

Curbing The Economic Effects Of Abrupt Weather Changes On Agricultural Development In Eswatini

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Abstract:

Background: *This study examines strategies for curbing the economic effects of abrupt weather changes on agricultural development in Eswatini. Agriculture remains a cornerstone of Eswatini's economy and livelihoods, yet it is increasingly vulnerable to climate-induced shocks such as droughts, floods, and erratic rainfall patterns.*

Materials and Methods *The study adopts a qualitative research approach supported by primary data collected from 193 farmers, extension officers, and agricultural stakeholders, alongside secondary data from policy documents and climate reports*

Results: *The findings reveal that abrupt weather changes significantly reduce crop yields, increase production costs, exacerbate income volatility, and heighten vulnerability among smallholder farmers. Climate-smart agriculture practices, improved early warning systems, access to finance and insurance, and strengthened institutional support emerged as key mitigation measures*

Conclusion: *The study concludes that integrated, context-specific, and Africa-led adaptation strategies are essential for enhancing agricultural resilience and reducing economic losses. The findings offer practical policy insights for governments, development partners, and agricultural institutions seeking sustainable responses to climate variability. (Mhlanga-Ndlovu & Nhamo (2017))*

Key Words: *Climate change; Agriculture; Economic impact; Climate-smart agriculture; Eswatini*

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I. Introduction

Agriculture remains a central pillar of Eswatini's socio-economic development, contributing significantly to employment creation, food security, rural livelihoods, and national income. A substantial proportion of the population depends directly or indirectly on agricultural activities for subsistence and income generation. However, in recent decades, the agricultural sector has become increasingly vulnerable to abrupt weather changes associated with climate change, including prolonged droughts, floods, heatwaves, and erratic rainfall patterns. These climatic shocks have disrupted traditional farming systems, reduced crop yields, increased production costs, and undermined household and national economic stability. Climate change poses a particularly severe threat to developing countries, where dependence on rain-fed agriculture, limited adaptive capacity, and constrained financial resources heighten vulnerability. In Eswatini, recurrent droughts and floods have resulted in food shortages, rising poverty levels, and increased reliance on food aid. These conditions highlight the urgent need for effective strategies to mitigate the economic impacts of abrupt weather changes on agricultural development. Although climate change and agriculture have received considerable scholarly attention at the global and regional levels, empirical studies focusing on country-specific mitigation strategies remain limited, particularly in the context of Eswatini. Existing research tends to prioritise impact assessment rather than practical, policy-oriented solutions aimed at curbing economic losses and enhancing resilience. This gap underscores the importance of the present study. The aim of this study is to examine the economic effects of abrupt weather changes on agricultural development in Eswatini and to identify viable strategies that can reduce vulnerability and promote resilience. Specifically, the study seeks to analyse the nature and extent of climate-related economic impacts on agriculture, assess existing coping mechanisms, and propose policy-relevant interventions aligned with sustainable development. (Arora & Mishra (2019)) (Kunene (2019))

II. Literature Review

Climate change has emerged as one of the most significant challenges to agricultural development globally. The literature consistently demonstrates that changes in temperature, precipitation patterns, and the frequency of extreme weather events have profound implications for agricultural productivity and economic stability. According to the Intergovernmental Panel on Climate Change, climate variability has already reduced agricultural yields in many regions, with developing economies bearing the greatest burden due to limited adaptive capacity. (De Wrachien et al. (2021)) (Fawzy et al. (2020)) (Macamo (2021))

In Sub-Saharan Africa, agriculture is particularly sensitive to climatic shocks because of its reliance on rain-fed production systems and smallholder farming. Studies indicate that droughts and floods have led to declining crop yields, livestock losses, and food insecurity, exacerbating poverty and inequality. Climate-induced shocks also disrupt agricultural value chains, increase input costs, and reduce household incomes, thereby undermining broader economic development. Southern Africa has experienced recurrent climate extremes, including prolonged droughts linked to El Niño events and destructive floods. Empirical research in the region highlights the strong correlation between climate variability and reduced agricultural output, increased rural vulnerability, and heightened food insecurity. In Eswatini, these challenges are compounded by land degradation, limited irrigation infrastructure, and constrained access to financial services. The literature further identifies climate-smart agriculture as a critical approach to enhancing resilience and reducing economic losses. Climate-smart practices integrate productivity enhancement, adaptation, and mitigation, enabling farmers to cope with climatic shocks while sustaining livelihoods. Early warning systems, agricultural insurance, improved extension services, and institutional support are also recognized as key mechanisms for mitigating climate risks. Despite these insights, existing studies often focus on macro-level assessments or isolated interventions, with limited attention to integrated, context-specific strategies. Moreover, there is a lack of empirical evidence linking adaptation measures directly to economic outcomes at the national level in Eswatini. This study addresses these limitations by providing a comprehensive analysis of economic impacts and mitigation strategies within a country-specific framework. Existing literature highlights climate change as a major constraint on agricultural productivity, particularly in developing economies. Studies indicate that climate variability has reduced global agricultural output, with Sub-Saharan Africa experiencing disproportionate impacts. In Southern Africa, extreme weather events are closely linked to food insecurity, poverty, and economic instability. Research specific to Eswatini underscores the vulnerability of smallholder farmers, limited adaptive capacity, and recurring climate shocks. However, much of the literature emphasises impact assessment rather than mitigation and resilience-building, underscoring the need for this study. (Bailey et al. (2019)) (Darjee et al. (2023)).

III. Conceptual Framework

This study is anchored in a climate resilience and systems-based theoretical framework, which views agricultural development as an interconnected system influenced by environmental, economic, institutional, and social factors. Abrupt weather changes, such as droughts and floods, are conceptualised as external shocks that disrupt this system, affecting agricultural productivity, household income, food security, and overall economic stability. Within this framework, climate variability directly influences agricultural outputs through changes in rainfall patterns, temperature extremes, and the frequency of climate-related disasters. These environmental stressors interact with structural factors such as access to land, water, technology, financial services, and institutional support, thereby shaping farmers' vulnerability and adaptive capacity. Adaptive capacity is treated as a central mediating variable in this study. It encompasses farmers' ability to anticipate, cope with, and recover from climate shocks through the adoption of climate-smart agricultural practices, irrigation technologies, diversification strategies, and access to early warning systems. Institutional support, including extension services, policy frameworks, and development partnerships, further strengthens resilience by enabling the uptake of adaptive measures. (Harris & Lucas (2019))

The conceptual framework therefore links abrupt weather changes to economic outcomes through a chain of vulnerability and response mechanisms. Effective mitigation strategies are expected to reduce economic losses, stabilise agricultural incomes, and promote sustainable agricultural development. This framework provides the analytical basis for examining the effectiveness of existing adaptation measures and identifying policy-relevant interventions in Eswatini.

IV. Methodology

Study Design: This study adopted a qualitative research design to explore the economic effects of abrupt weather changes on agricultural development in Eswatini and to identify appropriate mitigation strategies. A qualitative approach was considered suitable due to its ability to capture in-depth perspectives, lived experiences, and contextual realities of farmers and key stakeholders affected by climate variability. (Kangogo et al. (2020))

Procedures & Methodology: Primary data were collected using structured questionnaires administered to a total of 193 respondents across Eswatini's four administrative regions: Hhohho, Manzini, Lubombo, and Shiselweni. The study population comprised smallholder and commercial farmers, agricultural extension officers, marketing officials, and relevant policymakers. This diverse sample enabled triangulation of perspectives across different levels of the agricultural value chain. Secondary data were obtained from government policy documents, climate reports, agricultural statistics, and publications from international organisations. These sources provided contextual background and complemented primary data findings. Data analysis was conducted using thematic analysis. Responses were coded and grouped into key themes relating to climate impacts, economic effects,

coping mechanisms, and adaptation strategies. This approach facilitated the identification of recurring patterns and relationships across the dataset. Ethical considerations were strictly observed, including informed consent, voluntary participation, and confidentiality of respondents' information. A qualitative research design was employed. Primary data were collected using structured questionnaires administered to 193 respondents, including farmers, extension officers, and policymakers across all four regions of Eswatini. (Darjee et al. (2023)). Secondary data were obtained from government publications, climate reports, and agricultural policy documents. Data were analysed using thematic analysis to identify patterns related to climate impacts, economic effects, and adaptation strategies. Ethical considerations, including informed consent and confidentiality, were strictly observed.

V. Results

The findings of the study reveal that abrupt weather changes have had significant and far-reaching economic effects on agricultural development in Eswatini. Analysis of primary data from farmers, extension officers, and policymakers highlights multiple interrelated themes, including declining agricultural productivity, rising production costs, income instability, increased vulnerability of smallholder farmers, and uneven adoption of adaptation strategies. A dominant theme emerging from the data is the reduction in crop yields attributable to prolonged droughts and erratic rainfall patterns. Respondents reported frequent crop failures, delayed planting seasons, and reduced harvest volumes, particularly for maize, beans, and vegetables. These yield reductions have directly translated into lower household incomes and increased food insecurity, especially among subsistence farmers who rely heavily on rain-fed agriculture. Flooding was identified as another major climatic shock affecting agricultural production. In low-lying areas, floods destroyed crops, eroded fertile soils, and damaged irrigation infrastructure. Farmers in the Lubombo and Shiselweni regions reported repeated losses due to flooding, which discouraged investment in farming activities and reduced long-term productivity. The study further found that abrupt weather changes have significantly increased the cost of agricultural production. Farmers reported rising expenditures on seeds, fertilisers, pesticides, and irrigation equipment as they attempted to cope with changing climatic conditions. Increased pest and disease outbreaks, linked to changing temperature and humidity levels, further compounded production costs. These rising input costs disproportionately affected smallholder farmers with limited access to credit and savings. Income volatility emerged as a critical economic consequence of climate variability. Respondents indicated that unpredictable weather conditions made it difficult to plan production cycles and forecast earnings. This uncertainty undermined household financial stability and constrained farmers' ability to invest in improved technologies or expand production. For many households, reduced agricultural income resulted in increased dependence on remittances, casual labour, or food aid. The findings also reveal disparities in adaptive capacity across different categories of farmers. Commercial and better-resourced farmers demonstrated relatively higher resilience through the adoption of irrigation systems, climate-smart agricultural practices, and crop diversification. In contrast, smallholder farmers faced substantial barriers to adaptation, including limited access to finance, inadequate extension services, and insufficient climate information. Institutional support mechanisms were found to play a crucial role in shaping adaptation outcomes. Where extension services, training programmes, and early warning systems were accessible, farmers were better able to anticipate and respond to climatic shocks. However, respondents highlighted gaps in coverage, coordination, and resource allocation, which limited the effectiveness of existing support structures. Overall, the results indicate that while adaptation strategies exist, their benefits are unevenly distributed. Abrupt weather changes continue to undermine agricultural productivity and economic stability, underscoring the need for integrated, inclusive, and well-coordinated interventions to enhance resilience across the sector.

VI. Discussion

The findings of this study provide important insights into the economic implications of abrupt weather changes on agricultural development in Eswatini and reinforce existing theoretical and empirical literature on climate vulnerability in developing economies. Consistent with climate resilience and systems theory, the results demonstrate that climatic shocks such as droughts and floods interact with structural and institutional factors to shape agricultural and economic outcomes. The observed decline in crop yields and increased production costs aligns with regional and global studies which indicate that climate variability undermines agricultural productivity, particularly in rain-fed systems prevalent in Sub-Saharan Africa. The findings confirm that abrupt weather changes not only reduce output but also exacerbate income instability, thereby deepening rural poverty and food insecurity. This supports the argument that climate change is not merely an environmental issue but a critical development and economic challenge. The disparities in adaptive capacity between smallholder and commercial farmers highlight the importance of access to resources, technology, and institutional support. Farmers with access to irrigation, climate-smart agricultural practices, and financial services demonstrated greater resilience, underscoring the role of investment and policy support in mitigating climate risks. These findings echo previous studies that identify adaptive capacity as a key determinant of resilience and economic stability under climate stress. Institutional support emerged as a pivotal factor in enhancing adaptation outcomes. Extension

services, early warning systems, and training programmes enabled farmers to anticipate and respond more effectively to climatic shocks. However, gaps in coverage and coordination limited the reach and effectiveness of these interventions. This suggests the need for stronger institutional frameworks, improved inter-agency coordination, and sustained investment in agricultural support systems. From a policy perspective, the findings underscore the necessity of integrating climate adaptation into national agricultural and development policies. Climate-smart agriculture should be mainstreamed as a core development strategy, supported by targeted financing, insurance mechanisms, and capacity-building initiatives. Furthermore, inclusive policy approaches that prioritise smallholder farmers are essential to ensure equitable distribution of adaptation benefits and long-term sustainability. Overall, the study reveals that while adaptation strategies can significantly reduce economic losses, their effectiveness depends on inclusive implementation, institutional capacity, and alignment with local realities. Addressing these factors is critical for enhancing agricultural resilience and achieving sustainable development in Eswatini. (Bailey et al. (2019))

VII. Conclusion

The findings of this study provide important insights into the economic implications of abrupt weather changes on agricultural development in Eswatini and reinforce existing theoretical and empirical literature on climate vulnerability in developing economies. Consistent with climate resilience and systems theory, the results demonstrate that climatic shocks such as droughts and floods interact with structural and institutional factors to shape agricultural and economic outcomes. The observed decline in crop yields and increased production costs aligns with regional and global studies which indicate that climate variability undermines agricultural productivity, particularly in rain-fed systems prevalent in Sub-Saharan Africa. The findings confirm that abrupt weather changes not only reduce output but also exacerbate income instability, thereby deepening rural poverty and food insecurity. This supports the argument that climate change is not merely an environmental issue but a critical development and economic challenge. The disparities in adaptive capacity between smallholder and commercial farmers highlight the importance of access to resources, technology, and institutional support. Farmers with access to irrigation, climate-smart agricultural practices, and financial services demonstrated greater resilience, underscoring the role of investment and policy support in mitigating climate risks. These findings echo previous studies that identify adaptive capacity as a key determinant of resilience and economic stability under climate stress. Institutional support emerged as a pivotal factor in enhancing adaptation outcomes. Extension services, early warning systems, and training programmes enabled farmers to anticipate and respond more effectively to climatic shocks. However, gaps in coverage and coordination limited the reach and effectiveness of these interventions. This suggests the need for stronger institutional frameworks, improved inter-agency coordination, and sustained investment in agricultural support systems. From a policy perspective, the findings underscore the necessity of integrating climate adaptation into national agricultural and development policies. Climate-smart agriculture should be mainstreamed as a core development strategy, supported by targeted financing, insurance mechanisms, and capacity-building initiatives. Furthermore, inclusive policy approaches that prioritise smallholder farmers are essential to ensure equitable distribution of adaptation benefits and long-term sustainability. Overall, the study reveals that while adaptation strategies can significantly reduce economic losses, their effectiveness depends on inclusive implementation, institutional capacity, and alignment with local realities. Addressing these factors is critical for enhancing agricultural resilience and achieving sustainable development in Eswatini.

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