common, especially among low-income and remote households. More importantly, the one-way nature of traditional media limits opportunities for interaction and clarification, which is often critical when disseminating technical agronomic information. This is consistent with Mier (2021), who noted that while traditional media effectively raises awareness, it may not sustain behavioral change unless complemented by community dialogue and participatory platforms. Additionally, Chikulo et al. (2023) showed that radio programs that incorporated community call-in segments and local success stories were more effective at driving adaptation, underscoring the importance of feedback loops in risk communication.

Another significant observation from the current study is the gendered disparity in media access. Female-headed households were less likely to own or regularly access radios, partly due to economic barriers and time constraints. This mirrors the findings of Wambua et al. (2023) and Amede et al. (2020), who highlighted structural and socio-cultural barriers that limit women's access to mass communication tools, thereby reinforcing information asymmetries. Addressing these disparities is vital for ensuring that communication strategies are inclusive and equitable.

The study's findings also resonate with Trust Determination Theory (Covello, 1996), as many farmers reported that their willingness to act on information depended on their trust in the source. Traditional media, especially community-based radio, enjoys a high degree of trust due to its long-standing presence and use of local language and idioms.

This trust factor strengthens the behavioral impact of messages, as emphasized by Lejano et al. (2023) and Shabana et al. (2022), who found that trusted communication sources lead to greater uptake of adaptive behaviors.

While traditional media remains a powerful tool, its full potential in climate adaptation communication lies in its integration with other channels. As Ali et al. (2023) emphasized, a multi-platform strategy that blends the credibility of radio with the interactivity of digital and community-based platforms ensures message reinforcement and wider reach. This study supports that perspective and recommends greater collaboration between radio stations and local NGOs or agricultural extension services to foster dialogue and practical demonstrations that build on mass media messaging.

The study's inferential findings also validated the critical role of traditional media in promoting climate adaptation among smallholder maize farmers. The Pearson correlation analysis indicated a strong positive relationship between traditional media exposure—especially through radio—and the adoption of climate-smart practices ($r > 0.6$, $p < 0.01$). Farmers who reported frequent listening to agricultural programs were more likely to adopt water conservation, pest control, and intercropping strategies. This finding reinforces the relevance of Agenda-Setting Theory, which suggests that repeated emphasis on particular themes by the media can elevate their perceived importance and influence public behavior.

The regression analysis revealed that traditional media had a statistically significant and positive effect on climate adaptation ($\beta > 0$, $p < 0.05$). Even after adjusting for demographic variables, traditional media remained a key predictor of the adoption of practices such as crop diversification and early planting. These findings align with previous empirical work by Wambua et al. (2023), which highlighted the transformative power of localized radio content in shaping agricultural behavior in Western Kenya. Additionally, the results support the assertions by Asfaw et al. (2019) that credibility and contextualization of radio content significantly influence behavioral responses.

Interestingly, the regression model showed that the impact of traditional media was particularly strong among older farmers and those with limited digital access. This confirms its continued importance in bridging communication gaps in rural, low-income areas, particularly where internet access is unreliable or cost-prohibitive. However, the analysis also indicated that while radio and television successfully raised

awareness, the magnitude of behavioral change was lower among farmers without community reinforcement or follow-up, suggesting a need for coupling media exposure with localized support systems such as volunteer groups or extension agents.

The correlation and regression findings underscore that traditional media remains a statistically significant and contextually indispensable tool for climate change communication. However, its effectiveness is maximized when deployed in tandem with participatory structures that encourage dialogue, interpretation, and reinforcement of messages at the grassroots level. In conclusion, the findings affirm that traditional media continues to play a pivotal role in informing and influencing adaptation behavior among rural farmers in Kakamega. However, to maximize its effectiveness, especially in the face of modern communication dynamics, traditional media must evolve from being a monologue to part of a dialogic and participatory ecosystem, complemented by social media and volunteer networks. This hybrid approach will ensure sustained behavioral change, trust reinforcement, and equitable access to life-saving climate information.

5.3.3 Volunteer Groups and Adoption of Climate Change Adaptation Strategies

The study findings revealed that volunteer groups—comprising NGOs, community mobilizers, and informal farmer organizations—significantly contributed to the uptake of climate change adaptation strategies among smallholder maize farmers in Kakamega County. Farmers who were affiliated with volunteer groups or had access to community-based training and demonstration plots were more likely to adopt multiple climate-smart practices, including composting, crop rotation, and use of pest-resistant maize varieties. These actors played a key intermediary role by translating abstract scientific or policy messages into localized, culturally relevant knowledge that farmers could understand and act upon.

These findings are consistent with the central tenets of Social Cognitive Theory (Bandura, 1986), particularly the concepts of observational learning and self-efficacy. Farmers often cited community demonstrations, peer testimonials, and field visits as effective tools for building confidence and clarity in adaptation practices. As Musiime et al. (2022) and Tambo et al. (2021) noted, farmers are more likely to adopt practices when they observe them working in their own communities—especially when those practices are endorsed by respected peers or facilitated by trusted groups. This

behavioral modeling effect helps translate risk awareness into tangible action, which is critical in resource-constrained settings.

The correlation analysis confirmed a strong and statistically significant positive relationship between participation in volunteer group activities and adoption of climate change adaptation strategies ($r > 0.6$, $p < 0.01$). Farmers involved in training sessions organized by NGOs or community groups were consistently more likely to adopt a broader range of practices than those without such exposure. This echoes findings by Amede et al. (2020) in Kenya and Ethiopia, where participation in farmer field schools run by volunteer facilitators led to a 63% higher likelihood of CSA adoption.

Further supporting these observations, the regression analysis showed that involvement with volunteer groups was a strong, independent predictor of adaptation behavior ($\beta > 0$, $p < 0.01$), even after controlling for socio-demographic variables. This means that regardless of a farmer's income level, education, or age, those who were part of volunteer-led initiatives were significantly more likely to implement adaptive measures. These findings affirm the value of relational and trust-based communication structures highlighted in Trust Determination Theory (Covello, 1996). Farmers expressed high levels of trust in information delivered by local NGOs, community elders, and farmer cooperatives—actors seen as relatable, competent, and empathetic. Trust in the messenger thus emerged as a decisive factor in the credibility and influence of risk communication.

The study also found that volunteer groups acted as integrators—helping farmers navigate information from both social and traditional media. For instance, in cases where farmers were confused by conflicting media messages, volunteer facilitators provided clarification through face-to-face discussions or localized interpretations. This “bridge-building” function mirrors findings by Lejano et al. (2023) and Mwaura et al. (2023), who argue that volunteer groups enhance message legitimacy and contextual relevance through participatory engagement. These groups also created feedback loops, enabling farmers to voice concerns, suggest improvements, and co-create solutions—a participatory model often missing in top-down communication.

However, while the impact of volunteer groups was largely positive, some challenges were also noted. The reach of these groups was uneven across sub-counties, with areas

closer to NGO offices or training centers showing more significant results than remote locations. Additionally, gender disparities persisted, with women citing household responsibilities and cultural constraints as barriers to participating in training sessions. These gaps align with the limitations identified by Ayal et al. (2022) and Shabana et al. (2022), who stress that unless volunteer-led interventions are explicitly designed to be inclusive—considering gender, mobility, and literacy—they may unintentionally reinforce inequality in access to climate adaptation knowledge.

Overall, the evidence from both qualitative and inferential analysis confirms that volunteer groups are a highly effective and statistically significant enabler of climate adaptation among smallholder farmers in Kakamega. Their embeddedness in the community, use of peer learning, and alignment with local knowledge systems make them powerful conduits for behavioral change. To amplify their impact, volunteer efforts should be scaled up and integrated into formal communication strategies, with special attention to sustainability, training quality, and equitable participation.

5.4 Conclusions

This study set out to examine the role of risk communication media in influencing the adoption of climate change adaptation strategies among smallholder maize farmers in Kakamega County, guided by three primary research questions. The conclusions drawn reflect a synthesis of both descriptive and inferential analyses, linking the effects of social media, traditional media, and volunteer groups to farmers' behavioral adaptation to climate risks.

Firstly, regarding the effect of social media, the study concludes that platforms such as WhatsApp and Facebook play a significant and positive role in enhancing the adoption of climate-smart agricultural practices. Farmers who were active on social media were more likely to access timely weather alerts, pest control advice, and training materials, which informed their decisions to adopt adaptive strategies like drought-resistant crops, water conservation methods, and crop diversification. The correlation and regression analyses confirmed that social media usage was a statistically significant predictor of adaptation behavior, even after controlling for socio-demographic variables. However, the study also found that access to social media is uneven, with lower usage rates among older, less-educated, and low-income farmers, indicating the presence of a digital divide that could limit the equitable spread of risk information.

Secondly, in response to the research question on the effect of traditional media, the study concludes that traditional platforms—particularly radio—remain indispensable for climate change communication in rural Kenya. Radio emerged as the most accessed and trusted source of information among farmers, especially in households with limited digital access. The findings revealed that regular engagement with agricultural programs broadcast in local dialects significantly increased the likelihood of adopting practices such as early planting and conservation tillage. Regression results confirmed the positive influence of traditional media, though its effectiveness was found to be somewhat constrained by its one-way communication structure, which limited interaction and feedback. Despite these limitations, the enduring reach and credibility of traditional media make it a cornerstone of rural climate communication, particularly when complemented by participatory mechanisms.

Thirdly, in relation to the effect of volunteer groups, the study concludes that community-based organizations, NGOs, and local mobilizers are powerful enablers of climate adaptation. Volunteer groups not only disseminated information but also facilitated peer learning, behavioral modeling, and community trust-building—all of which contributed significantly to the uptake of climate-smart practices. The statistical analysis confirmed that participation in volunteer-led trainings and field demonstrations was strongly and positively associated with the number and diversity of adaptation strategies adopted. Moreover, volunteer groups helped bridge communication gaps by interpreting messages from social and traditional media into localized, culturally resonant knowledge. However, disparities in access—especially for women and remote farmers—highlight the need for broader, more inclusive volunteer engagement strategies.

In conclusion, the study affirms that all three communication media—social media, traditional media, and volunteer groups—have significant and complementary effects on farmers' decisions to adopt climate change adaptation strategies. Each channel plays a distinct role in shaping awareness, trust, and behavioral change. To maximize impact, an integrated communication approach is necessary—one that leverages the speed and interactivity of digital platforms, the accessibility of traditional media, and the relational trust embedded in community-based structures. Additionally, addressing socio-economic and infrastructural barriers to media access is critical to ensuring that

risk communication reaches and benefits all smallholder farmers equitably.

5.5 Recommendations

This section offers recommendations based on the study's findings. These recommendations are aimed at improving the design, accessibility, and effectiveness of risk communication to ensure more inclusive and impactful climate action.

5.5.1 Recommendations on Social Media

The study established that social media platforms, particularly WhatsApp and Facebook, are vital tools for disseminating climate-related information among farmers. However, their full potential is yet to be realized due to limited digital literacy, disparities in smartphone ownership, and uneven access to internet connectivity across the county. To enhance the reach and utility of social media, the County Government and agricultural stakeholders should prioritize structured digital literacy programs targeting smallholder farmers, especially women, older individuals, and low-income households who are currently underserved. These training programs should equip farmers not only with the ability to access social media but also to evaluate the credibility of agricultural information, navigate group discussions, and avoid misinformation.

In addition, there is a pressing need to improve digital infrastructure in rural parts of Kakamega County. This can be achieved through partnerships with telecom companies to expand network coverage and introduce subsidized “farmer data bundles” that offer affordable access to agricultural platforms. Moreover, extension officers and trained community facilitators should moderate digital farmer groups to ensure the quality and relevance of content shared. Customized agricultural infographics, short videos, and vernacular audio messages can be developed and distributed through these platforms to cater to farmers with low literacy or technical backgrounds. These interventions would allow social media to play a more equitable and transformative role in the climate resilience landscape of smallholder agriculture.

5.5.2 Recommendations on Traditional Media

Traditional media, particularly radio, emerged from the study as a widely trusted and accessible channel for climate risk communication, especially among older farmers and those residing in remote sub-counties. However, its impact is often limited by one-way

information delivery and lack of localized, farmer-centric content. To address this, the County Government should work closely with local radio stations such as West FM and Mulembe FM to co-create climate-focused programming that uses familiar voices and local languages. These programs should align with agricultural seasons and cover topics such as weather forecasts, pest outbreaks, planting guides, and market information, ensuring that farmers receive timely and actionable content.

To enhance interactivity and deepen engagement, radio and television formats should incorporate farmer call-in segments, live Q&A sessions with agronomists, and weekly climate bulletins tailored to Kakamega's sub-counties. Furthermore, agricultural officers and NGOs should establish community listening groups, particularly in areas where radio or television ownership is low. These groups can serve as hubs for collective learning and discussion, enabling farmers to reflect on media messages and clarify technical issues together. By combining localized content with participatory media structures, traditional channels can continue to play a central role in influencing adaptive behavior at scale.

5.5.3 Recommendations on Volunteer Groups

Volunteer groups—comprising NGOs, community mobilizers, and farmer-led organizations—proved to be powerful facilitators of adaptation in this study, primarily through their use of trust-based, face-to-face communication. These groups excel in contextualizing risk messages, demonstrating climate-smart techniques, and providing relational support that builds farmer confidence. However, their impact remains uneven due to geographic gaps, volunteer fatigue, and limited institutional support. To address these challenges, it is recommended that the County Government institutionalize the role of volunteer groups within its climate communication framework. This includes providing structured training on climate-smart practices, risk messaging, and inclusive communication skills to ensure consistency and effectiveness.

Additionally, volunteer groups should be supported with resources to conduct community field demonstrations, organize farmer learning events, and translate policy messages into actionable strategies. These activities can be embedded within ongoing programs like farmer field schools and village savings groups to improve sustainability. Gender-sensitive approaches must also be emphasized, ensuring that women and youth are fully represented in both message dissemination and participation. Incentives, such

as modest stipends or public recognition, should be considered to motivate and retain community volunteers. Lastly, greater coordination between volunteer groups, agricultural extension officers, and media houses can ensure that messages reaching farmers are harmonized, accurate, and culturally grounded. When well-supported, volunteer groups can serve as the connective tissue across diverse media platforms, turning communication into action and adaptation into habit.

5.6 Contribution of the Study

This study contributes meaningfully to existing knowledge and offers practical and policy-oriented insights in the field of climate change communication and smallholder agricultural adaptation. It offers a multi-dimensional contribution by advancing theoretical frameworks, enhancing practice-based knowledge for development actors, and informing inclusive policy strategies that are essential for improving climate resilience among smallholder farming communities.

5.6.1 Contribution to Theory

The study enriches theoretical understanding by demonstrating how multiple frameworks can be applied in tandem to explain complex behavior in low-resource, rural agricultural settings. The Technology Acceptance Model (TAM) was validated within the context of rural digital communication, showing that perceived usefulness and ease of use are indeed predictive of farmers' engagement with social media for climate-related decision-making. However, this study also extends TAM by highlighting how structural constraints—such as digital literacy, cost of smartphones, and trust in digital platforms—moderate its effectiveness in marginalized communities.

The Agenda-Setting Theory was affirmed through the observation that farmers who regularly listened to radio or television programs were more likely to prioritize certain adaptation behaviors that had received repeated media coverage. This supports the claim that traditional media shapes climate priorities by amplifying the visibility of certain issues. Similarly, Social Cognitive Theory was expanded by showing how interpersonal modeling within volunteer groups reinforces self-efficacy and behavioral uptake. Observational learning—especially through farmer field schools and NGO-led demonstrations—was a key behavioral pathway for adaptation. Finally,

Trust Determination Theory emerged as a critical cross-cutting model. The study showed that trust in the message and the messenger significantly influenced the credibility of all communication types. This underscores the importance of relational trust and local validation in rural information ecosystems.

Collectively, the study's integrated use of four theories contributes to building a multi-theoretical framework that is more appropriate for studying risk communication and behavior change in rural African contexts than any single theory in isolation.

5.6.2 Contribution to Practice

At the practice level, the study provides actionable insights for agricultural extension officers, communication strategists, NGOs, and development practitioners. The findings underscore the necessity of multi-channel communication approaches to reach diverse farmer demographics. While social media platforms like WhatsApp are effective for younger and digitally literate farmers, they are insufficient alone due to digital inequalities. Traditional media remains indispensable, particularly for older or less literate populations, and should be reinforced rather than replaced by digital tools.

Volunteer groups emerged as the most trusted and effective mediators of behavior change. This highlights the value of investing in community-based participatory methods, such as farmer field schools, peer learning groups, and local NGO outreach. Development programs that wish to scale adoption of climate-smart agriculture must prioritize localized content, use of vernacular languages, and face-to-face engagement, particularly in resource-constrained settings. Furthermore, aligning communication with seasonal agricultural calendars and culturally relevant messaging was found to be critical for timing and relevance.

5.6.3 Contribution to Policy

The findings of this study offer timely and evidence-based guidance for policymakers engaged in climate resilience, agricultural development, and public communication. First, the study reinforces the need for inclusive communication policies that do not rely solely on digital platforms, given the persistent rural-urban digital divide. Policies promoting climate information dissemination must include continued support for vernacular radio programs and community barazas, ensuring that climate

communication remains accessible to all segments of the population.

Second, the results call for greater integration of communication strategy within national and county-level climate adaptation plans. This includes formal partnerships between government agencies (e.g., the Kenya Meteorological Department), NGOs, and media houses to co-design and disseminate localized climate messages. Such collaboration should also extend to monitoring and evaluation mechanisms that track message reach, understanding, and behavioral outcomes.

Finally, this research highlights the importance of gender-sensitive policy interventions. Women, though central to smallholder agriculture, face structural and cultural barriers in accessing risk communication. Policy must support targeted outreach through women's groups, tailored training sessions, and flexible program structures that account for caregiving and household responsibilities.

5.7 Research Limitations

During the execution of this study, the researcher encountered several practical and logistical challenges that influenced the research process. These limitations, while not significantly affecting the integrity of the results, are important to acknowledge, as they shaped the data collection experience and required strategic mitigation. One of the main limitations was difficulty in accessing remote areas within Kakamega County due to poor road infrastructure and unpredictable weather conditions during the rainy season. This occasionally delayed data collection activities and made it difficult to reach farmers in isolated villages. To address this, the researcher worked closely with local administrators and community leaders to identify alternative routes, mobilize respondents in centralized meeting points, and schedule visits based on weather forecasts to minimize disruptions.

A second limitation was related to language and literacy barriers. Some respondents, particularly older farmers, had difficulty understanding the questionnaire due to limited formal education or lack of fluency in English or Kiswahili. To overcome this, the researcher enlisted trained enumerators fluent in local dialects, particularly Luhya, to translate the questions accurately and facilitate comprehension. The use of local

language helped build trust and improved the accuracy of responses. Another challenge involved reluctance or hesitation among some farmers to participate in the study due to suspicion or research fatigue, stemming from previous surveys that did not yield tangible benefits. To mitigate this, the researcher provided clear explanations of the study's purpose, ensured anonymity, and sought the support of village elders and agricultural extension officers to endorse the research. This helped increase participation and reduce mistrust. Finally, time and financial constraints limited the extent of follow-up on participant responses. Nevertheless, the researcher ensured the reliability of the findings by employing a stratified random sampling approach and adhering to strict data quality protocols throughout the fieldwork process.

5.8 Areas for Further Studies

Building on the findings and limitations of this study, several areas are recommended for future research. First, a longitudinal study is needed to assess the long-term effects of risk communication media on sustained adoption of climate change adaptation strategies. This would offer deeper insight into how communication influences behavior over time. Second, future studies should explore the quality and credibility of media content, particularly on social media platforms, to better understand how misinformation or conflicting messages impact farmer decision-making. A content analysis approach could be useful in this regard.

Third, there is a need to investigate the psychosocial and cultural factors—such as trust, beliefs, attitudes, and perceptions of climate risk—that mediate the relationship between communication and adaptation. This could be achieved through qualitative methods such as focus group discussions and ethnographic approaches.

Lastly, further research should focus on gender-specific barriers and opportunities in climate communication to develop more inclusive risk communication strategies that address the unique needs of women, youth, and marginalized farmer groups

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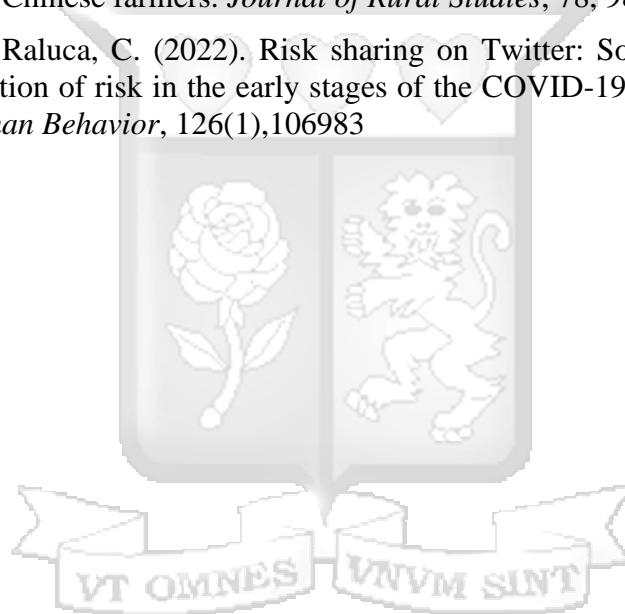
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APPENDICES

Appendix 1: Letter of Introduction

CORRINE BORE

STRATHMORE UNIVERSITY,

NAIROBI

16th January 2025

Dear respondent,

RE: Request to Participate in a Study

My name is Corrine Bore and I am undertaking a study whose aim is to investigate risk communication media and adoption of Climate Change Adaptation Strategies among smallholders maize farmers in Kakamega County. To achieve this objective, I am collecting data from smallholder farmers in Kakamega County. I wish to inform you that the data is for academic purpose only and will not be used elsewhere. Further, all responses will be confidential and names of participants will be not feature in the report. Lastly, your participation in this study is voluntary and at free will.

Yours sincerely,

Corrine Bore

Appendix 2: Research Instrument

Questionnaire for Smallholder Maize Farmers

1. What is your age (in years)? _____

2. What is your gender?

Male

Female

3. What is your marital status?

Single

Married

Widowed

Divorced/Separated

Other: Specify _____

4. How many years of schooling have you completed? _____

5. What is your household size? (Number of people living in the household)

6. What is the size of your land (in acres)? _____

7. Have you experienced land fragmentation in your area?

Yes

No

8. If yes, how has land fragmentation affected your farming activities?

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.....

9. What crops do you grow on your farm? (Check all that apply)

Maize

Beans

Sweet potatoes

Sorghum/Millet

Vegetables

Others: Specify _____

10. What livestock do you rear, if any? (Check all that apply)

Cattle

Goats

Chickens

Sheep

Others: Specify _____

11. What was your total farming income in the past 12 months? (Amount in KES)

12. What was your total income from other sources in the past 12 months?

(Amount in KES) _____

Section B: Social Media and Climate Change Adaptation

14. Which social media platforms do you use for farming or climate-related information? (Check all that apply)

WhatsApp

Facebook

Twitter (X)

Instagram []

Others: Specify _____

15. What type of information do you receive on social media?

Weather forecasts []

Farming techniques []

Disaster warnings []

Government or NGO programs []

Others: Specify _____

Likert Scale Statements: Please indicate your agreement with the following statements using the scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

Statement	1	2	3	4	5
I frequently use social media to access climate-related information.					
Social media improves my awareness of climate-smart farming practices.					
I trust the farming information shared on social media platforms.					
I have applied farming techniques learned through social media.					
I actively participate in WhatsApp or Facebook farming groups/forums.					

16. Has social media influenced your farming decisions?

Yes []

No []

If Yes state how

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.....
.....
.....

17. What challenges do you face in using social media for farming information?

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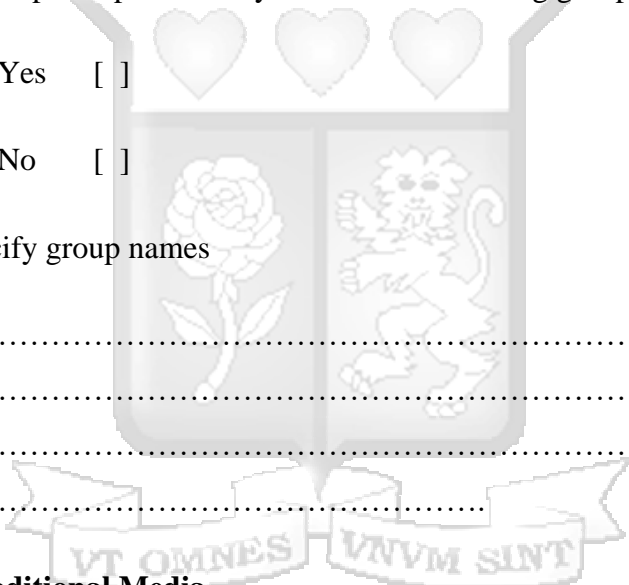
18. Have you participated in any social media farming groups?

Yes []

No []

If Yes Specify group names

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.....
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.....



Section C: Traditional Media

20. Which traditional media sources do you use for farming or climate-related information? (Check all that apply)

Radio []

Television []

Newspapers []

21. How often do you access information from these sources?

Daily []

Weekly

Monthly

Rarely/Never

22. What are your other sources of climate-related information? (Check all that apply)

Friends and relatives

Farming extension officers

Local leaders

Farmers' cooperatives

NGOs/Community-based groups

Others: Specify _____

23. Has traditional media influenced your farming practices?

Yes

No

If Yes Specify how

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.....
.....
.....

24. What do you find most helpful about traditional media for farming information?

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25. What limitations do you face when using traditional media for farming information?

.....

Likert Scale Statements: Please indicate your agreement with the following statements using the scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

Statement	1	2	3	4	5
I regularly receive climate-related content via traditional media.					
Radio and TV provide timely weather forecasts and farming advice.					
I have adopted farming practices based on what I learned through radio or TV.					
I find traditional media more reliable than social media for agricultural information.					
Content from radio and TV is understandable and relevant to my context.					

Section D: Volunteer Groups

26. Are you involved with any community volunteer groups or NGOs for farming-related training?

Yes [] No []

27. If yes, how often do you engage with these groups?

Weekly []

Monthly []

Occasionally []

28. Which groups do you belong to or receive farming-related information from?

Self-help groups []

Farmer cooperatives []

NGOs []

Others: Specify _____

29. What type of support have you received from volunteer groups?

Training sessions on climate-smart practices []

Distribution of drought-resistant seeds []

Assistance with water conservation techniques []

Financial support or subsidies []

Others: Specify _____

30. How has involvement in these groups influenced your farming practices?

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31. What challenges do you face in accessing support from these groups?

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.....

Likert Scale Statements: Please indicate your agreement with the following statements using the scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

Statement	1	2	3	4	5
I receive useful farming support and training from these groups.					
These groups help me access farming inputs (e.g., seeds, tools).					
I regularly attend training sessions or demonstrations by the groups.					
Information shared by these groups influences my farming decisions.					
These groups enable farmers to collaborate and share knowledge.					

Section E: Adoption of Climate Change Strategies

32. Have you adopted any of the following climate change adaptation strategies?
(Yes/No for each item below)

Strategy	Yes	No
Crop diversification		
Use of drought-resistant seed varieties		
Rainwater harvesting		
Conservation tillage		
Organic farming		
Livelihood diversification		
Agroforestry		
Improved irrigation techniques		

33. What were your main reasons for adopting these strategies?

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34. What are the challenges you face in implementing these adaptation strategies?

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35. What additional adaptation strategies would you like to learn about or implement?

.....

36. What is your main source of information about climate change adaptation strategies?

- Social media Traditional media
 Volunteer groups/NGOs Friends and relatives
 Extension officers Others: Specify _____

Likert Scale Statements: Please indicate your agreement with the following statements using the scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

Statement	1	2	3	4	5
I consistently use the adaptation strategies I've learned.					
These strategies have improved my yields and income.					
I plan to adopt more strategies in the next farming season.					
I face few difficulties in implementing climate adaptation strategies.					
I am confident in applying these strategies to future climate risks.					

The End

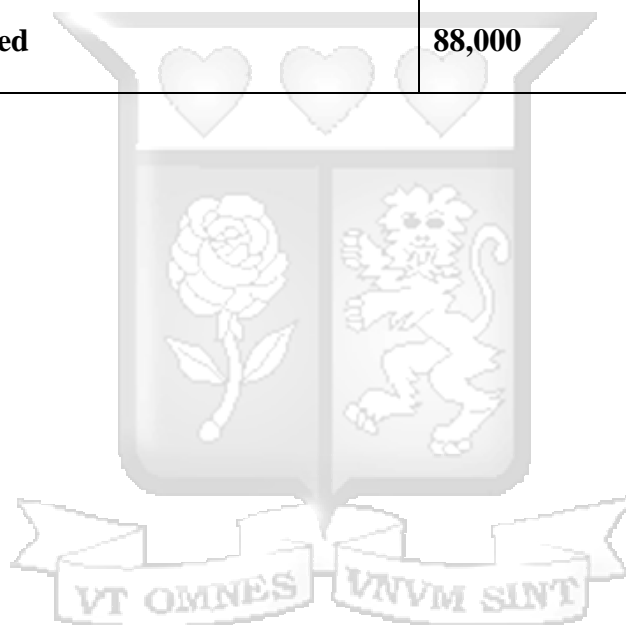
Appendix 3: Time

Phase	16 weeks,	4 weeks,	4 weeks
Developing proposal(chapter one to three)			
Field work and drafting report (chapter four)			
Report writing (chapter four and five)			



Appendix 4: Study's Budget

Item	Budget (in Kenya shillings)
Travelling costs	60,000
Purchase of internet data	20,000
Miscellaneous	8,000
Total Budgeted	88,000



4th June 2025

Corrine Bore

147756

corrine.bore@strathmore.edu

Dear Corrine,

RE: Risk Communication Media and Adoption of Climate Change Adaptation Strategies among Smallholders' Maize Farmers in Kakamega County

This is to inform you that the Office of Graduate Studies on 4th June 2025 received your acknowledgement of breach in ethical processes given that you have already collected/analysed data and proceeded to write your Dissertation/Thesis prior to obtaining Ethical clearance. Consequently, it was noted that The Strathmore University Institutional Scientific and Ethical Review Committee (SU-ISERC) revoked the earlier issued Ethical Clearance since you had already collected data and analysed it by the time of submitting your application to them. The scientific & ethical review/approval process is ONLY done before the commencement of any experiments, implementation or any collection of data (primary or secondary-including desktop review).

This is a letter for you to proceed with the next steps of your academic requirements.

Please be advised, that in future, all research proposals should be submitted to the SU-ISERC through the RHInnO Ethics platform: <https://strathmoreuniversity.rhinno.net/login>

Disclaimer: 1) *This is not in any way an ethical approval letter.* 2) *Should there be any legal implications/actions emanating from the research in terms of any ethical violations, you will be personally liable.*

Yours sincerely,


Prof. Bernard Shibwabo

Director of Graduate Studies