THE ROLE OF SOCIAL CAPITAL IN BUILDING CLIMATE CHANGE RESILIENCE AMONGST SMALLHOLDER FARMERS IN BERGVILLE

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ABSTRACT

This study examines the influence of social capital on the climate change adaptation strategies and resilience-building of smallholder farmers in Bergville, KwaZulu-Natal, South Africa. Using a mixed methods approach, data were collected from 150 purposively selected farmers through structured questionnaires, focus group discussions, and key informant interviews. Quantitative data were analysed using *IBM SPSS Statistics* (Version 29). Descriptive statistics, chi-square tests, and a probit regression model were employed to assess the effect of social capital variables on adaptive behaviour. Qualitative data were thematically analysed to explore farmers' perceptions of the benefits and constraints of using social networks to build resilience."

Findings indicate that trust in peer information, participation in collective action, access to extension services, and frequent community interaction are strong positive predictors of climate adaptation. Farmers embedded in active social networks had significantly higher odds ($P < 0.05$) of adopting climate-smart practices, while those excluded from group activities or decision-making faced greater vulnerability. Despite the strength of bonding social capital, bridging and linking forms essential for accessing external resources and knowledge remain underutilized. The study highlights the transformative potential of social capital in strengthening climate resilience, while noting the institutional and structural barriers that limit its effectiveness. Strengthening inclusive and functional social networks, alongside enhanced extension support, is vital for building sustainable adaptation pathways in rural farming systems.

Keywords: Adaptive strategies, climate adaptation, collective action

PREFACE

The research contained in this dissertation was completed by the candidate while based in the school of Agriculture, Earth and Environmental Sciences of the College of Agriculture, Engineering and Science, University of KwaZulu-Natal, Pietermaritzburg, South Africa.

The contents of this work have not been submitted in any form to another university and, except where the work of others is acknowledged in the text, the results reported are due to investigations by the candidate.

Signed: Prof. Paramu Mafongoya (Supervisor)

Date: 28 August 2025

Signed: Dr. Shenelle Lottering (Co-Supervisor)

Date: 28 August 2025

DECLARATION

I, Pearl Musenge, declare that:

i. The research, except where otherwise indicated, is my original research.

ii. This dissertation has not been submitted for any degree or examination at any other university.

iii. This dissertation does not contain other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from those persons. iv. This dissertation does not contain other authors' writing, unless specifically acknowledged as being sourced from other authors. Where other written sources have been quoted, then:

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Candidate's signature: 

Date: **28/08/2025**

Name: Ms. P. Musenge

As the candidate's research supervisor, I agree to the submission of this thesis for examination.

Signed:  **Date:** **28/08/2025**

Name: Prof. P. Mafongoya

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Although my name appears on the cover of this dissertation, its completion is the result of the unwavering support, encouragement, and contributions of many individuals. I am sincerely grateful to everyone who has played a role in making this journey both possible and memorable. This dissertation, and the graduate experience it reflects, would not have been the same without their presence and impact.

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Most importantly, I owe a deep debt of gratitude to my family. Their enduring love, patience, and unwavering support have been the foundation upon which I have built this academic journey. This dissertation is dedicated to them for their encouragement during difficult times, their belief in my potential, and their constant presence in my life. Their sacrifices and support have made this accomplishment possible.

DEDICATION

This thesis is dedicated, firstly, to my parents Mrs. Musenge and Mr. J. Musenge, for giving birth to me and supporting me spiritually throughout my life. May their souls rest in peace. Secondly, I would also like to dedicate this work to my family, my children (Thimna and Manzezulu) for the support, encouragement, and patience. Thank you so much.

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This dissertation follows a paper-based format, consisting of a series of publishable articles that collectively address the central research question. Each paper is presented as a standalone chapter with its own abstract, introduction, methodology, results, and discussion. While some overlap and repetition may occur across chapters, particularly in the background and methods sections, this is necessary to ensure that each paper is self-contained and suitable for publication. The concluding chapter synthesizes the findings of the individual papers and discusses the overall contributions to knowledge, policy, and practice.

CHAPTER 1: THE PROBLEM AND ITS SETTING

1.1 INTRODUCTION TO THE RESEARCH PROBLEM

Informed by established community networks and institutions such as local norms, traditional leadership, and cooperative structures, farmers in South Africa often acquire and refine agricultural knowledge through various channels within their communities. Previous studies have confirmed that these social and institutional arrangements play a critical role in facilitating knowledge exchange and learning among smallholder farmers (Prajapati et al., 2025) . Recognizing the importance of these informal systems, the Department of Agriculture, Land Reform and Rural Development (DALRRD) in South Africa has promoted the formation of cooperatives, self-help groups, and structured engagements between extension officers and smallholder farmers (Department of Agriculture, 2021). These initiatives are designed to enhance the dissemination of technical and climate-related agricultural information to farmers and improve their adaptive capacity (Tamako et al., 2020). However, despite these efforts, challenges remain in ensuring equitable access to information, particularly for marginalized groups such as women, youth, and poor households, and in integrating community-based knowledge with formal institutional support.

Social capital is often the most valuable asset available to farmers who lack resources, particularly in marginalized rural settings where access to formal support systems is limited (Silvert et al., 2022). It serves as a critical mechanism through which these farmers can meet essential livelihood needs such as acquiring agricultural inputs, accessing climate information, securing labour, and receiving emotional and social support during crises (Ma et al., 2024). Therefore, understanding the dynamics and processes of social capital within communities is vital for recognizing how disempowered and underserved smallholder farmers navigate systemic inequalities and build resilience. This recognition also helps inform the development interventions that are more inclusive, participatory, and attuned to local realities.

Smallholder farmers in Bergville face increasing challenges in adapting to climate change (Vilakazi et al., 2025). Despite the increasing recognition of social capital as a crucial factor in enhancing resilience to climate change, most studies focus on other regions, such as the

uMkhanyakude and OR Tambo districts, and little research has specifically examined its role among smallholder farmers in Bergville, KwaZulu-Natal, South Africa.

Existing studies highlight the importance of social networks and community relationships in facilitating adaptive capacity among smallholder farmers (Dapilah et al., 2020). However, few have examined how these social dynamics function within the distinct socio-economic, cultural, and agro-ecological context of Bergville, KwaZulu-Natal. This region is characterized by its mountainous topography, dependence on rain-fed agriculture, traditional governance systems, and high rates of poverty and youth outmigration (Municipality, 2020). These unique features shape how farmers interact with one another, access resources, and respond to climate risks. The lack of localized research that explores how social capital functions under these specific conditions presents a significant gap in understanding how adaptation strategies can be effectively designed and supported in Bergville.

Social capital plays a vital role in building climate resilience by fostering collaboration, trust, and resource sharing within such communities (Carmen et al., 2022). In the context of climate change, strong social networks can accelerate the dissemination of knowledge, facilitate collective problem-solving, and promote the adoption of innovative and climate-resilient farming practices (Simelton and McCampbell, 2021). Situating this study in Bergville, becomes possible to gain deeper insight into how social capital can be mobilized within marginalized rural settings not only to buffer climate shocks but also to enable long-term, community driven resilience strategies.

However, the specific mechanisms through which social capital contributes to resilience among smallholder farmers in Bergville remain underexplored. Understanding these dynamics is essential for developing targeted interventions that enhance adaptive capacity, ultimately contributing to the sustainability and food security of vulnerable agricultural communities. Therefore, the aim of this research is to investigate the role of social capital in building climate change resilience among smallholder farmers in Bergville, South Africa.

1.2 RESEARCH SIGNIFICANCE

Smallholder farming in South Africa engages an estimated four million individuals, providing both food and income (Giller et al., 2021). The development and empowerment of

smallholder farmers is widely recognized as a key strategy to reduce poverty and food insecurity and aligns with national and international development priorities, including the SDGs and MDGs FAO (2017). Research on farmers' knowledge acquisition and dissemination is helpful for farming systems, and farmers' empowerment depends on their capacity and willingness to take in new information and disseminate it (Tamako, 2020).

This research is significant because it examines the role of social capital in enhancing climate change adaptation among smallholder farmers. By identifying how farmers leverage social networks to access information, share resources, and cooperate in climate-resilient practices, the study provides insights for more sustainable, community-driven adaptation strategies. Findings will inform policy and practice**,** benefiting local governments, development organizations, and agricultural extension services in strengthening support mechanisms for smallholder farmers.

1.3 RESEARCH OBJECTIVES

a) **Objective 1: To analyse the role of social capital in shaping farmers' adaptive strategies to climate change**

- This objective will be addressed through a review of existing literature Chapter 2, examining how social networks facilitate the sharing of information, access to resources, and cooperative actions that enhance resilience to drought, erratic rainfall, and other climate-induced stressors

b) **Objective 2: To assess the forms, sources, and intensity of social capital among smallholder farmers in Bergville**

- This objective will guide the empirical data collection section Chapter 3, focusing on identifying and categorizing the types of social capital (bonding, bridging, linking), their prevalence, and how they manifest through networks such as kinship ties, cooperatives, traditional leadership, and community-based organizations.

c) **Objective 3: To evaluate the impact of social capital on climate change adaptation and resilience**

- This objective will be addressed in Chapter 4, using the empirical findings to critically examine both the enablers and limitations of social capital such as exclusionary norms, weakened institutions, or lack of formal institutional linkage and how these factors affect farmers' ability to adapt over time.

1.4 RESEARCH QUESTIONS

The specific research questions guiding this study are:

a) How do farmers incorporate social capital into their efforts to enhance climate resilience?

b) What social capital resources are available to smallholder farmers in Bergville for climate change adaptation?

c) What strategies can be implemented to strengthen social networks and community support for enhancing climate resilience?

1.5 RESEARCH HYPOTHESES

a) There is a statistically significant positive relationship between the adoption of social capital-based strategies and climate resilience among smallholder farmers in Bergville.

b) Farmers who actively engage in social capital networks demonstrate higher levels of climate resilience compared to those who do not.

c) There is a statistically significant positive effect of social capital on smallholder farmers' climate change adaptation and resilience in Bergville.

1.6 THIS DISSERTATION COMPRISES FIVE CHAPTERS.

- Chapter One introduces the study by outlining the background, research problem, objectives, research questions, and the significance of the research. It also provides a detailed contextual overview of Bergville, the study area.

- Chapter Two presents a comprehensive review of literature on the role of social capital in smallholder farming communities, particularly in the context of climate change resilience. Key themes explored include bonding, bridging, and linking social capital; the intersection of social capital with gender, age, and land tenure; and the integration of social capital with formal adaptation systems.
- Chapter Three outlines the research methodology, detailing the qualitative and quantitative approaches adopted, the sampling techniques, data collection methods (e.g., interviews, surveys, focus groups), the procedures used for data analysis and results. Ethical considerations and study limitations are also discussed. This chapter supports Objective 2, assessing the types, sources, and intensity of social capital among smallholder farmers in Bergville and categorizing the social networks and community structures operating in the region.
- Chapter Four presents the results and discussion of empirical findings addressing Objectives 1 and 3. It examines how social capital shapes farmers' adaptive strategies to climate change and evaluates both the enabling and constraining factors in leveraging social capital for building resilience. Findings are interpreted thematically and discussed in relation to the literature reviewed in Chapter Two.
- Chapter Five concludes the study by summarizing the key findings, drawing conclusions, and offering recommendations for policy, practice, and future research. It highlights the study's contribution to climate change adaptation and rural development.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter presents a review of relevant literature that provides conceptual and empirical grounding for this study. It focuses on the role of social capital particularly bonding, bridging, and linking social ties in enhancing the adaptive capacity and resilience of smallholder farmers to climate change. The review explores how access to networks, institutions, and collective resources strengthens farmers' ability to cope with climate shocks. It also draws on studies that examine the intersection of social capital, climate adaptation strategies, and livelihood

sustainability. Furthermore, it highlights key policies and frameworks that support community-based resilience in mobilizing social assets for climate response.

The chapter begins by critically examining South African studies on smallholder farmers, focusing on the structure, prevalence, and functions of social networks in facilitating climate adaptation. It then situates these findings within the broader sub-Saharan African context before comparing them with global research on social capital and climate resilience, highlighting similarities, differences, and contextual factors that influence adaptive strategies. It also draws on studies that examine the intersection of social capital, climate adaptation strategies, and livelihood sustainability, as well as key policies and frameworks supporting community-based resilience through mobilization of social assets.

Despite progress in understanding social capital and adaptation, gaps remain in South Africa; (i)specific evidence on the forms and intensity of social capital among smallholder farmers, (ii) the pathways through which social networks influence adaptive strategies, and (iii) empirical assessment of enabling and constraining factors affecting resilience. This study seeks to address these gaps by focusing on smallholder farmers in Bergville, KwaZulu-Natal.

2.2 THEORETICAL FRAMEWORK

This study adopts Social Capital Theory and the Sustainable Livelihoods Framework (SLF) to examine the role of social relationships in enhancing climate change resilience among smallholder farmers in Bergville.

Social Capital Theory, as described by (Siddiqa, 2024), emphasizes the importance of social networks, norms of trust, and reciprocity in facilitating cooperation and access to resources.

Social networks including family ties, farmer groups, and institutional linkages enable farmers to share knowledge, labour, and support when responding to climate-related challenges (de Brito et al., 2024).

Social capital can be categorized into three dimensions:

- **Bonding:** close relationships within communities, such as kinship ties.
- **Bridging:** networks that connect different groups or communities.
- **Linking:** connections to formal institutions, including government agencies and NGOs (Pizarro, 2022).

These networks are particularly important in Bergville, where smallholder farmers often rely on collective action, shared decision-making, and information exchange to manage climate stressors, such as droughts, floods, and unpredictable rainfall patterns.

The Sustainable Livelihoods Framework (SLF) considers social capital as one of five core livelihood assets, alongside human, natural, financial, and physical capital (Mohammadi et al., 2023). The SLF explains how individuals, operating within a vulnerability context such as climate change utilize these assets to pursue livelihood strategies that enhance well-being and resilience(Banu and Fazal, 2025). Within this framework, social capital contributes to adaptation strategies, including cooperative farming, pooled resources, and access to early warning systems.

The integration of these frameworks provides a comprehensive understanding of how resilience is not only shaped by infrastructure or finance, but also by social cohesion and institutional support (Jewett et al., 2021). Social capital enhances adaptive capacity by enabling information flow, mutual support, and institutional engagement all of which are crucial for smallholder farmers facing climate change(Dapilah et al., 2020) .

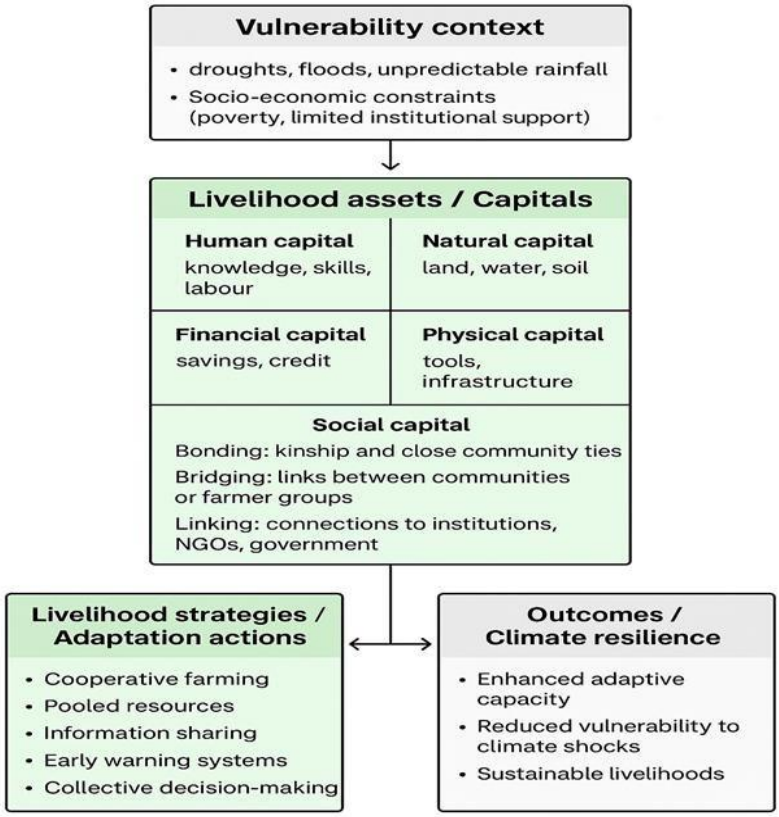

Figure 2.1: Theoretical Framework Linking Social Capital and Climate Resilience

Therefore, this theoretical framework guides the analysis of how different forms of social capital influence resilience outcomes and livelihood sustainability in Bergville's smallholder farming communities.

2.3 CLIMATE CHANGE RESILIENCE AMONG SMALLHOLDER FARMERS

Climate change has significantly increased the vulnerability of smallholder farmers across Africa. It has emerged as one of the most formidable challenges to global food systems, with smallholder farmers in Sub-Saharan Africa (SSA) particularly vulnerable to its effects (Juju et al., 2020). Key challenges include declining soil fertility, rising pest outbreaks, and reduced water availability (Subedi et al., 2023). In South Africa, these climate-induced stressors are further intensified by widespread land degradation and persistent socio-economic inequalities, both of which hinder effective adaptation efforts (Dlamini et al., 2024). In regions such as Bergville, farmers face compounded risks due to severe soil erosion, deforestation, and increasingly erratic rainfall patterns, making their agricultural livelihoods particularly precarious.

These farmers manage small plots of land (typically under 2 hectares) and primarily engage in subsistence agriculture. Their exposure to extreme weather events, such as droughts, floods,

and heatwaves, is compounded by structural issues such as poverty, weak institutional support, and inadequate access to climate information and credit facilities (Tamasiga et al., 2023)

In recent years, there has been a paradigm shift in academic discourse and development policy from solely technical and infrastructural adaptation strategies to a broader consideration of social, institutional, and community-based resources that underpin adaptive capacity (Phiri, 2023). At the heart of this shift lies the recognition of social capital a critical, though often underutilised, asset within rural farming communities.

The Intergovernmental Panel on Climate Change (Change, 2021) underlines that the increased frequency of extreme weather events (EWEs) droughts and floods threatens regional food security and biodiversity. Smallholder farmers, dependent on natural resources, face livelihood disruptions, pushing communities into cycles of poverty and vulnerability. Understanding these vulnerabilities is essential for designing targeted resilience strategies at community and policy levels.

According to (Gebre, 2021) Africa is experiencing increasing frequencies of climate extremes that exacerbate poverty and food insecurity among smallholder households. In South Africa, provinces such as KwaZulu-Natal and the Eastern Cape home to many rural farmers are particularly at risk due to soil degradation, erratic precipitation, and overexploitation of natural resources(Du Preez and Van Huyssteen, 2020). These trends threaten agricultural productivity and sustainability, with women-headed households facing even greater challenges due to gendered access barriers (Dyanty et al., 2025).

These vulnerabilities highlight the urgency of designing targeted, multi-level resilience strategies informed by both local realities and national policy frameworks, such as the South African National Climate Change Adaptation Strategy and the NDMC Climate Vulnerability Assessments (2022). Table 2.1 Illustrates the common climate stressors affecting smallholder farmers across Southern Africa and their primary effects.

Table 2.1: Climate Change Stressors and Effects on Smallholder Farmers

Climate Stressor	Direct Effect	Long-term Consequence
Drought	Crop failure, livestock deaths	Food insecurity, income loss
Flooding	Soil erosion, waterlogging	Land degradation, lower yields
Heatwaves	Reduced crop growth, pest infestations	Declining productivity, migration
Rainfall variability	Unpredictable planting seasons	Increased vulnerability, risk aversion
Source: Adapted from Molua and Ndip (2020); Agholor and Nkambule (2020)		

South Africa's vulnerability is not uniform but varies across provinces due to differences in exposure, adaptive capacity, and socio-economic conditions.

The National Climate Change Adaptation Strategy in South Africa emphasizes the need for integrating local knowledge with scientific planning, yet implementation remains patchy at the community level (Department of Environmental Affairs, 2019). Mtyelwa (2021) argue that smallholders often lack formal insurance mechanisms and climate-resilient infrastructure, forcing them to rely on coping mechanisms like reducing meal frequencies or selling livestock.

The vulnerability of smallholder farmers is not uniform but varies based on agro ecological zones, socioeconomic status, and household composition. As illustrated by Table 2.2, different provinces in South Africa exhibit varying vulnerability indices.

Table 2.2: Provincial Climate Vulnerability Index for South African Smallholders

PROVINCE	EXPOSURE	SENSITIVITY	ADAPTIVE	VULNERABILITY

			CAPACITY	INDEX
LIMPOPO	High	High	Low	Very High
KWAZULU-NATAL	High	Medium	Low	High
WESTERN CAPE	Medium	Low	Medium	Moderate
SOURCE: DEA (2019); AGHOLOR & NKAMBULE (2020)				

Smallholder farmers across Africa and South Africa are highly susceptible to climate variability due to their limited financial, institutional, and technological buffers. Addressing this vulnerability requires multi-scalar interventions that combine local agency, targeted policy support, and investment in adaptive innovations tailored to specific environmental and socioeconomic contexts.

2.3.1 The Vulnerability of Smallholder Farmers to Climate Change

Smallholder farmers, who typically cultivate less than two hectares of land, form the backbone of agricultural production across SSA (Getahun, 2020). However, they face a disproportionate burden from climate variability have gained traction, their uptake remains uneven and often hampered by social inequalities, knowledge gaps, and institutional barriers due to their limited economic assets, reliance on seasonal rainfall, and marginalisation from formal financial and policy systems (Chingombe and Musarandega, 2021). Adaptive practices do not occur in a vacuum they are deeply embedded within socio-cultural and governance frameworks. In South Africa, rural inequalities, land degradation, and poverty further deepen their vulnerability. Gender disparities compound the problem, with women-headed households often lacking access to land, credit, and extension services (Makhetha, 2024).

Although climate-smart agriculture (CSA) practices such as water harvesting and droughttolerant seeds are increasingly promoted, adoption remains uneven. Barriers include high input costs, lack of institutional support, and limited access to information Jellason et al. (2021). Importantly, adaptation is shaped not only by technology but also by social, cultural, and governance frameworks that determine how knowledge and resources are distributed.

2.3.2 Defining Climate Resilience in Smallholder Farming Systems

Climate resilience in agricultural systems refers to the capacity of individuals and communities to absorb, adapt, and transform in response to climate-related shocks (Hertel et al., 2021). In the context of smallholder farming, climate resilience refers to the capacity to sustain agricultural production and secure livelihoods despite increasing climate variability.

This includes the ability to maintain food security, diversify income sources, and adopt appropriate adaptation strategies. According to Adefila et al. (2024) building such resilience requires a multifaceted approach that integrates agronomic innovations, timely access to climate information, institutional support, and the strengthening of socio-cultural systems. Chandler (2019) argue, many resilience strategies fail because they are top-down, technocratic, and disconnected from the lived experiences and social realities of rural farmers. Rather than viewing resilience solely as a function of technology or infrastructure, recent literature emphasises the importance of community networks, cultural knowledge systems, and institutional relationships. These elements are captured within the broader concept of social capital a lens that has gained increasing scholarly interest in climate adaptation research (Carmen et al., 2022).

Resilience discourse in Africa often emphasizes technological solutions such as drought tolerant seeds, water harvesting systems, and climate-smart agriculture. However, these measures tend to overlook the social infrastructure through which knowledge, labour, and risk are distributed (Hall, 2020). The failure to integrate social dynamics in resilience-building has been particularly evident in countries like South Africa, where adaptation programs are often top-down and misaligned with local community structures (Rochell et al., 2024). Rather than viewing resilience solely as a function of technology or infrastructure, recent literature emphasises the importance of community networks, cultural knowledge systems, and institutional relationships. These elements are captured within the broader concept of social capital a lens that has gained increasing scholarly interest in climate adaptation research (Tamasiga et al., 2024).

2.4 SOCIAL CAPITAL

Social capital, encompassing the web of social networks, norms, trust, and institutions, is increasingly recognized as a cornerstone in the adaptive strategies of smallholder farmers facing climate change (Dapilah et al., 2020). Unlike tangible assets such as land or technology, social capital operates through relationships offering intangible yet powerful support mechanisms that determine how well communities respond to environmental shocks (Mbiba et al., 2019).

2.4.1 Types of Social Capital: Definitions and Relevance

The classification of social capital into bonding, bridging, and linking forms is a dominant analytical lens in current literature (Kyne and Aldrich, 2020). Each type serves unique roles depending on the nature of the social ties and their institutional reach.

Table 2. 3: Types of Social Capital and Relevance

Type of Social Capital	**Definition**	**Examples in Rural SSA Context**	**Climate Resilience Function**
Bonding	Strong, close-knit relationships among homogenous groups (e.g., family, kin)	Labour-sharing among relatives; seed sharing; informal savings groups	Provides short-term coping support (e.g., food, shelter, farming inputs)
Bridging	Horizontal ties across diverse groups (ethnic, religious, socio-economic)	Farmer cooperatives; intercommunity farmer forums; market associations	Enables knowledge exchange, innovation diffusion, and access to broader networks
Linking	Vertical ties connecting communities with institutions (NGOs, government)	Engagement with agricultural extension, disaster relief agencies, microfinance	Facilitates access to formal adaptation resources, policy influence, and funding

Source: Adapted from Claridge (2018)

Each form of social capital supports resilience in distinct ways. Bonding capital fosters trust and reciprocity during crises, bridging capital enables cross-community learning, and linking capital connects marginalised farmers to formal support systems, including climate finance and disaster risk governance (Krahn, 2021).

2.4.2 Bonding Capital: Foundations of Collective Action

Bonding capital is typically grounded in relationships built on kinship, locality, or ethnic ties. It is the most immediate form of social support and often the first response mechanism during climate shocks. Abimanyu (2023) found that strong intra-family networks enabled resource pooling for climate-smart agriculture. Such networks were critical in sustaining farming activities during flood years when markets and institutions were inaccessible.

Bonding capital has its limitations. Excessive reliance on close-knit networks can lead to insularity, reinforcing traditional norms that may resist innovation or exclude outsiders (Haddad, 2025). In some cases, women or youth may be marginalised in patriarchal structures, limiting their access to critical adaptive resources.

2.4.3 Bridging Capital: Innovation and Knowledge Diffusion

Bridging capital plays a vital role in expanding the horizons of smallholder farmers by fostering connections with diverse groups (Silvert et al., 2022). (Dumas et al., 2025), farmers in Ghana who participated in local “agroecology hubs” multi-stakeholder groups involving traders, scientists, and fellow farmers were more likely to adopt agroforestry and conservation farming practices.

Similarly, in Kenya, Birir (2021)observed that participation in mixed-gender self-help groups significantly increased adoption rates of soil and water conservation practices. These groups often acted as innovation platforms, breaking down socio-cultural barriers and facilitating inter-village learning.

Bridging capital is also crucial for scaling adaptation. Unlike bonding capital which is highly localised, bridging capital allows practices and innovations to move across landscapes, strengthening regional resilience (Azad and Pritchard, 2023).

2.4.4 Linking Capital: Institutional Access and Formal Integration

Perhaps the most transformative form of social capital, linking capital refers to vertical connections with formal institutions, including government agencies, NGOs, and research bodies (Cummings et al., 2019). It is through these connections that community's access early warning systems, climate finance, training programmes, and policy decision-making platforms (Nkiaka et al., 2019).

However, linking capital is also the most fragile and unequally distributed. Marginalised communities, particularly those in remote areas or with histories of political exclusion, often lack strong institutional ties (Panday et al., 2021). Mani et al. (2021) noted that in South Africa, historical land tenure systems and institutional fragmentation have weakened the link between rural farmers and the state's climate adaptation agenda.

Stadler et al. (2024) revealed that female headed households were significantly less likely to access climate-resilient extension programs, primarily due to weak linking capital and gendered norms in South Africa.

2.4.5 Interactions and Trade-Offs Between Social Capital Types

While the three types of social capital are conceptually distinct, they frequently interact, reinforce, or conflict in real-world scenarios. Table 2.4 below illustrates the nuanced relationships and potential trade-offs between them:

Table 2. 4: Interactions and Trade-Offs Between Social Capital

Interaction	**Example from SA**	**Implication for Adaptation**
Bonding supports bridging	Farmer groups initiated by kin networks invite members from other villages	Enhances trust while expanding learning networks
Bridging undermines bonding	Exposure to outside knowledge challenges traditional farming norms	May lead to resistance or internal conflict
Linking strengthens bridging	NGO-facilitated multi-village trainings develop cross-community cooperation	Increases trust and institutional legitimacy

Weak bonding impedes linking	Communities with low trust resist engaging with state actors	Undermines uptake of formal adaptation services

Source: Synthesised from Kehinde et al. (2025); Quarmine et al. (2025); Wynants et al. (2021)

These trade-offs highlight the context-dependent nature of social capital. Adaptation strategies must therefore be designed in ways that recognize and navigate local dynamics, rather than assuming all social networks function uniformly or beneficially (De Luque-Villa and González-Méndez, 2024).

2.4.6 Role of Social Capital in Gendered Resilience

Social capital also intersects with gender, class, and generational power relations, shaping how benefits are distributed. (Theeuwen et al., 2021) show that in many parts of rural SSA, men dominate leadership positions in cooperatives and community institutions, often controlling access to resources and decision-making.

Njikho (2020), in a study of gendered food security in Southern Malawi, found that women's informal networks were critical for accessing food during droughts. However, these networks were rarely acknowledged in formal climate programs, leading to policy blind spots.

Efforts to institutionalise inclusive linking capital through quotas, gender-sensitive extension services, and community listening forums are thus crucial for equitable resilience building (Huyer et al., 2021).

2.4.7 Gender and Power Dynamics within Social Capital

Despite its potential, social capital is not universally accessible. Several studies warn that social capital can reproduce or exacerbate existing inequalities, particularly along the lines of gender, age, and land ownership (Bessière and Gollac, 2023). Women, while often central to food production and caregiving, may be excluded from decision-making bodies or land tenure arrangements, limiting their access to adaptation resources (Nchu et al., 2019).

ETIM (2024) highlighted that in some Nigerian farming communities, elites dominate community leadership structures and capture the benefits of adaptation programs. This calls for a critical examination of power relations within social networks and the design of inclusive policies that enable marginalised groups to participate meaningfully in adaptation processes.

2.4.8 Gaps and Future Directions

While the literature affirms the value of social capital in enhancing resilience, there are key gaps that remain. Firstly, most research has focused on West and East Africa, with relatively few studies conducted in South African contexts such as Bergville, where land histories, traditional authority, and rural governance structures differ significantly. Secondly, few studies provide longitudinal or mixed-methods analysis of how social capital evolves in the face of sustained climate pressure or external interventions.

Additionally, the relationship between social capital and institutional trust remains underexplored. For social capital to be effective, communities must not only trust each other but also the institutions providing adaptation support. Where institutional legitimacy is weak, even well-funded interventions may fail.

2.4.9 Conclusion

Social capital is a multi-dimensional and indispensable asset for climate resilience among smallholder farmers in SSA. Bonding capital ensures immediate coping through familial and kinship networks. Bridging capital fosters innovation and horizontal learning, while linking capital connects communities to formal adaptation pathways. However, the functions and effectiveness of these capitals are shaped by socio-economic factors such as gender, institutional history, and political inclusion.

Recognising the interactions, synergies, and trade-offs between different forms of social capital is essential for designing context-responsive adaptation strategies. Rather than viewing social capital as a static asset, future research and policy should treat it as a dynamic process shaped by power, participation, and institutional landscapes.

2.5 SOCIAL CAPITAL AS A DRIVER OF ADAPTIVE CAPACITY

Several studies have confirmed the role of social capital in facilitating adaptive behaviour among smallholder farmers (de Brito et al., 2024). In Ethopia (Bedeke et al., 2019), found that strong intra-community ties influenced the adoption of drought-resistant maize varieties and collective irrigation schemes. Similarly, (Maina, 2020) observed that Kenyan farmers engaged in community self-help groups were more likely to adopt soil and water conservation practices.

(Yimam and Holvoet, 2024) further show that informal savings groups, such as *iddirs* and *equb*, enabled Ethiopian farmers to pool resources for emergency responses during climateinduced food shortages.

These findings are consistent with Dressel et al. (2020), who argue that adaptive capacity is socially embedded, relying on collective trust and agency rather than solely on technical innovations.

Social capital also enhances information dissemination. Harmon (2022) demonstrated that farmer-to-farmer networks often outperform state-led extension services in delivering early warning information, particularly in remote areas with limited institutional presence.

In South Africa, similar dynamics are visible through unique forms of social capital such as stokvels and burial societies. Stokvels community-based rotating savings and credit groups provide households with liquidity during climate shocks, allowing them to buy inputs, hire labour, or recover from crop losses (Lukwa, 2024). Burial societies, while primarily focused on funeral support, also act as safety nets by pooling funds that can be redirected for food, medical, or agricultural needs during crises (Walter, 2020). These institutions are deeply embedded in South African rural life and play a vital role in cushioning smallholder farmers against economic stressors linked to climate variability.

Overall, social capital serves as a driver of anticipatory and transformative resilience. Communities with strong networks of trust, reciprocity, and cooperation not only cope more effectively with immediate shocks but also restructure their systems to better withstand future risks (Tamasiga et al., 2024). By integrating both SSA-wide insights and South Africa specific evidence, it is clear that adaptive capacity is strengthened not only through technological interventions but also through robust social institutions that channel collective action and shared resources.

2.5.1 The Emergence of Social Capital in Adaptation Discourse

The term social capital refers to the networks, norms, trust, and relationships that facilitate collective action and cooperation for mutual benefit (Saz-Gil et al., 2021). In smallholder settings, social capital plays a pivotal role in sharing climate information, accessing financial resources, exchanging labour, and promoting community cohesion during environmental disruptions (Carmen et al., 2022). (Shiell et al., 2020) highlight that social capital operates through three interconnected dimensions:

- Bonding capital: Close relationships among homogenous groups such as family members or ethnic communities.
- Bridging capital: Connections across different social or demographic groups, fostering diversity and innovation.
- Linking capital: Vertical ties between individuals or communities and formal institutions, such as governments, NGOs, and research organisations.

Each of these forms of capital contributes differently to adaptive capacity. Bonding capital may provide emotional and material support during crises, while bridging capital facilitates knowledge exchange. Linking capital is particularly critical for accessing state-driven adaptation services and resources.

2.6 SOCIAL CAPITAL AND THE CO-PRODUCTION OF ADAPTATION

Research shows that smallholder farmers often engage in collective adaptation not only through state interventions but also by leveraging informal institutions. For example, farmer cooperatives, self-help groups, village savings associations, and traditional leadership systems act as platforms for information dissemination and mutual support (Nichols, 2021). In South Africa, indigenous knowledge systems and social cohesion underpin many climate response strategies, particularly in areas where government presence is minimal (Kom et al., 2023).

(Haque et al., 2024) argue that social capital also influences the degree to which communities can engage with formal adaptation processes, including disaster risk reduction (DRR), extension services, and climate financing mechanisms. Where linking capital is weak, communities may remain isolated and unresponsive to national adaptation frameworks.

2.6.1 Climate Information and Knowledge Exchange through Social Networks

One of the most cited functions of social capital in climate adaptation is its role in information dissemination. Smallholder farmers often rely on their peers, elders, or local associations to interpret climate forecasts or adopt new agricultural practices (Kumasi et al., 2019). In regions with low literacy or limited access to digital platforms, interpersonal relationships become critical in converting scientific knowledge into actionable strategies (Gómez-Carmona et al., 2023).

For instance, the diffusion of indigenous farming knowledge combined with extension services reflects a hybrid system of bonding and linking capital. Social capital also enhances psychological resilience by fostering a sense of belonging and collective efficacy, which are crucial during crises (Carmen et al., 2022).

This underscores the need for participatory communication models that integrate both indigenous and formal knowledge systems. Failure to do so may result in miscommunication, mistrust, or the rejection of externally introduced interventions.

2.6.2 Links Between Social Capital and Climate Change Resilience Strategies

There is increasing empirical evidence that links high levels of social capital with greater uptake of climate-smart agriculture (CSA) practices, effective disaster preparedness, and proactive land-use changes. For example, Murendo et al. (2022) found that farmers with strong network ties were more likely to implement soil conservation methods. Communal grazing systems in South Africa often rely on trust-based arrangements that reduce environmental degradation while improving livestock resilience(Nyantakyi-Frimpong et al., 2019). In this context, social capital is not merely a passive attribute but an active driver of behavioral change and innovation.

Community-based adaptation (CBA) models often rely heavily on existing social capital, suggesting that any climate adaptation strategy that neglects this dimension risks being topdown and unsustainable(Conway et al., 2019). By fostering co-production of knowledge and participatory governance, social capital facilitates context-specific solutions to climate vulnerabilities.

2.7 CHALLENGES IN LEVERAGING SOCIAL CAPITAL FOR CLIMATE RESILIENCE

Despite its transformative potential, leveraging social capital for climate adaptation presents several challenges. Social capital is not evenly distributed; it often reflects existing power asymmetries, where elites control access to key networks and resources (Hamilton and Lubell, 2019). In South Africa, this can be seen in traditional authority structures where chiefs and headmen sometimes dominate resource allocation processes, leading to elite capture and the exclusion of ordinary farmers (Ubink and Duda, 2021).

In Bergville, traditional leadership systems may marginalize youth and women, thereby reproducing inequalities under the guise of communal resilience (Govender et al., 2023). Similarly, patriarchal norms within farmer groups and cooperatives may limit women's participation in decision-making, reducing their access to extension services, land, and credit opportunities (Lecoutere and Wuyts, 2021).

Another limitation is that social capital can sometimes be inward-looking or conservative, resisting innovation or the integration of external knowledge systems. This "dark side" of social capital can reinforce parochialism, inhibit broader climate action, and perpetuate social exclusion (Cuaton and Su, 2023). For example, reliance on customary practices in KwaZuluNatal may exclude scientifically informed adaptation measures, leading to slower uptake of improved post-harvest and climate-smart technologies.

Over-reliance on social networks in the absence of institutional support can also strain relationships and lead to resource fatigue, especially during protracted crises such as extended droughts or recurring floods (Rakauskiene et al., 2025).Thus, while social capital is an important resource, it should not be viewed as a substitute for state-led adaptation policies and formal support systems. Instead, it must complement institutional frameworks, ensuring that adaptation strategies remain inclusive, equitable, and resilient

2.8 IMPLICATIONS FOR POLICY AND PRACTICE: STRENGTHENING SOCIAL CAPITAL FOR RESILIENCE

Policymakers and development practitioners must recognize the critical role of social capital in shaping effective and inclusive climate adaptation strategies (Tamasiga et al., 2024). In the South African context, this requires aligning interventions with national frameworks such as the National Climate Change Adaptation Strategy (NCCAS), which emphasizes locally driven adaptation and the integration of indigenous knowledge systems; the National Development Plan (NDP) 2030, which underscores inclusive rural development and resilience-building; and the Agricultural Policy Action Plan (APAP), which prioritizes farmer support services, cooperatives, and improved market access.

Strengthening social capital should therefore involve supporting local institutions, enhancing participatory governance, and ensuring that historically marginalized groups are central to resilience-building efforts (Ndlovu and Msimanga, 2023). In Bergville and similar contexts, this could mean formalizing community seed banks to safeguard genetic diversity, incentivizing inclusive cooperatives that give women and youth equal decision-making power, and embedding traditional knowledge systems within broader adaptation frameworks (Nakanyete, 2024). These measures directly support NCCAS's call for community-driven approaches and the NDP's objective of inclusive economic participation.

Investments in digital platforms that facilitate peer-to-peer learning, early warning dissemination, and market access can enhance the bridging and linking dimensions of social capital while complementing the government's digital transformation agenda under the Department of Agriculture, Land Reform and Rural Development (DALRRD). Furthermore, donors and governments should fund longitudinal research to monitor how social capital evolves in response to climate shocks, migration, and policy changes (Chan et al., 2019).

Such monitoring aligns with South Africa's National Climate Change Response Policy (NCCRP), which highlights evidence-based planning and continuous learning.

Ultimately, fostering climate resilience among smallholder farmers requires not just environmental or technological solutions but also the nurturing of social fabrics that bind

communities together. In this light, social capital is both a pathway and an outcome of climate-resilient development (Huyer et al., 2021).

2.8.1 Policy Recommendations for Strengthening Social Capital

Table 2.5: Policy Recommendations for Social Capital

Policy Domain	**Action Needed**	**Alignment with SA Policy Frameworks**
Institutional Recognition	Integrate social capital indicators into climate adaptation frameworks (Molua & Ndip, 2020).	NCCAS (2020): Calls for mainstreaming social dimensions in adaptation planning.
Capacity Building	Train community leaders to facilitate participatory decision-making and knowledge co-production (DEA, 2019).	NDP 2030: Promotes communitybased leadership and inclusive governance.
Financial Support	Channel funding to community-based adaptation projects, including savings groups and cooperatives (Mthembu & Zwane, 2019).	APAP (2014): Strengthens farmer organizations and rural financial support systems
Gender Inclusion	Promote equal access to social networks and leadership for women and youth (Agholor & Nkambule, 2020).	NCCAS & NDP 2030: Emphasize gender equity and youth inclusion in climate adaptation.

CHAPTER 3: TYPES OF SOCIAL CAPITAL AMONG SMALLHOLDER FARMERS IN BERGVILLE

3.1 ABSTRACT

Social capital plays a pivotal role in shaping the adaptive capacity of smallholder farmers, especially when responding to climate-related challenges. This study examines the forms,

sources, and intensity of social capital among smallholder farmers in Ward 2 of Bergville, KwaZulu-Natal. Data were collected from 150 respondents using a structured questionnaire and analyzed using both descriptive statistics and a probit regression model. Results indicate that social capital within this community is predominantly defined by long-standing networks, familial bonds, and limited participation in formal cooperatives or organized groups. Most respondents practiced mixed farming, had low levels of formal education, and were primarily female revealing gendered dynamics in resilience-building. The regression analysis further revealed that variables such as education level, farming experience, trust in peer-shared information, participation in collective action, and access to extension services significantly influenced the use of social capital in climate adaptation. These findings highlight the critical need to strengthen both informal and institutional social systems to enhance climate resilience.

Keywords: *climate adaptation, smallholder farming, community networks, extension services, informal support systems*

3.2 INTRODUCTION AND CONTEXTUALIZATION

Bergville, located in northern KwaZulu-Natal, is predominantly a communal farming region where smallholder farmers rely on a mix of crop cultivation and livestock rearing (Mthembu et al., 2019).

Crops such as maize, dry beans, cabbage, and potatoes are commonly grown, primarily for household consumption and informal markets (Tamako et al., 2022). Farming households face persistent constraints including limited access to inputs, weak market linkages, poor infrastructure, and a shortage of tailored agricultural extension services (Vilakazi et al., 2025).These constraints are compounded by climate variability, with farmers increasingly exposed to droughts, erratic rainfall, and soil degradation.

In this context of vulnerability, informal networks and community structures play a vital role in sustaining livelihoods. Farmers often rely on reciprocal labour exchange, collective problem-solving, and information sharing within local groups and kinship networks to offset the weaknesses of formal support systems (Kesonga Nsele et al., 2023); (Moloabi, 2023).The dependence on social capital becomes especially important where state extension services are limited or absent, reflecting broader patterns in rural South Africa (Marima, 2021).

Given these dynamics, the study focuses on how different forms and levels of social capital influence farmers' capacity to adapt to climate stress. While Chapter 2 reviewed the theoretical and empirical foundations of social capital, this section narrows the discussion to Bergville's farming systems and institutional context as justification for the chosen research design. By examining how communal tenure, group affiliations, and local leadership structures shape resource flows and adaptive strategies, the study seeks to generate context specific insights into the role of social networks in resilience building.

Therefore, the main objective of this study is to assess the role of social capital in shaping the adaptive strategies and resilience building of smallholder farmers in response to climate change. By examining the forms, sources, and intensity of social capital among farmers in Bergville, the study aims to uncover how social networks, group affiliations, and institutional relationships support long-term agricultural sustainability. Understanding these dynamics is crucial for designing community-based interventions that enhance farmers' capacity to withstand climate-related stressors. The findings of this study will provide valuable insights to policymakers, development agencies, and local agricultural stakeholders seeking to strengthen rural resilience through social structures. The study contributes to existing literature by identifying the household and demographic factors that influence access to and utilization of social capital for climate adaptation. The findings will be essential in informing the development of locally appropriate, socially embedded resilience strategies in the context of smallholder agriculture.

3.3 MATERIALS AND METHODS

3.3.1 Study area and description of sampled farmers

This research was conducted in Bergville, a small rural town situated under the jurisdiction of the uKhahlamba Local Municipality within the uThukela District Municipality in the KwaZuluNatal province of South Africa (Figure 1). The area represents a typical rural agricultural setting, with socio-economic and climatic challenges similar to other parts of the province (Mthembu et al., 2022). Bergville is governed by a dual system involving both elected

municipal councils and traditional authorities, particularly in decisions related to land use and communal land allocation (Mabizela, 2020).

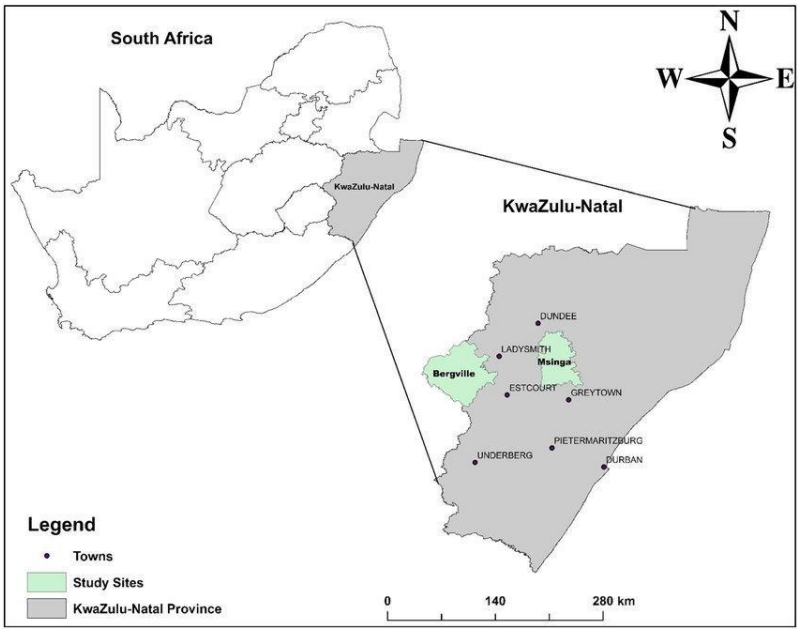

Figure 3.1. KwaZulu-Natal Map showing the location of Bergville and surrounding towns within the uThukela District Municipality. **Source:** Author's compilation using Google Maps (2024).

Bergville lies in a summer rainfall zone, receiving most of its precipitation between October and March. The driest month is typically July, with an average rainfall of around 10 mm (Barichievy, 2022). Annual rainfall varies between 700 mm and 800 mm, although recent years have shown increasingly erratic patterns and prolonged dry spells, which pose a growing threat to smallholder livelihoods. The average annual temperature is approximately 21.5°C, with January as the hottest month and July as the coldest, where temperatures can drop to an average of 11°C (Department of Agriculture, 2016).

The topography of Bergville is largely hilly, and the region is susceptible to soil erosion a problem exacerbated by overgrazing and unsustainable land-use practices. Soils are generally shallow, with moderate fertility and drainage constraints, which reduce overall land productivity (Vilakazi et al., 2019). Despite these challenges, approximately 35% of the land is deemed suitable for agriculture. However, most farming is still subsistence-based, with minimal commercial-scale output.

The local economy remains highly agriculture-dependent, yet is constrained by degraded soils, poor farming techniques, and inadequate infrastructure. High poverty levels (Stats SA,

2022) and limited institutional support (NDMC, 2021) further restrict agricultural development in the area (Edoun and Bakam, 2022).

In Bergville, women play a central role in small-scale agricultural production, managing mixed farming systems that include both crops and livestock (Manicom and Kruger, 2020).

A purposive sampling strategy was adopted to select both the study sites and participants. As a form of non-probability sampling, purposive sampling involves the deliberate selection of respondents based on their relevance to the research objectives and their first-hand experience with the phenomena under investigation. In this case, the study targeted smallholder farming households in Bergville, a region chosen due to its pronounced exposure to climate variability, persistent drought events, and underlying socio-economic vulnerabilities that affect agricultural resilience.

The sampling criteria focused specifically on active, long-term small-scale farmers as well as key community informants with in-depth knowledge of agriculture, climate adaptation, and rural development, particularly those who had resided in the area for an extended period. A total of 150 respondents were selected to participate in the household survey, ensuring sufficient variability in demographics and farming practices. To complement the quantitative data, two focus group discussions (FGDs) were conducted in ward two of the study area. Each FGD consisted of seven participants, with gender-separated sessions to encourage open dialogue and reduce response bias. Notably, individuals selected for the FGDs had not participated in the household survey, ensuring broader representation and capturing diverse community-level perspectives on social capital and climate resilience. Key informant interviews were also conducted with agricultural extension officers, nurses, nongovernmental organizations (NGOs) and school teachers.

3.3.2 Research Design

A mixed-methods research design was adopted to collect data from participants, incorporating both quantitative and qualitative approaches to provide a comprehensive understanding of the research problem. Purposive sampling was used to select 150 active smallholder farming households from Ward 2 in Bergville. This sample size was determined in consultation with local agricultural advisors and based on the total number of smallholder households in the ward ensuring that the selected participants reflected a reasonable proportion of the farming

population. While not statistically representative of all farmers in Bergville, this sample was sufficient to provide diverse insights into adaptation strategies and social capital dynamics.

The quantitative component involved administering a structured household questionnaire through face-to-face interviews, designed to generate measurable data on climate change adaptation and social capital. The qualitative component comprised focus group discussions (FGDs) and key informant interviews. To address potential gendered power dynamics in discussions, FGDs were conducted separately for men and women. This approach enabled participants to express their perspectives more openly, especially on sensitive topics related to decision-making, access to resources, and adaptation practices. Key informant interviews were further conducted with extension officers, community leaders, and lead farmers to provide contextual depth and expert perspectives.

The rationale for employing a mixed-methods approach lies in its capacity to capture the complexity of socio-ecological systems and enhance the validity of research findings through triangulation. As noted by (Driscoll et al., 2007),integrating both quantitative and qualitative methods broaden the scope of inquiry and compensates for the limitations inherent in using either method in isolation. This design allowed the study to examine both statistical patterns and contextual narratives, which are crucial for understanding the multifaceted nature of livelihood vulnerability and adaptation strategies in rural agricultural settings.

3.3.3 Data Analysis

The main instrument for gathering primary data was a structured questionnaire. In order to help the administration process, four numerators received training prior to starting the fieldwork. Informed agreement was given by each respondent, and participation in the study was completely voluntary. The standardised questionnaire was used to collect data through face-to-face interviews in compliance with the Declaration of Helsinki's ethical criteria. The questions were properly constructed and that the tool's structure, clarity, and relevancy matched the goals of the study, it was pre-assessed.

The survey instrument comprised structured sections aligned with the core research objectives of the study, focusing on the assessment of social capital and its influence on climate change adaptation among smallholder farmers in Bergville. These sections were tailored to capture both quantitative indicators and qualitative insights. Interviews were

conducted in isiZulu, the participants' native language, to foster understanding and culturally appropriate communication, which enhanced the validity of responses. A total of 150 active smallholder farmers from Ward 2 in Bergville took part in the survey.

The quantitative data was coded and analyzed using Statistical Package for the Social Sciences version 29 (SPSS). Responses to closed-ended questions were captured using a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). The reliability of Likert-scale items was tested using Cronbach's alpha, with the score of 0.846 indicating a high level of internal consistency, well above the acceptable threshold of 0.70 (Hayes and Coutts, 2020); (Mulaudzi et al., 2024). Cross-tabulation combined with chi-square tests was used to determine significant associations between key variables, with statistical significance set at $p < 0.05$. In addition, binary choice modeling was used to assess adoption decisions. A Probit regression model was specifically applied to estimate the probability of farmers adopting climate adaptation strategies as influenced by various social capital indicators.

For the qualitative data, focus group discussions (FGDs) and key informant interviews were transcribed verbatim, translated into English where necessary, and subjected to a thematic analysis. Coding was carried out manually using a hybrid approach: deductive codes were drawn from the research objectives (e.g., trust, collective action, access to support), while inductive codes emerged from participants' narratives. Initial open coding was followed by grouping related codes into categories, and finally synthesizing them into broader themes. To enhance rigor, intercoder agreement was sought by cross-checking a sample of transcripts among the research team.

Thematic findings from FGDs and interviews were then triangulated with survey data to identify convergence, complementarity, or divergence between quantitative trends and qualitative narratives. For instance, while the survey quantified levels of trust and group membership, qualitative accounts provided deeper insights into the social dynamics, cultural norms, and barriers shaping farmers' adaptation choices. This integration of methods strengthened the validity of the study's conclusions by capturing both measurable patterns and contextual realities

In order to accomplish the goals of the research study, cross tabulation was also utilized to analyze the data that the researcher was interested in. The researcher can evaluate the

strength of the relationship between variables by combining cross tabulation with a statistical measure such the chi-square (Wildemuth, 2009). A statistical test called a chi-square test compares actual observed frequencies to anticipated frequencies using cross-tabulation (Talib and Sulieman, 2022). To ascertain the link between two or more variables in this study, cross-tabulation approach was used. Furthermore, a score was obtained using chi-square, and the importance of that score was shown using the p-value. A significant difference between the variables under investigation is indicated by a p-value of less than 0.05. To group the information gathered from the focus groups and key informants' interviews into topics, a thematic analysis was carried out. Descriptive statistical analysis was used to assess the demographics and socio-economic characteristics of the smallholder farmers. Binary choice models are the most feasible when analyzing choice decisions for example Probit, Logit models (Horowitz and Savin, 2001). In order to handle the data, choice models were required because binary responses were found (Sekabira et al., 2012). To estimate the probability of adopting climate adaptation strategies as influenced by social capital, a Probit regression model was applied. This approach is suited for binary outcome variables and helps explain the influence of explanatory variables on the likelihood of adoption.

The general equation of probit model is:

Yi = F(Xi ß)+ εi

Yi ={ 1, if the farmer adopted at least one climate adaptation strategy

0, $otherwise$

ε~N (0,1); ß = maximum likelihood; ε = error term; X = set of independent variables included in the model.

Since estimates of the probit model provide only direction of effects, the marginal effects are usually calculated to interpret the actual change in probability of independent variables.

Marginal effects = ß i ϕ (z)

Whereby: Y (0,1) =β0 +β1X1, + β2 X2 +β3 X3 +β4 X4 ……. βn X n + ε ij)

Where β0 is the constant term or intercept and β1, β2 …. βn represent the parameters to be estimated and ε is the error term.

Whereby:

Y= Probability that a farmer adopts climate change adaptation strategies (1, when the farmer adopted atleast one climate adaptation strategy, 0 is otherwise).

The βs are the unknown coefficients to be estimated X is a vector of independent variable comprising of (X1) gender, (X2) age, (X3) level of education, (X4) years of farming, (X5) trust in networks, (X6) group membership, (X7) frequency of interation, (X8) access to extension officers, (X9) participation n collective action.

Table 5. Independent variables to be used in the probit regression model.

Variable	Type	Definition and measurement	Expected sign
Gender	Dummy	0 = male, 1 = female	+/-
Age	Continuous	farmer's age in completed years	-
Level of Education	Categorical	1= no formal education, 2= primary, 3= secondary, 4= tertiary, 5 = vocational	+
Farming Experience	Categorical	1 = < 5 year, 2 = 5–10 years, 3 = 11–20 years, 4 = > 20 years	+/-
Social Support Access	Dummy	1=farmer receives material/financial/community support during climate events; 0 = otherwise	+
Trust in Peer Information	Ordinal	1 = No trust, 2 = Somewhat trust, 3 = Completely trust	+
Participation in Collective Action	Dummy	1 = farmer has engaged in joint climate adaptation action with others; 0 = otherwise	+
Access to Extension Service	Dummy	1 = receives information through social networks; 0 = otherwise	+
Frequency of Interaction	Ordinal scale	1 = Never, 2 = Rarely, 3 = Monthly, 4 = Weekly, 5 = Daily	+

Group Membership	Dummy	1 = farmer is a member of a farmer group/cooperative; 0 = otherwise	+

3.4 RESULTS AND DISCUSSION

3.4.1 Demographic Data

The demographic characteristics of the sampled smallholder farmers were measured using frequencies and percentages. A total of 150 respondents participated in the questionnaire survey. Female respondents were (84%) and males accounted for (16%). The sample is predominantly female (84%), with males comprising only 16%. This marks a significant deviation from studies in neighbouring countries like Eswatini, where male dominance in farming was noted (Masuku et al., 2014). However, Beharielal et al. (2022), found that smallholder farming is increasingly a female-dominated livelihood in KwaZulu-Natal. This gender distribution may influence the formation of bonding social capital, as women often form dense, localized support networks grounded in kinship and mutual aid. These results show that females dominate the small holder farming in Bergville KwaZulu-Natal.

The majority of respondents ranged between the ages of 46 to 55 years. The age profile of respondents indicates that the majority (46%) are between 46–55 years, followed by 30% who are above 55 years, and 14% aged 36–45 years. The 18–25 and 26–35 age brackets are underrepresented, accounting for only 1.3% and 8.7%, respectively, these findings suggest that smallholder farming in Bergville is predominantly undertaken by older adults. This age pattern reflects the physically intensive nature of farming and may also indicate that younger individuals are increasingly disengaged from agriculture in favor of urban employment opportunities. (Kwabena Donkor et al., 2020) found that smallholder farming was most common among individuals in their productive years, reinforcing the view that agricultural engagement is highest among mature adults who possess both physical capability and farming experience.

The results in Table 3.1 show that the majority of respondents (44%) had only attained primary education, while 20% had no formal education. Secondary education accounted for 22%, and only 8% and 4.7% had vocational or university-level qualifications, respectively. A minimal

1.3% attained postgraduate education. These figures highlight a generally low level of formal education among smallholder farmers in Bergville. Limited educational attainment may impede access to technical farming information, digital platforms, and institutional support systems.

However, this may also foster strong reliance on informal, experience-based knowledge sharing, particularly within localized social networks. Similar findings were reported by Ankrah et al. (2023)**,** who found that low levels of education among rural farmers in SubSaharan Africa often correlate with low participation in formal agricultural programs but encourage community-based learning and adaptive knowledge transfer. Sibanda (2023) also noted that in contexts of limited literacy, smallholder farmers depend heavily on interpersonal trust and traditional practices passed down through generations, which becomes a central component of social capital and resilience.

A significant majority (61.3%) have resided in Bergville for more than 20 years, only a small minority (1.3%) have resided for less than a year. This suggests that smallholder farming in the region is primarily practiced by long-term residents with deep-rooted connections to their communities. These findings are consistent with Chidza (2024), who emphasized that long term community residence enhances farmers' ability to build durable social ties that are critical for effective adaptation to climate-related challenges.

The results in Table 3.1 also show that a high proportion of experienced farmers also supports this view with 32% reporting over 20 years of farming experience. As noted by (Bellanthudawa et al., 2025), prolonged farming experience, particularly in resource-limited rural settings, contributes to the development of practical knowledge, collaborative practices, and local coping mechanisms that strengthen social resilience.

The results indicate that a majority of smallholder farmers (72%) in Bergville owned less than one hectare of planting land, while an additional 21.3% operate on one-hectare plots. This can be attributed to the fact that limited access to land is characteristic of communal tenure systems and reflects broader challenges around land scarcity. The findings also revealed that a significant majority of farmers in Bergville (84%) practice mixed farming, managing more than one crop or livestock type. This pattern may also indicate that social capital (e.g., access to diverse farming knowledge, shared labour, and group resource use) plays a vital role in enabling diversification. This finding collaborated with (Kapari et al., 2023) study where it was found that diversified farming systems enhance smallholder resilience by spreading climatic and market risks.

Table 3.1. Demographic information of respondents

Variables	Category	Percentage (%)
Age of respondents		
	18-25,26-35	1.3, 8.7
	36-45, 46-55	14,46
	> 55	30
Gender		
Male, Female	1,2	16,84
Level of Education		
	No formal Education	20
	Primary	44
	Primary	22
	Secondary	8
	Vocational/ Technical Training	4.7
	University/ College Degree	0.6
Years lived in Bergville		
	< 1, 1-5	1.3, 4.7
	6-10, 11-20	10.7, 22
	> 20	61.3
Years of Farming Experience		
	< 5	19.3
	5-10	24
	11-20	24.7
	>20	32.0
Farm Size (Ha)		
	< Ha	
	1	72.0
	1,5	21.3
	2	3.3
	3	2.4
Crops/ Livestock Grown	Cabbage	1.3
	Maize	10.7
	Livestock	4.0
	More than one	84.0

3.4.2 Types and Sources of Social Capital and Networks

The results (Figure 3.2) show memberships in community-based organizations. A significant majority (78%) of respondents reported not being members of any CBO. As Kullu (2023) notes, such organizations are central to building bridging and linking social capital, since they connect farmers to broader networks, extension services, and institutional resources. The absence of widespread organizational membership therefore suggests that opportunities for farmers in Bergville to build bridging ties with external actors remain limited. This aligns with (Mulungu and Mudege, 2020), who found that unaffiliated farmers in rural African contexts struggle to access technical knowledge and policy support.

The survey further revealed that only 10.7% of respondents belong to a farming group or cooperative, while 28.3% reported never participating in community activities. Such limited engagement weakens bridging capital, reducing opportunities for collective learning, joint marketing, and experimentation with new practices (Kenney et al., 2020). Weak bridging structures in Bergville may partly reflect socio-economic fragmentation, where smallholder farmers prioritize household survival over community collaboration, thereby constraining the ability of networks to scale up adaptive practices.

The results also show that 43.3 % of farmers sometimes receive help from family or neighbors, consistent support is lacking, with only 12.5% receiving help often. These findings reflect weak bonding social capital at the household level, which is critical for coping with environmental shocks (Yang et al., 2024). A majority of 28.9% of respondents reported moderate access, while 27.0% indicated no access to local leaders and institutions, this could be attributed by uneven distribution of social resources and community leadership (Merkaj et al., 2020).

Results further revealed that 81.3% of farmers disagreed or strongly disagreed that they regularly receive climate change information, indicating a substantial gap in climate communication that hinders informed adaptation (Merkaj et al., 2020).

The results showed 81.7% of the respondents disagreed that their social networks assist in adopting new farming techniques. Ganguly et al. (2020) reported that social capital is

underutilized as a channel for technical knowledge sharing and innovation. These results may have been impacted by the fact that while informal networks may exist, Bergville farmers' social capital sources and types are typically weak, dispersed, and unevenly leveraged, which limits their ability to adapt and be resilient to climate change.

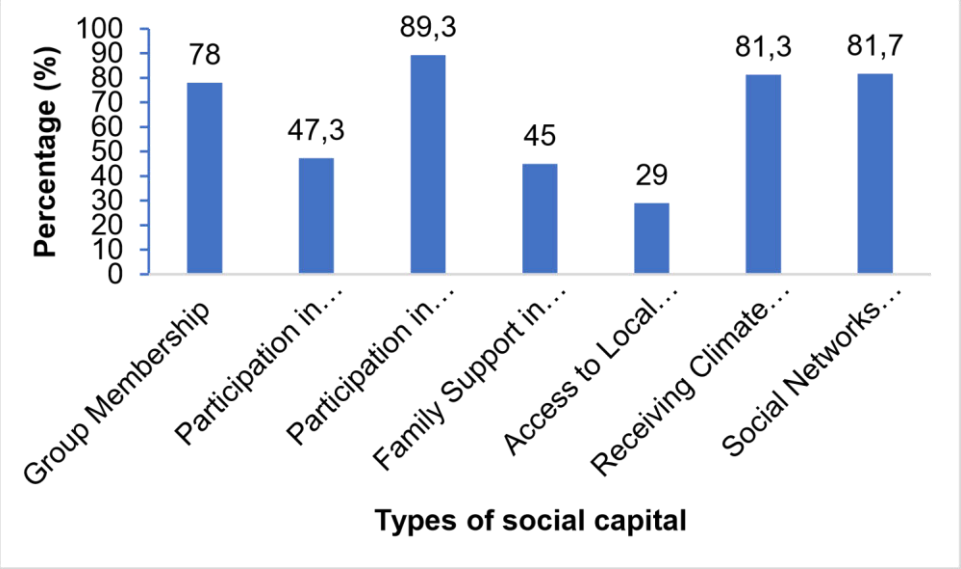

Figure 3.2: Types and Sources of Social Capital and Networks among Smallholder Farmers.

These findings show that while some informal ties exist, the overall structure of social capital in Bergville is fragmented. Bonding ties are relatively weak and inconsistent, bridging capital is undermined by low group membership and collective activity, and linking capital is constrained by uneven institutional access and poor information flows. This theoretical framing helps explain why Bergville farmers face barriers in mobilizing social resources for climate resilience: social capital remains present but poorly aligned with adaptation needs.

CHAPTER 4: THE IMPACT OF SOCIAL CAPITAL IN CLIMATE CHANGE ADAPTATION AND RESILIENCE

4.1 ABSTRACT

This chapter presents the empirical findings of a study investigating the role of social capital in shaping climate change adaptation strategies among smallholder farmers in Bergville, KwaZulu-Natal. Drawing on survey data from 150 respondents, the chapter uses descriptive statistics, chi-square analysis, and a probit regression model to explore how dimensions of social capital trust, group membership, collective action, and access to support affect adaptive capacity.

Results indicate that farmers with greater trust in peer-shared information, frequent community interaction, and access to informal support systems are significantly more likely to adopt adaptive practices. Participation in collective action and access to extension services also emerge as strong enablers. However, structural constraints including limited institutional support, gendered exclusion, elite capture in local cooperatives, and uneven information flow hinder the equitable utilization of social capital. While bonding capital is relatively strong, bridging and linking forms remain underdeveloped, limiting access to technical advice, inputs, and climate early warnings.

The findings underscore the transformative potential of social networks in enhancing climate resilience while highlighting the need for targeted interventions to address social and institutional barriers. These insights are critical for policymakers, NGOs, and local institutions seeking to strengthen inclusive and socially embedded climate adaptation strategies.

Keywords: *Adaptive capacity, peer networks, collective action, climate resilience, farmer group participation, social trust dynamics, rural vulnerability*

4.2 INTRODUCTION

As the impacts of climate change intensify across rural South Africa, smallholder farmers face increasing pressure to adapt to erratic rainfall, soil degradation, and frequent weather shocks (Tun Oo et al., 2023). In Bergville, KwaZulu-Natal, where farming remains a primary livelihood under communal land tenure systems, the absence of strong institutional infrastructure compels farmers to rely heavily on social capital as a key coping mechanism (Kruger et al., 2022). Social capital the networks of trust, norms, shared knowledge, and reciprocal relations

has emerged as a critical driver of adaptive capacity, particularly in resource-constrained settings(Kruger et al., 2022).

Chapter 3 examined the forms and intensity of social capital among smallholder farmers in Bergville, this chapter focuses on analysing its functional impact in shaping farmers' adaptive responses to climate stress. The chapter seeks to evaluate both the benefits and limitations of using social capital as a vehicle for building long-term resilience. These objectives are grounded in growing evidence that adaptive behaviours such as shifting planting times, sharing resources, or experimenting with drought-resistant crops are often enabled not solely by formal policy interventions, but by informal, trust-based networks within communities (Ntuli, 2023).

Empirical studies have underscored that access to peer knowledge, participation in collective activities, and group affiliations significantly enhance farmers' ability to respond to climate uncertainty (Tamasiga et al., 2024). In Bergville, where public extension services remain fragmented, farmers increasingly depend on informal learning, mutual aid systems, and farmer-led forums to acquire climate adaptation knowledge (Kruger et al., 2021). Despite this growing reliance, not all farmers benefit equally. Gender norms, generational divides, and exclusionary group practices continue to shape how social capital is accessed and utilized (Bessière and Gollac, 2023).

This chapter uses quantitative and qualitative data to evaluate the effects of trust, group membership, social support, and participation in collective action on climate adaptation. By identifying both enablers and systemic constraints, the findings aim to inform socially embedded, context-specific adaptation strategies that enhance resilience while addressing inequality in rural farming communities. Trust, in particular, is explored as a catalyst for behavioural change in environments where formal institutions are either weak or absent (Brezzi et al., 2021).

Notably, the findings indicate that while bonding social capital (kinship and neighbourly ties) remains strong, bridging and linking forms which connect farmers to external institutions and knowledge systems are underdeveloped (Bukachi et al., 2021). This structural imbalance often limits farmers' ability to access technical advice, improved inputs, or disaster early warnings. In turn, this exacerbates the vulnerabilities of farmers who are already marginalized by age, gender, or geography (Bukachi et al., 2021).

This chapter, therefore, provides a critical analysis of how social capital functions not only as a support mechanism but also as a determinant of equitable resilience. By identifying both the enabling factors and the systemic constraints that affect social capital utilization in Bergville, the chapter contributes to the development of socially embedded climate strategies that are inclusive, participatory, and context-specific. These insights will be particularly valuable to policymakers, NGOs, and local institutions aiming to strengthen adaptive capacity in rural South Africa, where formal safety nets often fail to reach the most vulnerable farming communities.

4.3 MATERIALS AND METHODS

This study was conducted in Ward 2 of Bergville, located within the uKhahlamba Local Municipality of KwaZulu-Natal Province, South Africa. The area is characterized by a predominantly rural economy dependent on rain-fed agriculture, with smallholder farmers practicing mixed farming systems under communal land tenure province (Mthembu et al., 2022). The region's vulnerability to climate-related shocks such as droughts, erratic rainfall, and soil erosion necessitates a focus on community-based coping mechanisms, including informal social networks (Vilakazi et al., 2019).

Bergville operates under a dual governance system comprising traditional authorities and local municipal councils (Mabizela, 2020). The terrain is largely hilly with shallow soils, which combined with erratic rainfall patterns and limited extension support, constrain agricultural productivity (Arora et al., 2023). The target population included long-term, active smallholder farmers who have been exposed to climate variability and engage in local agricultural adaptation strategies.

A purposive sampling technique was used to select both the location and participants. This method enabled the selection of individuals with deep experiential knowledge of farming and social capital in the local context. A total of 150 smallholder farmers were surveyed, ensuring variability in demographics, farming experience, and social network engagement. In addition to the household survey, two gender-disaggregated focus group discussions (FGDs) and several key informant interviews were conducted with agricultural officers, educators, and local NGO staff to capture broader perceptions of community resilience and social capital dynamics.

4.3.1 Research Design and Data Collection

A mixed methods research design was adopted, combining quantitative and qualitative tools to capture the complexity of social capital and climate adaptation. Structured household questionnaires were administered through face-to-face interviews conducted in isiZulu to ensure cultural and linguistic clarity. The survey instrument was pre-tested for clarity and reliability.

Quantitative sections focused on measurable indicators such as trust levels, frequency of community engagement, access to support systems, and group membership. A 5-point Likert scale was used for responses related to perceptions and experiences. The qualitative component included open-ended questions, FGDs, and key informant interviews, providing contextual depth and capturing nuanced views on the perceived benefits and limitations of social capital in climate adaptation.

The combination of both data types enabled triangulation and enhanced the study's internal validity, aligning with best practices in mixed methods research (Driscoll et al., 2007).

4.3.2 Data Analysis Techniques

Statistical Package for the Social Sciences version 29 (SPSS). Participants' answers to a variety of closed-ended questions were coded using a 5-point Likert scale, with 1 denoting strongly disagree and 5 denoting strongly agree. The Likert-scale data's reliability was examined using Cronbach's alpha. An internal consistency metric called Cronbach's alpha is used to assess how closely a group of items are related to one another (Hayes and Coutts, 2020). Cronbach's alpha = $\propto$ = 0.846 validated the overall reliability of the 8 Likert-type questions pertaining to smallholder farmers' assessments of how social capital contributes to climate change resilience > 0.70 is the allowed limit. According to recognised research criteria, a high degree of reliability was proven by a Cronbach's alpha score of 0.85 (Mulaudzi et al., 2024).

To evaluate relationships between variables such as trust, participation, and adaptive behaviour, cross-tabulations were employed alongside chi-square tests. These tests measured the strength and statistical significance of associations between social capital components and climate adaptation outcomes tabulation (Talib and Sulieman, 2022). A pvalue threshold of <0.05 was used to determine statistical significance.

For regression analysis, a probit model was applied to estimate the probability of adopting at least one adaptation strategy based on multiple social capital variables. This model is suitable for binary outcomes and allows the examination of marginal effects for each explanatory variable (Horowitz and Savin, 2001). Thematic analysis was conducted on qualitative data from FGDs and interviews to identify recurring themes related to the benefits and constraints of social capital in climate resilience. Themes included: trust in community leaders, exclusion from decision-making, limited group cohesion, and access to extension networks. These findings were used to enrich and contextualize the statistical outputs. This mixed-methods approach allowed for a comprehensive evaluation of how social capital operates as both an enabler and a limiting factor in smallholder farmers' ability to respond to climate risks. By aligning empirical results with community perceptions, the methodology provided robust evidence in support of the chapter's two objectives.

The results in Table 4.1 indicate that the probit model was a good fit for estimating the likelihood of adopting climate change adaptation strategies. Some social capital and demographic variables were statistically significant predictors ($P< 0.1$), suggesting they play a key role in shaping farmers' adaptive responses.

Age has a coefficient of -0.152 and is significant at the 10% level ($P = 0.075$). This suggests that an increase in age reduces the likelihood of adopting adaptation strategies. Older farmers may be less responsive to change, preferring familiar practices over new approaches, which could explain their lower participation in adaptation-related activities. This aligns with recent findings by ABEGUNDE (2021), who reported that younger farmers are typically more proactive in engaging with agricultural innovations due to their greater flexibility and exposure to new ideas.

Gender also returned a negative coefficient (-0.357) but was not statistically significant ($P = 0.138$). This implies that gender does not have a strong influence on the adoption of adaptation strategies in this context. These finding are consistent with Haque et al. (2024) study where women, despite limited resources, often engage more in collective adaptation mechanisms due to their roles in managing household-level climate risks.

Level of education is significant (P < 0.005) with a negative coefficient (-0.587). Surprisingly, this indicates that farmers with higher education levels are less likely to adopt the adaptation strategies analyzed in this model. A possible explanation is that more educated farmers may diversify into off-farm income or migrate away from agriculture, reducing their engagement in local adaptation efforts. This result is consistent with (Yusuf, 2024), who found that higher education may sometimes correlate with lower agricultural involvement, particularly in regions where farming is seen as a secondary livelihood option.

Farming experience had a positive coefficient (0.204) but was not statistically significant (P = 0.207). This suggests that although experienced farmers may be more aware of climatic challenges, experience alone does not significantly influence their participation in adaptation strategies. This supports findings by Karanika-Murray and Biron (2020), which argue that without access to external support or new knowledge, experience does not always translate into adaptive behavior.

Social support access had a positive coefficient (0.398) and significant at the 10% level (P = 0.073). This shows that farmers with access to social support systems are more likely to engage in climate change adaptation. Social support helps share risk, pool resources, and disseminate useful information. This is supported by (Dapilah et al., 2020), who emphasized the importance of social networks in facilitating farmers' resilience against climate shocks.

Trust in peer Information also had a positive coefficient (0.345) and is significant at the 10% level (P= 0.084). This implies that farmers who trust information from peers are more likely to adapt. Trust increases the credibility of shared knowledge and facilitates faster behavioral change. (Antwi-Agyei and Stringer, 2021)found that peer influence and trust significantly impact the willingness of farmers to implement adaptation practices, especially in areas with weak formal extension systems.

Participation in collective action was statistically significant at the 5% level (P = 0.034) with a positive coefficient (0.411). This indicates that farmers involved in collective groups or

community activities are more likely to adopt adaptation strategies. Collective action lowers costs, builds shared resources, and enables joint decision-making, which enhances resilience. This finding aligns with (Zafar et al., 2023), who highlighted the critical role of communitybased institutions in managing climate-related risks.

Access to extension service also yielded significant results at the 5% level (P = 0.049) with a positive coefficient (0.362). This suggests that farmers who interact with extension services are more likely to engage in adaptation strategies. Extension agents serve as vital links to knowledge, technology, and policy. Similar results were observed by (Amadu, 2022), who found that access to extension services is one of the most influential drivers of agricultural adaptation in Sub-Saharan Africa.

Frequency of Interaction has a positive coefficient (0.273) and significant (P= 0.096). This implies that the more frequently a farmer interacts with others whether community members or institutions the higher their likelihood of adopting adaptation strategies. Interactions foster learning, trust, and exposure to successful practices. This was echoed by (Mutenje et al., 2021), who observed that frequent social interactions enhance knowledge sharing and build adaptive capacity.

Group membership had a positive coefficient at (0.339) and nearly significant (P = 0.061). Farmers who are members of formal or informal groups are more likely to adopt adaptation strategies. Group participation creates avenues for sharing experiences, accessing resources, and engaging in collective problem-solving. (Coger et al., 2022) highlight that farmer groups are instrumental in mobilizing local adaptation efforts and improving resilience outcomes.

Table 4.1 Probit Model; Social Capital Factors Influencing Climate Adaptation

Variable	Coefficient	Std. Error	Chi-square	P-value
Constant	2.957	0.7718	14.681	<0.001
Gender	-0.357	0.2404	2.205	0.138
Age	-0.152	0.0852	3.164	0.075*

Level of Education	-0.587	0.1514	15.041	<0.001***
Farming Experience	0.204	0.162	1.589	0.207
Social Support Access	0.398	0.176	3.215	0.073*
Trust in Peer Information	0.345	0.198	2.978	0.084*
Participation in Collective Action	0.411	0.155	4.512	0.034**
Access to Extension Service	0.362	0.182	3.872	0.049**
Frequency of Interaction	0.273	0.164	2.771	0.096
Group Membership	0.339	0.179	3.496	0.061

*****significant at 1%; **significant at 5%; significant at 10%**

The findings of this study reveal that social capital plays a nuanced role in the agricultural lives of smallholder farmers in Bergville. While the majority of farmers demonstrate strong community ties through long-term residence and extensive farming experience, the actual utilization of social capital for climate change adaptation remains limited. The dominant form of social capital is bonding social capital reflected in kinship support and local trust but bridging and linking forms, which are crucial for knowledge transfer and external resource access, appear weak.

The probit regression model further highlighted that variable such as age, education level, trust in peer information, and access to extension services significantly influence the likelihood

of utilizing social capital for adaptation. Older farmers and those with lower education levels were less likely to rely on or benefit from social networks for adaptive purposes. Group membership and participation in collective action were also positively associated with access to social capital.

While social structures exist, their effective use in resilience-building strategies remains suboptimal. This suggests a need for targeted interventions to strengthen not just the presence but also the functionality of social networks in promoting adaptive farming.

The study recommends a strategic approach to enhancing the role of social capital in climate change adaptation among smallholder farmers in Bergville. Efforts should be directed toward strengthening bridging and linking forms of social capital by facilitating more meaningful connections between farmers and external institutions such as agricultural extension services, NGOs, and information networks. These connections are vital for improving access to climate information and innovative adaptation strategies. Promoting the formation and sustainability of inclusive farmer groups and cooperatives is essential. These platforms encourage collective action and resource sharing, particularly benefiting women and elderly farmers who are often central to community-based support systems.

There is a need to invest in farmer education and peer-to-peer learning initiatives that enhance trust in locally shared information and increase the adoption of adaptive practices. Improving access to extension services should also be prioritized, ensuring that these services are effectively integrated into existing community structures to boost their relevance and reach. Given the low participation of youth in farming activities, youth-focused interventions must be developed to engage younger generations in agriculture and social capital building. The study recommends the establishment of participatory monitoring frameworks that can track the development and effectiveness of social capital in enhancing adaptive capacity over time. These recommendations, if implemented, could significantly strengthen the resilience of smallholder farming communities in Bergville.

4.3.3 Sources of Adaptation Knowledge

The analysis of respondents' sources of climate adaptation knowledge reveals the varying roles that social networks, government services, and media play in shaping farmers' adaptation responses in Bergville. The results show that social networks are the most prominent source, with 36.7% (n=55) of smallholder farmers relying on community-based interactions, peer-to-peer learning, and informal exchanges for information on how to respond to climate-related risks. This strong reliance on social networks reinforces the significance of bonding and bridging social capital as vital assets in contexts where formal institutional support is limited.

Focus group discussions (FGDs) supported this finding, with several participants emphasizing that "most of what we learn is from our neighbors and relatives," especially when facing seasonal uncertainty or unfamiliar weather conditions. Government extension services were reported by 26.7% (n=40) of the respondents as a key source of adaptation information. This suggests that while government programs are present and somewhat impactful, their reach may be constrained by logistical, personnel, or infrastructural limitations. Despite these challenges, extension officers remain an important formal channel for disseminating scientific knowledge and adaptation practices among rural farmers.

Media platforms, such as radio, television, and mobile phones, accounted for 22.7% (n=34) of reported information sources. Radio in particular is known to be a critical communication tool in rural areas, given its accessibility and affordability. These results point to an emerging role of mass media and digital tools in improving climate information flow, though access and literacy may affect uptake.

A smaller share of respondents 14% (n=31) indicated that they did not actively seek or receive adaptation information from any source. This knowledge gap could be due to barriers such as poor network coverage, low digital literacy, or limited group involvement, which may hinder farmers' ability to access timely and relevant adaptation strategies.

These findings underscore the interconnected nature of adaptation knowledge acquisition and social capital. The predominance of informal networks suggests that enhancing collective platforms, trust-building, and peer-learning could amplify the uptake of adaptive practices. Moreover, targeted efforts to improve the capacity and outreach of government extension services and to expand access to reliable media content could further strengthen farmers' adaptive capacity in Bergville.

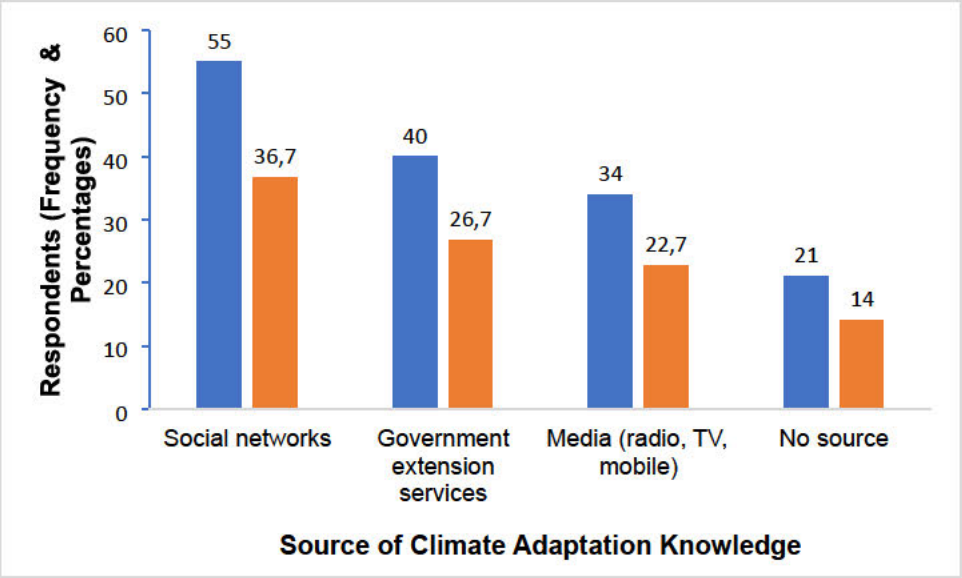

Figure 4.2: Sources of Climate Adaptation Knowledge Among Smallholder Farmers in Bergville

4.3.4 Perceived Importance of Social Networks in Adaptation

Likert-type questions rated on a five-point scale (*Strongly Disagree* to *Strongly Agree*) were used to assess perceptions of trust, support, collaboration, and resource access among smallholder farmers in Bergville. The responses reflect varying degrees of confidence in the role of social capital in supporting climate adaptation. With regard to teamwork and collective action, the majority of respondents (68.4%) *Agreed*, indicating a strong belief in the value of working together to adapt to climate change. This result highlights that collective mechanisms such as shared labour, group decision-making, and coordinated responses are well recognized and practiced within these farming communities.

Regarding the assistance they receive during severe weather occurrences, 51.3% of respondents said they occasionally receive it, whereas 23.7% said they do it infrequently. This suggests that while informal community safety nets exist, they are inconsistently activated possibly depending on the intensity of the weather event or the nature of social relationships involved.

Responses related to trust in information shared via social networks were more varied. Approximately 35.5% of farmers selected *Neutral*, 32.9% indicated *Agree*, and 30.3% selected a lower trust level (rating 2). Only 1.3% chose *Strongly Disagree*. These results suggest that while some farmers place confidence in peer-shared knowledge, a sizable portion remain

sceptical, which may delay or discourage the adoption of shared adaptive practices or innovations. For general social support, 52% of respondents rated it as *Moderate*, while 29.6% selected *Neutral*. Only 16.4% reported *High* levels of support. This indicates that although social ties are present, they do not always result in substantial assistance during times of need possibly reflecting the limitations of resource availability or the nature of social obligations.

A notable concern was not evident in perceptions of network effectiveness in helping farmers adapt. On a contrary, 69.1% of respondents expressed positive views, about how networks help them adapt. This suggests that community-based social structures are increasingly valued for their role in enhancing resilience and supporting adaptive practices.

Regarding access to shared resources such as tools, seeds, and information, the majority of respondents (52.6%) indicated Moderate Access, with fewer selecting either Low or High access. This pattern suggests that infrastructural or logistical barriers may limit equitable access within the community, potentially weakening the benefits of social capital.

Overall, the findings reflect a mixed yet insightful picture, while social cohesion and collaboration are acknowledged and moderately practiced, farmers show varied confidence in the reliability, effectiveness, and practical benefits of their networks. This partial underutilization of social capital points to an opportunity for targeted interventions aimed at strengthening trust, functionality, and inclusivity of community networks to enhance adaptive capacity.

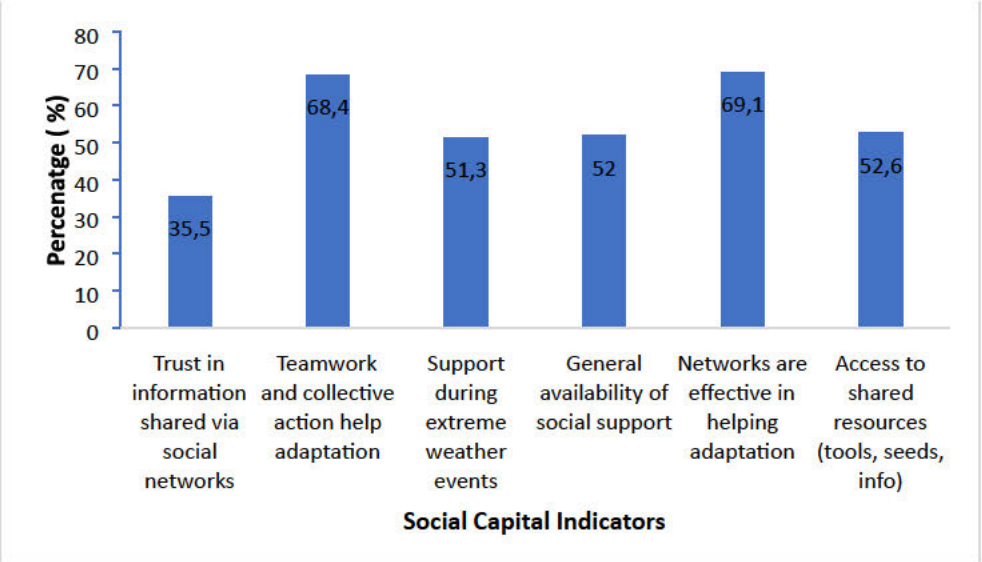

Figure 4.3: *Perceptions of Social Capital in Supporting Climate Adaptation Among Smallholder Farmers in Bergville (n = 150)*

4.3.5 Farmer's perception of trust in peer information

The results (Figure 4.4), shows the cross-tabulation between levels of trust in peer information and adoption of climate change adaptation strategies reveal a distinct relationship. Among respondents who reported Complete Trust, a majority (73.7%) indicated they have adopted climate adaptation practices. Similarly, 61.1% of those who expressed Somewhat Trust also reported using adaptation strategies. Conversely, only 25.9% of those who stated they had "No Trust" in peer engaged in any climate change adaptation activity.

The Pearson Chi-Square test confirms that this relationship is statistically significant (χ^2 = 93.219, df = 12, P< 0.001), indicating that levels of trust in social networks significantly influence the likelihood of adopting climate adaptation strategies. The pattern shows a strong positive correlation between trust and adaptation behavior as trust increase, so does the likelihood adaptation.

These findings indicate a strong positive relationship between trust and adaptive behavior. Farmers who trust information from peers are significantly more likely to adopt strategies to cope with climate change. This implies that strengthening trust within social networks for example through farmer groups, peer-learning programs, or extension-linked community forums could be a powerful tool to enhance resilience and uptake of adaptive practices in smallholder communities.

These findings emphasize that trust in peer-shared information is a key enabler of climate resilience in smallholder contexts. Farmers who trust their peers are significantly more likely to replicate adaptive behaviors, share knowledge, and engage in collective responses to environmental challenges. This aligns with (Karki et al., 2025), who argue that in the absence of formal extension services, community trust becomes a primary channel for agricultural knowledge transfer.

Interventions that build and reinforce trust within farming communities such as farmer-led forums, peer-learning groups, and participatory extension networks may dramatically improve the uptake of climate-smart practices. Bonding social capital, in particular, serves as a catalyst

for both learning and collective action, reinforcing the crucial role of social cohesion in climate adaptation. These findings have clear implications for policy and development programming, especially in rural areas like Bergville where formal support systems remain limited.

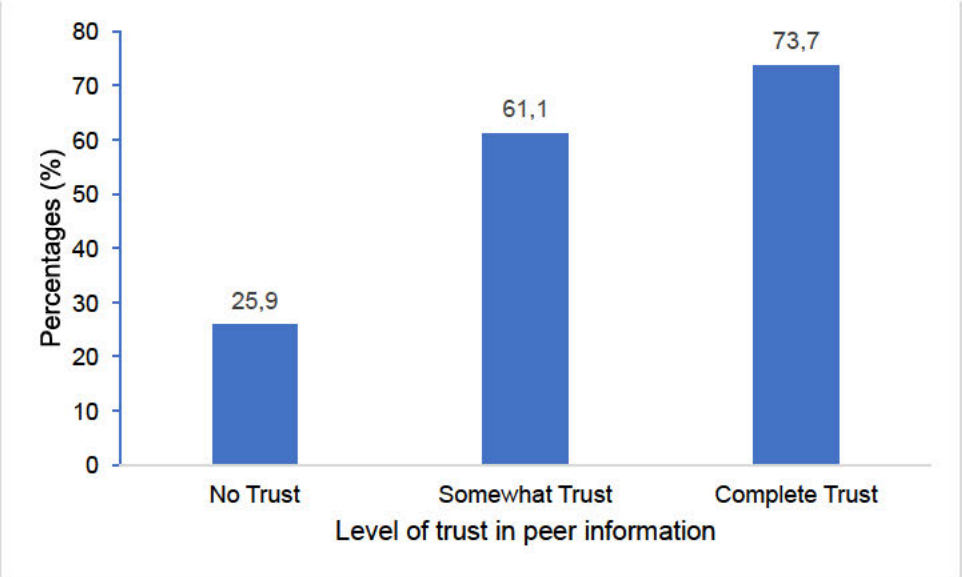

Figure 4.4: *Adoption of Climate Change Adaptation Strategies*

Table 4.2 *Trust in Peer Information vs. Adaptation*

Statistic	**Value**
Pearson Chi-Square	93.219
Degrees of Freedom	12.0
p-value	<0.001
Valid Cases	152.0
Cells with Expected Count < 5	11.0
Minimum Expected Count	0.03

Table 4.3 presents the chi-square test results assessing relationships between various social capital indicators (trust, participation, access to support, information-sharing,) and the adoption of climate adaptation strategies or behaviors among smallholder farmers. These associations are central to understanding the influence of social capital. Significant relationships were found between several aspects of social capital and adaptation behaviour.

Farmers who reported better access to resources through social networks were significantly more likely to report easier access to external support and adoption of climate adaptation strategies ($P< 0.001$). Respondents who used social networks to learn new farming techniques were more likely to identify these networks as important knowledge sources ($P < 0.001$), confirming the knowledge-spreading function of social capital.

Trust in information shared by peers was significantly associated with adoption behaviour ($P= 0.002$), suggesting that social cohesion and communication strengthen behavioural response. Demographic indicators such as gender, farming experience, and years in the community showed no significant influence on participation in organisations or adaptation behaviour, indicating that social interaction quality may be more crucial than static demographic factors. These results empirically confirm that social capital is a significant enabler of climate change adaptation when it functions to improve access, trust, and knowledge-sharing mechanisms.

Table 4.3: Chi-Square Tests Between Social Capital Variables and Climate Adaptation

Variables Compared	Chi^2	df	p-value	Significance
Years in Bergville × Community Organisation Membership	1.039	4	0.904	Not Significant
Gender × Participation in Community-Based Organisations	3.054	4	0.549	Not Significant
Access to Resources × Ease of Accessing External Support	102.591	16	<0.001	Significant
Learning Techniques × Networks as Knowledge Sources	114.995	16	<0.001	Significant
Types of Resources × Support for Farming Activities	158.160	24	<0.001	Significant
Resources for Climate × Support for Climate Change Adaptation	158.160	24	<0.001	Significant
Years of Farming × Community Organisation Membership	2.769	3	0.429	Not Significant
Gender × Participation in Community Events	3.054	4	0.549	Not Significant
Trust in Fellow Farmers' Info × Adaptation Behavior	25.082	8	0.002	Significant

***Represents significant difference p-value < 0.05. **Represents significant difference p-value < 0.01. ***Represents significant difference p-value < 0.001. ns: not significant.**

Figure 4.4 reveals out of the total respondents, only 10.7% reported being members of farmer groups or cooperatives, while 89.3% indicated no affiliation. However, among those who belonged to groups, a significantly higher proportion (75%) engaged in collective adaptation actions such as shared labour for planting, coordinated planting schedules, or cooperative pooling of resources during droughts. In contrast, only 25% of non-members reported taking part in such actions.

This substantial difference highlights the potential role of organized farmer networks in fostering collaboration in the face of environmental stress. Group settings often facilitate the dissemination of agricultural innovations, coordinated action, and access to communal resources factors that strengthen adaptive capacity in rural settings.

The observed pattern suggests a meaningful relationship between group membership and adaptive behaviour. These findings support the growing literature that positions group-based participation as a catalyst for resilience, particularly where institutional support is limited (Perach et al., 2023). Interventions aiming to strengthen local adaptive responses may benefit from encouraging the formation and participation in farming cooperatives and group-based networks. Such structures not only enable knowledge exchange but also promote mutual accountability and collective resilience strategies among smallholder farmers.

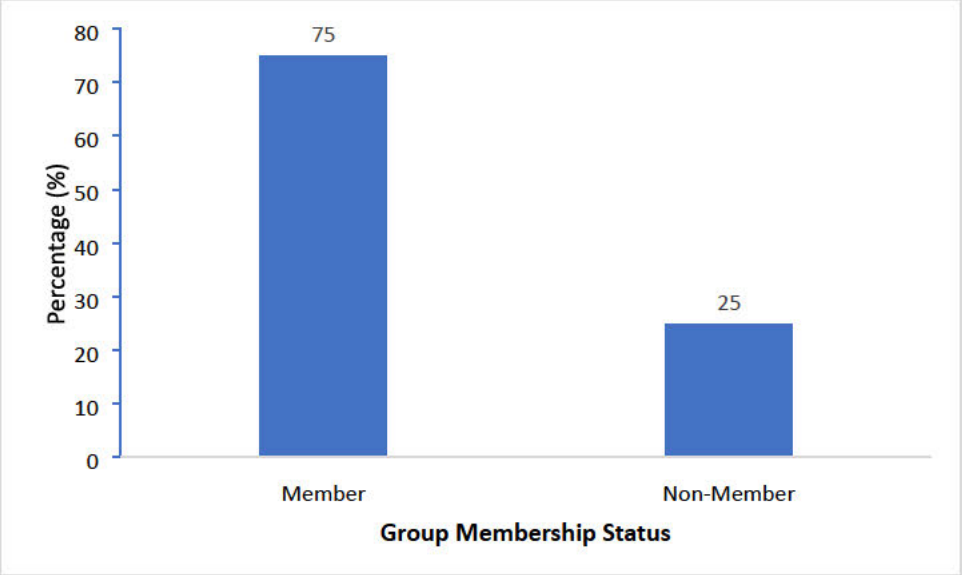

Figure 4.4 Group Membership and Collective Adaptation

4.3.6 Frequency of Interaction and Climate Learning

The findings from the cross-tabulation between community meeting frequency and climate knowledge acquisition illustrate the important role of regular social engagement in fostering adaptive learning and resilience among smallholder farmers. The results show that farmers who reported attending community meetings daily or weekly had the highest rates of climate knowledge uptake through social networks, with 78.3% of daily participants and 44.8% of weekly participants acknowledging that they had adopted new climate-related practices due to shared information. In contrast, those who rarely or never participated in community gatherings reported little to no benefit in terms of climate learning. For instance, respondents who never attended community meetings reported 0% uptake of climate adaptation knowledge from peers.

These results further indicate the critical role of frequent interaction in enhancing adaptive capacity, primarily through peer learning, knowledge exchange, and collective problemsolving mechanisms. Regular participation in community events provides a platform for farmers to share experiences, learn context-specific coping strategies, and support one another in managing environmental uncertainty. This finding is consistent with studies by (Šūmane et al., 2018), which argue that interaction within trusted local networks significantly enhances farmers' ability to respond to climate risks through informal and socially embedded knowledge-sharing channels.

The analysis suggests that encouraging more frequent and structured engagement among farmers such as through local forums, village committees, or cooperatives could be a strategic avenue to strengthen climate resilience. Enhancing opportunities for interaction may lead to improved awareness, peer experimentation with new adaptation techniques, and broader uptake of successful coping mechanisms within farming communities. These insights reinforce the importance of social capital as a conduit for adaptive learning and behavioural change in resource-constrained, climate-vulnerable settings like Bergville.

Table 4.4 Frequency of Interaction and Climate Knowledge Gained Through Social Networks

Frequency of Community Meetings	Yes – Gained Knowledge (%)	No – Did Not Gain Knowledge (%)
Daily	78.3	21.7
Weekly	44.8	55.2
Monthly	25.0	75.0
Rarely	10.0	90.0
Never	0.0	100.0

4.3.7 Analysis of Social Capital and Adaptation

The results presented in Table 4.5 provide compelling evidence that various dimensions of social capital are significantly associated with climate change adaptation practices among smallholder farmers in Bergville. This analysis underscores the critical role that social capital plays in enabling farmers to respond to climatic stressors, particularly in rural areas with limited access to formal resources.

One of the most prominent findings relates to trust in peer-shared information. The results indicate a statistically significant relationship between trust and adaptive behaviour ($\chi^2 = 18.2$, P= 0.001), demonstrating that farmers who place trust in climate and agricultural advice from their peers are substantially more likely to implement adaptive strategies. Trust enhances the perceived credibility and relevance of information, thereby encouraging farmers to experiment with new practices and adopt innovations. In contexts where formal extension systems are weak or inconsistent, peer-to-peer trust becomes a crucial mechanism for knowledge diffusion and behavioural change.

Similarly, social support access was found to be significantly associated with adaptation ($\chi^2 = 16.9$, P = 0.002). Farmers who receive material or emotional assistance from family, neighbours, or local community members during climate shocks are more likely to adapt their agricultural practices. This suggests that informal safety nets and reciprocal support systems provide the necessary resilience for farmers to manage environmental risks. These support

structures can act as buffers that enable households to make strategic decisions without fear of resource depletion.

Group membership also showed a strong positive association with climate adaptation (χ^2 = 14.8, P = 0.003). Belonging to a farmer group, association, or cooperative enhances opportunities for shared learning, coordinated action, and pooling of resources. Farmers involved in such groups often have better access to information, peer motivation, and logistical support, all of which contribute to a higher likelihood of adopting adaptive responses. Group settings further foster accountability and collective planning, which are essential for long-term resilience.

The analysis also revealed that participation in collective action such as joint infrastructure development or communal land management was significantly related to individual adaptation behaviour (χ^2 = 15.4, P = 0.001). This finding illustrates the spill over effect that community-level engagement has on personal decision-making. When farmers are involved in collective adaptation efforts, they are more likely to internalize the value of proactive measures and replicate these strategies on their own farms.

Another significant factor was access to extension through informal networks (χ^2 = 13.6, P = 0.004). Farmers who received climate information from informal sources, such as community meetings, trusted peers, or local leaders, were more likely to adapt compared to those relying solely on formal institutions. This points to the growing influence of social learning and informal information dissemination in rural areas, where conventional outreach systems may be limited.

The strongest association in the analysis was observed with frequency of interaction within social settings (χ^2 = 20.1, P = 0.001). Farmers who engage more frequently in community meetings, group activities, or informal discussions demonstrate greater awareness of adaptation options and a higher likelihood of implementing adaptive practices. Frequent interaction fosters trust, increases exposure to diverse strategies, and creates a culture of shared responsibility in responding to climate challenges.

These findings confirm that various aspects of social capital particularly trust, social support, group affiliation, information flow, and the regularity of interaction serve as key enablers of climate change adaptation. Interestingly, demographic variables such as gender, years of farming, and length of residence in the community did not show significant relationships with

adaptation behaviour, suggesting that interactive and dynamic social processes may matter more than static characteristics.

***Table 4.5**: Analysis of Social Capital and Climate Adaptation*

Variable	Chi-Square (χ^2)	p-value	Significance
Trust in Peer Information	18.2	0.001	Significant
Social Support Access	16.9	0.002	Significant
Group Membership	14.8	0.003	Significant
Participation in Collective Action	15.4	0.001	Significant
Access to Extension through Networks	13.6	0.004	Significant
Frequency of Interaction	20.1	0.001	Significant

4.3.8 Perceived Benefits and Constraints of Social Capital for Resilience

The results presented in Table 4.6 illustrate farmers' perceptions of how various dimensions of social capital contribute to their resilience, particularly in relation to climate adaptation and farming practices. The responses are drawn from a 5-point Likert scale. These findings provide deeper insight into the practical and emotional benefits that farmers associate with participation in community-based networks and support systems.

The data reveal that a vast majority of farmers (93.4%) agreed that participation in community groups plays a critical role in supporting collective adaptation strategies. This high level of agreement highlights the significance of group identity, institutionalized cooperation, and social belonging within the farming community. Similarly, 85.5% of respondents agreed that access to local support systems strengthens their capacity to respond to climatic and

agricultural challenges. These results underscore the value of localized networks in buffering risk and enhancing decision-making.

Teamwork also emerged as a notable factor, with 68.4% of respondents acknowledging that collaboration improves their adaptive strategies. This affirms the role of collective mechanisms such as pooled labour, joint planning, and shared responsibilities in building resilience. Likewise, 50% of farmers agreed that access to improved farming techniques was facilitated through social interactions, indicating that communal learning plays a key role in promoting innovation and improved agricultural practices.

In terms of information and advice exchange, 37.5% of farmers agreed that shared advice contributed meaningfully to their adaptation strategies, although a significant portion remained neutral. This may suggest inconsistencies in advice quality, variation in trust levels, or unequal access to knowledgeable peers. Trust in shared information was considerably high, with 35.5% agreeing and another 32.9% strongly agreeing that information received through social channels was reliable. Trust remains a foundational element of social capital, and these figures suggest that peer-shared knowledge is often viewed as credible and actionable.

Farmers also identified the importance of social safety nets, particularly during climaterelated stress. Support received during extreme weather events was affirmed by 51.3% of respondents, with an additional 19.7% strongly agreeing, which highlights the value of emotional and material support systems in times of crisis. Resource sharing practices such as the use of communal farming equipment were endorsed by 43.4% of respondents, while 40.1% agreed that easy access to support services further enhanced their ability to cope.

Despite the general positivity surrounding social capital, certain areas showed more polarized or mixed responses. In the case of shared resources, for example, 33.6% of farmers rated this dimension low, while 32.9% rated it high, indicating a divide in perceptions that may stem from unequal access, competition over resources, or localized tensions within the community. These contrasting views may point to intra-community inequalities, inconsistent access, or localised disputes that impact the perceived value of shared assets.

Perceptions of the usefulness of community meetings were mixed, with 46% of respondents expressing disagreement. This could be attributed to issues such as meeting fatigue, dominance by elite voices, or a lack of actionable outcomes. These disparities suggest that

while many components of social capital are recognized as beneficial, others may be underperforming due to structural or relational limitations.

The findings affirm the central role that social capital plays in enhancing both material and informational resilience among smallholder farmers in Bergville. The ability to collaborate, trust, and access communal networks significantly improves farmers' adaptive capacity. These findings also point to the need for more inclusive structures and equitable resource distribution mechanisms to ensure that the benefits of social capital are widely and fairly experienced within the community.

Table 4.6: *Perceived Benefits of Social Capital in Enhancing Resilience*

Social Capital Dimension	Key Indicator / Statement	Agree	Strongly Agree
Community Participation	Participation in community groups supports collective adaptation strategies	93.4%	–
Social Capital Dimension	**Key Indicator / Statement**	**Agree**	**Strongly Agree**
Local Support Systems	Access to local support systems enhances response to climate/agricultural challenges	85.5%	–
Teamwork & Collaboration	Teamwork improves adaptive strategies	68.4%	–
Access to Farming Techniques	Farming techniques improved through social interactions	50.0%	–
Advice Sharing	Shared advice contributes to adaptive strategies	37.5%	–
Trust in Information	Information received through social channels is reliable	35.5%	32.9%
Support During Crises	Received support during climate-related extreme weather	51.3%	19.7%
Resource Sharing	Use of communal farming equipment helps coping mechanisms	43.4%	–
Access to Support Services	Easy access to support services improves adaptive capacity	40.1%	–
Equity in Shared Resources	Perceived value of shared resources	33.6% (I	32.9%
Usefulness of Community Meetings	Community meetings perceived as useful	54%	–

4.3.9 Constraints Limiting the Use of Social Capital for Climate Resilience

Despite these benefits, several constraints were identified that may hinder the effective use of social capital in building resilience. A significant proportion of farmers (64.7%) cited lack of

information or knowledge as a major barrier. This finding suggests that while networks exist, their capacity to generate and transmit technical or climate-specific knowledge remains limited. This limitation is particularly concerning given that adaptation often requires informed and timely responses.

Limited group cohesion emerged as another challenge, with 52% of respondents reporting that internal conflicts, lack of unity, or personal rivalries reduced the effectiveness of collective adaptation efforts. Weak cohesion can disrupt joint planning, reduce participation, and undermine the sustainability of group-based strategies (Mahajan, 2024).

Exclusion from decision-making was reported by 47.3% of farmers, particularly affecting women, youth, and new community members. Such exclusion reflects gendered and hierarchical power dynamics, often resulting in elite capture where influential individuals dominate group resources and decision-making processes (Ruto, 2016). Consequently, marginalized farmers may have limited access to critical resources, information, and adaptive opportunities, reducing the inclusivity and effectiveness of social capital.

Trust issues were reported by 45.3% of respondents, indicating that interpersonal or intergroup tensions still impede collaboration even in contexts with generally high levels of bonding capital. Trust deficits can weaken knowledge sharing, collective problem-solving, and coordination during climate shocks (Zheng, 2024).

43.3% of respondents cited lack of support from external actors (government or NGOs) as a barrier, reinforcing the view that while internal social capital is vital, it must be complemented by bridging capital and formal institutional support to maximize resilience outcomes. These constraints echo observations by (Laycock and Mitchell, 2019), who noted that underdeveloped networks and exclusionary practices can weaken the transformative potential of social capital in climate adaptation.

A further 43.3% of respondents cited limited support from external actors, including government and NGOs, as a barrier. This underscores the importance of bridging and linking social capital, which connect local farmers to formal institutions, technical assistance, and

wider resource networks. Without such external links, internal networks alone may be insufficient to enable full adaptive capacity (Silvert et al., 2022).

The analysis of constraints to leveraging social capital reveals a range of challenges that may inhibit the full potential of social networks in promoting adaptation practices. As illustrated

in Table 4.7, the most reported constraint, affecting 42.8% of respondents, was labelled as category 1.

This is followed by constraint 2 at 22.4% and constraint 3 at 19.7%, suggesting that a combination of structural or interpersonal factors may be involved. Constraint 4 accounted for 13.8% of responses, while an additional 1.3% reported unspecified or minor issues.

These findings indicate that multiple structural and interpersonal barriers including weak institutional links, exclusionary practices, limited group cohesion, and gendered power imbalances interact to reduce the effectiveness of social capital in promoting climate adaptation. Addressing these barriers requires inclusive governance, targeted capacity building, and strengthening of bridging/linking networks to ensure that all farmers, including marginalized groups, can fully benefit from social capital mechanisms.

Table 4.7: Reported Constraints to Leveraging Social Capital

Category	**Constraint**	**Percentage**
1	Lack of trust within the community	42.8%
2	Inaccessibility of formal institutions	22.4%
3	Limited participation in networks/groups	19.7%

4	Poor communication or information flow	13.8%
5	Unspecified or minor other issues	1.3%

CHAPTER FIVE: SUMMARY CONCLUSIONS AND RECOMMENDATIONS

This chapter synthesizes the key findings of the study and draws conclusions based on both qualitative and quantitative data collected on the role of social capital in enhancing climate change resilience among smallholder farmers in Bergville. Drawing on the empirical evidence, the chapter provides targeted policy recommendations for strengthening social networks, improving institutional linkages, and promoting inclusive collective action within agricultural communities. These recommendations are aimed at enhancing the adaptive capacity of smallholder farmers in the face of increasing climate variability and stressors. The final section of this chapter outlines suggested avenues for future research, including underexplored dimensions of social capital such as digital social networks, intergenerational knowledge transfer, and gender-differentiated resilience pathways that could further inform development practice and academic inquiry.

5.1 Summary

This research evaluated the role of social capital in building climate change resilience among smallholder farmers in Bergville, KwaZulu-Natal. The study aimed to explore how different forms of social capital (bonding, bridging, and linking) shape farmers' adaptive responses to climate-related risks such as erratic rainfall, drought, and soil degradation. A particular focus was placed on the ways in which trust, group participation, and access to informal and formal networks influence knowledge sharing, collective action, and access to support systems during

climate stress. Smallholder farmers in the region often face limited access to institutional resources, making social capital a critical, though unevenly leveraged, asset in their resilience strategies.

The role of social capital in building climate change resilience among smallholder farmers in Bergville has received limited scholarly and policy attention. While global and regional frameworks increasingly recognize the importance of community-based adaptation, few studies have focused specifically on how different forms of social capital function in resource constrained, climate-vulnerable rural areas like Bergville. Despite the growing frequency of climate shocks, there remains a gap in understanding how trust, group networks, and social cohesion contribute to farmers' adaptive capacity. As such, there is an urgent need to deepen insights into the functionality and limitations of social capital in promoting resilience, particularly where formal institutional support remains weak or inaccessible.

The research identified significant gaps in how smallholder farmers utilize social capital to support climate adaptation. Although strong community ties and long-term residency were common, many farmers lacked access to bridging and linking networks that connect them to external knowledge, institutional support, and adaptation resources. Limited group participation, low trust in shared information, and inconsistent engagement in collective action were observed across the sample. As in many rural areas of Sub-Saharan Africa, farmers in Bergville also face challenges such as weak infrastructure, low digital literacy, and exclusion from decision-making processes factors that collectively limit the transformative potential of social capital in building resilience.

The findings reveal that smallholder farming in Bergville is dominated by older women, with 84% of the surveyed farmers being female and only 16% male. Most respondents were between the ages of 46–55, followed by those over 55, indicating that smallholder agriculture is largely driven by older adults, while youth participation remains limited. Educational attainment was generally low, with 44% of farmers having only primary education and 20% having no formal schooling at all.

This limited formal education likely constrains access to formal training, digital tools, and climate adaptation resources. However, it also fosters strong reliance on local knowledge and

informal learning within social networks. The majority of farmers had over 20 years of farming experience and long-term residency in the community, with 61.3% having lived in Bergville for more than two decades. Most operated-on land smaller than one hectare and practiced mixed farming, which reflects both land scarcity and an adaptive strategy to spread climate change risks. These demographic characteristics underscore the importance of bonding social capital formed through kinship, long-term relationships, and localized networks in shaping how farmers adapt to climate challenges in this region.

The study identified significant limitations in the structure and functionality of social capital among smallholder farmers in Bergville, which affect their ability to adapt effectively to climate change. A major 78% of respondents reported not belonging to any community-based organization, and only 10.7% indicated membership in farming groups or cooperatives. This reflects limited access to bridging and linking social capital, which are essential for accessing institutional support, shared knowledge, and coordinated responses to climate threats. Participation in collective activities was similarly low, with 28.3% never taking part in community initiatives, pointing to weak engagement in formal and semi-formal support structures.

Another finding revealed that while informal networks exist, they are inconsistently activated. Only 43.3% of respondents reported sometimes receiving help from neighbours or family, while a mere 12.5% said they often received help. This demonstrates weak bonding social capital, which is critical in times of environmental stress. In terms of information access, 81.3% of respondents reported not receiving regular climate change information, and 81.7% disagreed that their networks supported them in adopting new farming techniques. Despite these gaps, 36.7% of respondents still relied on peer learning and informal exchanges for climate adaptation information highlighting the important, albeit under-leveraged, role of bonding capital in knowledge dissemination. Other sources included government extension services (26.7%) and media platforms such as radio and mobile phones (22.7%).

Probit regression and Chi-square analysis further revealed that trust in peer-shared information significantly influenced adaptive behaviour. Among those who expressed complete trust in peer information, 73.7% had adopted climate adaptation practices. Conversely, only 25.9% of those with no trust had adopted such strategies. This demonstrates a strong positive correlation between trust and adaptive behaviour. These results emphasize

the crucial role of trust in enabling knowledge uptake and behavioural change. Inconsistent support during extreme weather events and moderate access to communal resources (reported by 52.6%) further point to the fragmented nature of social capital in the region.

In conclusion, this research highlights the importance of strengthening trust, promoting group participation, and enhancing informal networks to increase the resilience of smallholder farmers in Bergville. Targeted interventions such as peer-learning forums, community-based adaptation training, and participatory extension programs can enhance the effectiveness of social capital as a tool for climate change adaptation in resource-constrained rural settings.

5.2. Conclusion

This study comprehensively examined the role of social capital in shaping the climate change resilience of smallholder farmers in Bergville, KwaZulu-Natal, highlighting the complex interplay between informal social networks, trust, community participation, and access to climate adaptation information. While social capital emerges as a critical resilience-building asset, its current form in Bergville is fragmented, unevenly accessed, and underutilized.

Demographic findings reveal that the majority of smallholder farmers are older women with limited formal education. While this demographic reflects a highly experienced farming base, it presents challenges for adopting formal knowledge systems and new technologies. Limited youth involvement further suggests a growing generational gap in agricultural continuity and innovation.

The study confirms that bonding social capital expressed through kinship and neighbourly ties remains relatively strong, providing basic support and information. However, bridging and linking social capital, which connect farmers to broader networks, institutions, and technical knowledge, is weak. Only 10.7% of respondents reported membership in formal cooperatives or farmer groups, 78% were not involved in community-based organizations, and 28.3% had never participated in communal activities. This restricted engagement limits information flow, collective learning, and collaborative responses to climate shocks.

Informal support structures, such as assistance from family or neighbors, exist but are inconsistently reliable. Most farmers do not regularly receive help during extreme weather

events, with only 12.5% reporting frequent support. Nevertheless, informal networks remain the primary source of climate adaptation knowledge, surpassing government or media channels. Despite this, access to timely and actionable information remains highly inadequate, with over 81% of farmers stating they do not receive regular climate change information.

Trust in peer-shared information emerged as a strong predictor of climate adaptation, confirmed through Chi-square and probit regression analyses. Farmers reporting higher trust were significantly more likely to adopt adaptive practices, underscoring trust as a critical facilitator of resilience.

Several systemic constraints were identified, including uneven access to local leadership, limited group cohesion, and insufficient collective action benefits. These structural barriers highlight that social capital in Bergville is still evolving and requires deliberate support to maximize its potential.

From a theoretical perspective, the findings advance Social Capital Theory by illustrating how differentiated access to bonding, bridging, and linking capital shapes adaptive behavior in rural agricultural contexts. The study shows that while bonding capital can support day-today coping, bridging and linking capital are essential for enabling transformative adaptation and equitable access to resources. In terms of the Sustainable Livelihoods Framework, the results demonstrate that social capital functions as a critical livelihood asset, interacting with other forms of capital (human, natural, and institutional) to determine adaptive capacity. The study further emphasizes that the mere presence of social networks is insufficient; their structure, inclusivity, and connectivity critically influence their effectiveness in sustaining livelihoods under climate stress.

In conclusion, while social capital holds immense promise for enhancing the adaptive capacity of smallholder farmers, its current state in Bergville is insufficient to fully address the challenges posed by climate change. Policy and development interventions should prioritize the strengthening of farmer groups, participatory extension forums, trust-building initiatives, and the creation of bridging and linking opportunities. By expanding both the depth and reach of social capital, stakeholders can enhance climate resilience, foster inclusive rural development, and support sustainable livelihoods in increasingly uncertain environmental conditions.

5.3 Recommendations

The factors that contribute to the vulnerability of smallholder farmers in Bergville such as weak social networks, limited access to reliable climate information, and underdeveloped institutional linkages highlight the critical need to enhance social capital as a foundation for building climate resilience. While this study affirms the essential role that social capital plays in shaping farmers' adaptive capacity, the uneven distribution and limited utilization of bridging and linking social capital present major barriers to effective adaptation. These findings provide valuable direction for policymakers, extension officers, and rural development stakeholders to improve farmers' access to information, strengthen communal support systems, and foster collaborative action in the face of escalating climate risks. The following recommendations are proposed to increase the inclusiveness and effectiveness of social capital in supporting climate change adaptation among smallholder farmers in Bergville.

- Promote farmer group formation and cooperative development to strengthen both bonding and bridging social capital. Support should be provided for the establishment of farmer-led associations that facilitate peer-learning, shared labour, and collective climate adaptation responses.
- Invest in training programs that focus on climate-smart agriculture and adaptation techniques, with a strong emphasis on peer-learning models. These should include participatory workshops, farmer exchange visits, and group demonstrations to harness the power of community knowledge transfer.
- Improve the functionality and trust within social networks by encouraging transparent communication, participatory decision-making, and inclusive leadership in community organizations. Programs should also provide leadership and conflict resolution training to local leaders and farming group coordinators.
- Strengthen the presence and capacity of extension officers in Bergville through training on social capital dynamics, gender-sensitive facilitation, and locally relevant adaptation strategies. Extension workers should also serve as liaisons that link formal institutions with informal networks.

- Encourage the use of digital tools and community radio to disseminate climate information, farming advice, and early warning systems. Mobile apps and locally tailored media content can help overcome barriers related to literacy and infrastructure.
- Develop women-centred agricultural support programs, given their dominant role in Bergville's farming systems. Special efforts must be made to increase women's access to training, resources, leadership roles, and decision-making platforms to boost overall household resilience.
- Create incentive-based adaptation platforms that reward collaborative and sustainable farming practices. This could include subsidies, seed grants, or recognition programs for groups that demonstrate effective climate adaptation through collective action.
- foster partnerships between government, NGOs, and research institutions to pilot and scale social capital-enhancing adaptation models. These collaborations can generate evidence-based innovations that integrate social cohesion with climate resilience strategies.
- Conduct routine monitoring and evaluation to assess the strength and function of social capital networks in rural adaptation. Data collected should be used to refine policies and design context-specific interventions, especially in under-served communities.
- Build capacity among local youth to encourage their participation in climate-resilient agriculture and social leadership. This could help counter the aging demographic trend and inject new energy and innovation into rural farming communities.
- Support community-led platforms for adaptation planning, where farmers, extension workers, and traditional leaders co-develop localized adaptation strategies. This will ensure interventions are grounded in local realities and have greater ownership.
- Facilitate regular community forums and learning circles to provide spaces for farmers to exchange knowledge, discuss local climate impacts, and co-design adaptive strategies. These forums should be inclusive of marginalized voices, particularly women and the elderly.
- Tailor interventions based on local context, accounting for social diversity, education levels, land access, and institutional reach. A one-size-fits-all approach is unlikely to

succeed; therefore, flexibility and responsiveness should underpin all programs aimed at enhancing social capital for resilience.

These recommendations, if implemented, can catalyse the potential of social capital as a transformative asset for climate change adaptation in Bergville. A more integrated, inclusive, and trust-based approach to rural development will enhance not only adaptive capacities but also social cohesion and long-term agricultural sustainability.

5.4 Future Research

Future research should consider comparative studies across different agro-ecological zones in South Africa to assess how social capital dynamics influence climate resilience in varied rural contexts. Such studies could identify regional differences in the formation and utilization of bonding, bridging, and linking social capital, allowing for targeted interventions based on community structure, cultural norms, and institutional engagement.

Longitudinal studies are also recommended to trace how changes in social capital over time affect adaptive behaviour, knowledge dissemination, and resilience outcomes, especially as climate variability intensifies. Future studies should explore how gender, age, and education influence the development and use of social capital for climate adaptation.

These socio-demographic factors can shape access to information, participation in community structures, and trust-building, which are all critical for collective climate responses. It is also important to investigate the effectiveness of farmer-led or peer-to-peer learning models as mechanisms for building trust and strengthening local networks. Further research could examine how digital and media tools (WhatsApp groups, SMS, community radios) can enhance or disrupt traditional forms of social capital in rural settings, particularly where digital literacy varies.

Studies focusing on the economic and food security impacts of enhanced social capital such as improved yield, risk reduction, and community cooperation could help policymakers and development agencies design social capital-based strategies to support rural climate resilience. Overall, future research should prioritize participatory and context-specific approaches that reflect the lived experiences and localized realities of smallholder farmers in climate-sensitive regions like Bergville.

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