

CLIMATE CHANGE AND FINANCIAL PERFORMANCE OF PERISHABLE FOOD RETAILERS IN FEDERAL CAPITAL TERRITORY, ABUJA, NIGERIA

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Abstract

Climate change presents mounting challenges to global food systems, particularly in developing economies where infrastructural deficits amplify vulnerability. This study examined how climate variability specifically, erratic rainfall, extreme heat, and flooding affect the financial performance of perishable food retailers in Nigeria's Federal Capital Territory (FCT), Abuja. Employing a mixed-methods approach, data were collected from 150 retailers through structured questionnaires and 20 in-depth interviews across major markets. The instruments were physically administered to the respondents and received accordingly. Quantitative data were analyzed using descriptive statistics, correlation, and multiple regression models, while qualitative data underwent thematic analysis. Results revealed that extreme heat ($\beta = 0.62$, $p < 0.001$) and erratic rainfall ($\beta = 0.18$, $p < 0.001$) significantly affect financial performance, whereas flooding ($p = 0.67$) showed no statistically significant effect. The model explains 92.7% ($R^2 = 0.927$) of the variation in financial outcomes. Retailers reported high spoilage rates, reduced customer turnout during adverse weather, and rising operational costs. Nonetheless, adaptive strategies such as small-quantity purchasing, product diversification, and shared cold storage demonstrate resilience and align with the Resource-Based View (RBV) framework, which emphasizes internal capabilities and dynamic adaptation. The study concludes that climate variability undermines profitability and operational stability but also stimulates innovative responses among small-scale retailers. It recommends investment in climate-smart infrastructure, solar-powered cold storage, and capacity-building programs to enhance adaptation. The study highlights the need for local strategies and supportive policies to strengthen climate adaptation and financial resilience among perishable food retailers in Abuja.

Keywords: Climate Change, Financial Performance, Perishable Food Retailers, Abuja

Introduction

Climate change has emerged as one of the most pressing global challenges of the 21st century, exerting far-reaching consequences on economic systems, livelihoods, and business sustainability across sectors. Among the most vulnerable economic actors are those engaged in the retail of perishable food items, whose products are highly sensitive to temperature fluctuations, rainfall variability, and disruptions in transportation and supply chains (FAO, 2022; IPCC, 2023). In both developed and developing nations, the impact of climate variability on food systems is well-documented, but the micro-level effects on small-scale and urban retailers, particularly in tropical cities like Abuja, Nigeria remain insufficiently explored.

Perishable food retailers operate within a narrow margin of error, relying heavily on timely procurement, consistent storage temperatures, and predictable market conditions. The exposure of their operations to climate-induced shocks such as heatwaves, erratic rainfall, flooding, and electricity outages significantly undermines product quality, accelerates spoilage, and reduces the shelf life of goods. These challenges inevitably translate into financial risks, including revenue loss, higher

operating costs, inventory shrinkage, and reduced customer trust (Amjath-Babu et al., 2020; World Bank, 2021). For urban centers like Abuja, where infrastructure deficits (e.g., irregular power supply, limited cold-chain facilities) are prevalent, these effects are magnified.

Nigeria, being highly dependent on agriculture and food-related commerce, is particularly susceptible to the consequences of climate change. The Federal Capital Territory (FCT) Abuja, despite its relative affluence, hosts a large and diverse population of perishable food retailers operating in traditional markets such as Garki, Wuse, Dutse, and Kubwa. These retailers form a critical link in the urban food supply chain, ensuring accessibility and affordability of fresh produce, dairy, meat, and seafood. However, the absence of adequate coping infrastructure, limited access to climate-smart technologies, and inconsistent policy support have made them increasingly vulnerable to climatic disruptions (Hannah et al., 2025).

At the heart of this study lies the relationship between climate change and financial performance defined here through indicators such as profit margins, revenue stability, inventory turnover, and cost efficiency. While broader literature has examined climate change impacts on agriculture, logistics, and food security, there is a research gap in understanding how these environmental dynamics affect the everyday financial realities of retailers handling perishable food items in urban Nigerian settings. This study seeks to fill that gap by focusing on the FCT Abuja, a rapidly growing metropolitan area that encapsulates both the opportunities and constraints faced by informal and semi-formal retailers in the face of environmental change. The aim is to examine how climate variability has affected the revenue and profitability of perishable food vendors, what adaptive strategies they are employing to manage climate-induced risks, and how these dynamics align with national and global efforts toward sustainable development (SDGs 2, 8, and 13).

Statement of the Problem

Climate change has become a global crisis with far-reaching implications, particularly for the food supply chain in developing countries. For perishable food retailers operating in Nigeria's Federal Capital Territory (FCT) Abuja, the effects of climate variability, ranging from erratic rainfall, extreme heat, to flooding pose significant threats to both inventory management and overall financial sustainability. These retailers, who typically operate with limited infrastructure and financial resources, face heightened vulnerability due to their dependence on stable environmental conditions to preserve and market fresh produce, dairy, meat, and other perishables (Olaewaju et al., 2024). Research from the Intergovernmental Panel on Climate Change (IPCC, 2023) confirms that rising temperatures and changing precipitation patterns disrupt food systems globally, and such impacts are even more severe in sub-Saharan Africa due to weak adaptive infrastructure. In Abuja, this has translated into increased spoilage rates, disrupted supply chains, power outages affecting refrigeration, and unpredictable customer behaviour; all of which directly affect revenue and profit margins of small and medium-scale food retailers (Blekking et al. 2022). As a result, these businesses experience fluctuating cash flows, reduced profitability, and in some cases, operational collapse.

Despite the existence of climate-smart agricultural and retail solutions such as solar-powered cold storage, improved logistics, and adaptive procurement strategies many retailers either lack awareness of or access to these innovations. While several global and national studies have examined the general impact of climate change on agriculture, there is a notable gap in literature focusing specifically on how climate change impacts the financial performance of perishable food retailers in urban African contexts like Abuja. This underrepresentation hinders the development of targeted interventions and policy recommendations. Moreover, while sustainable development goals emphasize the need for resilient food systems and inclusive economic growth, the financial struggles of small-scale perishable food retailers often go unnoticed in climate policy conversations. Understanding the extent to which climate-induced challenges affect their profitability, and how their adaptive strategies align with sustainability goals, is essential for informing both practice and policy in Nigeria's food economy (FAO, 2022; World Bank, 2021).

Therefore, this study is driven by the need to empirically assess the financial implications of climate change on perishable food retailers in FCT Abuja, to explore the coping mechanisms adopted, and to contextualize these outcomes within the broader pursuit of sustainable urban food systems and economic development.

Objectives of the Study

The broad objective of this study was to investigate effect of climate variability on the financial performance of perishable food retailers in Abuja. Specific objectives are to:

1. examine the effect of erratic rainfall on the financial performance of perishable food retailers in Abuja.
2. analyze the effect of extreme heat on inventory spoilage and profitability among perishable food retailers in Abuja.
3. assess how flooding events influence the financial performance of perishable food retailers in Abuja.

Research Questions

1. How does erratic rainfall affect the financial performance of perishable food retailers in Abuja?
2. What is the impact of extreme heat on inventory spoilage and profitability among perishable food retailers in Abuja?
3. How do flooding events influence financial performance of perishable food retailers in Abuja?

Research Hypotheses

- H₀₁: Erratic rainfall has no significant effect on the financial performance of perishable food retailers in Abuja.
- H₀₂: Extreme heat has no significant impact on inventory spoilage and profitability among perishable food retailers in Abuja.

H₀₃: Flooding events do not significantly influence the financial performance of perishable food retailers in Abuja.

This study is geographically confined to the Federal Capital Territory (FCT), Abuja, Nigeria. It focuses specifically on perishable food retailers, including but not limited to vendors of fruits, vegetables, dairy products, meats, and other items with a short shelf life that are sensitive to environmental changes. The study limits its investigation to the direct and indirect impacts of climate variability, particularly erratic rainfall, extreme heat, and flooding on the financial performance of these retailers. Financial performance in this context is measured using key indicators such as sales volume, profit margins, inventory spoilage, and operational costs. The research covers both formal and informal retail settings, including open markets like Garki and Wuse Markets, roadside kiosks, and mini grocery outlets across different districts of Abuja. The study is time-bound to reflect perceptions and financial data from the last 2–3 years, during which the region has experienced heightened climate variability. While it does not extend to producers or large-scale distributors, it captures the retail end of the supply chain where climate impacts are most visible to consumers and local entrepreneurs.

This study is significant in highlighting how climate variability particularly erratic rainfall, extreme heat, and flooding affects the financial performance of perishable food retailers in Abuja, Nigeria. It offers practical insights for policymakers, urban planners, and environmental agencies in designing targeted adaptation strategies for vulnerable small-scale businesses. By focusing on a largely understudied sector, the research also contributes to academic discourse on climate resilience and local economic sustainability. Moreover, it equips perishable food retailers with knowledge to adopt better inventory and risk management practices, ultimately supporting food security and livelihood protection in the face of climate change.

Literature review

Climate Change and Retail Business

Climate change has emerged as a critical factor influencing various sectors, including retail (IPCC, 2021). Retail businesses, particularly those dealing with perishable goods, are increasingly vulnerable to climate-induced disruptions such as extreme weather events, supply chain interruptions, and fluctuating consumer demand patterns (Linnenluecke & Griffiths, 2013; Earthscan, 2023). For instance, floods and droughts can disrupt transportation and delay deliveries, leading to stockouts or spoilage of perishable goods (Nguyen & Smith, 2021).

In the context of global retailing, it is projected that environmental risks, including climate change, could cost businesses up to USD 120 billion by 2026 (World Economic Forum, 2023). Perishable food retailers are particularly exposed because temperature-sensitive goods are more prone to spoilage under rising temperatures and humidity levels (FAO, 2022). Additionally, consumer behaviours shift in response to climate-induced factors like extreme weather can reduce foot traffic, alter purchasing patterns, and create demand fluctuations (Zhang et al., 2020).

To address these challenges, businesses are increasingly adopting adaptive strategies such as diversifying supply chains, investing in renewable energy and energy-efficient storage solutions, and

integrating climate risk assessments into operational planning (Gossling et al., 2023). Studies have shown a positive correlation between sustainable practices such as reducing carbon footprints and using renewable energy and improved financial performance in retail sectors, including higher return on assets (ROA) and profitability (Khan et al., 2023).

Financial Performance of Perishable Food Retailers

The financial performance of perishable food retailers is intricately linked to their ability to manage inventory, reduce waste, and respond promptly to market demands. Key financial indicators include profit margins, return on assets (ROA), and inventory turnover rates. Climate change poses significant challenges to these indicators by increasing operational costs (e.g., refrigeration), exacerbating inventory losses due to spoilage, and causing supply chain delays (Olawajun et al., 2024; Bako et al., 2025).

For example, a study of urban food systems in West Africa found that rising temperatures and erratic rainfall patterns have contributed to increased food spoilage and operational costs for retailers (Adelekan, 2021). In Nigeria's FCT Abuja, such climate-induced disruptions have led to a surge in perishable food losses, affecting both profitability and food security (NBS, 2023). These impacts are compounded by inadequate cold chain infrastructure, which makes it harder for retailers to maintain product quality under adverse conditions (Efficiency for Access Coalition, 2023).

Climate Change Impacts on Perishable Foods

Perishable food items are particularly susceptible to the adverse effects of climate change. Rising temperatures accelerate spoilage rates, while extreme weather events disrupt transportation and supply chains, leading to significant post-harvest losses (FAO, 2022; World Bank, 2023). In Nigeria, for instance, it is estimated that approximately 37% of the country's agricultural production requiring refrigeration is lost due to inadequate or non-existent cold chain infrastructure (BFA Global, 2023). The 2022 floods in Nigeria, which were exacerbated by climate change, destroyed over 110,000 hectares of farmland and displaced millions, highlighting the vulnerability of the agricultural sector to extreme weather events (World Bank, 2023). These disruptions not only affect the availability of perishable goods but also lead to increased prices, impacting both retailers and consumers (NBS, 2023).

Moreover, the lack of adequate cold storage facilities means that perishable goods often spoil before reaching the market, resulting in financial losses for retailers and contributing to food insecurity in the region (Enete & Amusa, 2023). Innovative solutions, such as solar-powered cold storage systems, are being explored to mitigate these challenges, offering reliable off-grid refrigeration options for perishable goods (BFA Global, 2023).

FCT Abuja and Similar Environments

The Federal Capital Territory (FCT) Abuja, like many urban centers in developing countries, faces unique challenges related to climate change and food retailing (Adelekan, 2021). Rapid urbanization has increased the demand for perishable foods, yet the infrastructure to support this demand remains

inadequate (NBS, 2023). Limited access to reliable electricity and modern cold chain systems hampers the operation of cold storage facilities, exacerbating the vulnerability of perishable food retailers (Efficiency for Access Coalition, 2023).

Innovative solutions are being implemented to address these challenges. Companies like ColdHubs and Ecotutu have introduced solar-powered cold storage systems that provide off-grid refrigeration for perishable food retailers (BFA Global, 2023; Ecotutu, 2023). These systems not only reduce food spoilage but also extend the shelf life of perishable goods, thereby improving the financial performance of retailers (Enete & Amusa, 2023). Furthermore, the adoption of such technologies aligns with broader Sustainable Development Goals, particularly SDG 2 (Zero Hunger), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action) (United Nations, 2015). By investing in resilient infrastructure and embracing innovative solutions, FCT Abuja can enhance the sustainability and profitability of its perishable food retail sector (World Bank, 2023).

Theoretical Framework: Resource-Based View (RBV)

The Resource-Based View (RBV) of the firm offers a valuable theoretical lens for understanding how perishable food retailers in FCT Abuja can achieve financial resilience in the face of climate change. The RBV posits that a firm's sustainable competitive advantage and performance stem from its ability to acquire, develop, and effectively deploy valuable, rare, inimitable, and non-substitutable (VRIN) resources (Barney, 1991). In this context, perishable food retailers' internal resources such as advanced cold storage technologies, resilient supply chains, and adaptive business models can serve as critical enablers of financial stability and sustainability amidst climate-induced disruptions.

Climate change presents both risks and opportunities for businesses. For perishable food retailers, rising temperatures and erratic weather patterns threaten product quality, disrupt supply chains, and increase operational costs (FAO, 2022; World Bank, 2023). Retailers with robust resources, such as efficient refrigeration systems, flexible sourcing arrangements, and proactive climate adaptation strategies, are better positioned to minimize spoilage, reduce inventory losses, and maintain profitability (Khan et al., 2023). This aligns with the RBV's assertion that competitive advantage arises from the firm's ability to leverage unique resources that competitors may find difficult to replicate. Furthermore, the RBV framework highlights the importance of dynamic capabilities, firms' abilities to integrate, build, and reconfigure internal and external competencies to respond to rapidly changing environments (Teece et al., 1997). In the context of FCT Abuja, where infrastructure challenges and climate variability exacerbate vulnerabilities, retailers with dynamic capabilities (e.g., adoption of solar-powered cold storage, diversification of suppliers) are more likely to sustain financial performance and contribute to local food security (BFA Global, 2023; Enete & Amusa, 2023). The RBV is therefore a fitting theoretical foundation for this study, as it emphasizes the role of resource mobilization and strategic adaptation in achieving financial resilience under environmental pressures. By applying this framework, the study will analyze how perishable food retailers' resource configurations and adaptive strategies influence their financial outcomes in the face of climate change in FCT Abuja. The findings will also inform policies and business practices that

support sustainable development goals, particularly SDG 2 (Zero Hunger), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action) (United Nations, 2015).

Empirical Review

Several empirical studies have examined how climate change influences the operations and financial outcomes of food and retail enterprises, especially in developing economies.

Blekking et al. (2022), in their study titled “The impacts of climate change and urbanization on food retailers in urban sub-Saharan Africa,” aimed to understand how urban food retailers respond to climatic and urbanization stressors. Using a review and comparative case approach across multiple African cities, the study found that extreme temperatures and rainfall disrupt supply chains, increase spoilage, and reduce profit margins. Retailers adopt resilience-oriented behaviours such as flexible sourcing, small-lot purchasing, and adaptive storage systems. The authors recommended improving urban infrastructure and supporting small retailers through climate adaptation policies.

Giroux, Battersby, and Crush (2021) investigated “Informal vendors and food systems planning in an African city” using a mixed-methods design that combined field surveys and stakeholder interviews. Their objective was to explore how informal food vendors adapt to environmental and governance shocks. Findings revealed that vendors adjusted selling hours, changed product lines, and relocated stalls to manage exposure to heat and flooding. They recommended that local governments integrate vendor adaptation practices into urban planning to enhance both livelihood resilience and food security.

Ogundeji and Alamu (2022), in “Cold chain logistics and food loss prevention in perishable food retailing in Nigeria,” employed a quantitative survey of perishable food retailers to analyze the effect of cold-chain systems on business performance. Their findings showed that the adoption of cold storage significantly reduced post-harvest losses and improved retailers’ profit margins. They recommended expanding access to solar-powered cold storage and energy-efficient technologies to enhance profitability and sustainability in the perishable goods sector.

Oyekale (2020) conducted a time-series analysis titled “Climate variability and food price volatility in Nigeria,” which examined the relationship between climatic fluctuations and retail price movements. The study established that temperature and rainfall variability increase food price instability, which in turn affects retailers’ revenue and income stability. The researcher recommended integrating climate risk information into national food pricing and trade policies to cushion the impact on retailers and consumers.

Olarewaju et al. (2024) examined “The impact of climate action on the financial performance of food, grocery, and supermarket retailers in the UK.” Using panel data regression, they found that firms adopting climate action strategies such as energy efficiency and emissions reduction reported improved financial outcomes and long-term profitability. Although based in a developed context, the study’s recommendation for climate-smart investment applies to developing economies, emphasizing that climate adaptation can be both sustainable and financially beneficial.

Collectively, these studies demonstrate that climate variability adversely affects the operational and financial performance of perishable food retailers. However, they also show that proactive adaptation; including infrastructure investment, flexible business practices, and supportive policy frameworks

enhances both resilience and profitability. This empirical evidence underpins the current study's focus on how climate change influences the financial performance of perishable food businesses in Abuja and how adaptive strategies can mitigate such impacts.

Methodology

This study adopted a mixed-methods approach, combining both quantitative and qualitative techniques to comprehensively explore the impact of climate change on the financial performance of perishable food retailers in the Federal Capital Territory (FCT) Abuja. The mixed-methods design allows for triangulation of numerical financial data with in-depth insights from stakeholders, ensuring a balanced and nuanced understanding of the challenges and adaptive strategies employed by these businesses (Creswell & Plano Clark, 2018).

The study is set in FCT Abuja, a rapidly urbanizing region that has become increasingly vulnerable to climate-induced challenges such as extreme weather events, infrastructural limitations, and energy supply instability (Adelekan, 2021; NBS, 2023). As a central hub for perishable food retailing, Abuja offers a diverse range of businesses, from small-scale vendors to larger market chains, providing an ideal setting for investigating the intersection of climate change and financial performance.

The target population for this study includes perishable food retailers operating in FCT Abuja. This encompasses fruit and vegetable vendors, dairy product retailers, and cold chain operators. To ensure comprehensive representation across different categories of retailers, market locations (e.g., Wuse Market, Garki Market), and business sizes, a stratified random sampling method was employed. The quantitative component involved 150 retailers, conveniently selected while the qualitative component includes 20 in-depth interviews with selected participants (NBS, 2023).

Data collection was made through structured questionnaires and semi-structured interviews. The quantitative survey gathered data on financial performance indicators such as profit margins, sales trends, and operational costs, alongside perceptions of climate change impacts including disruptions, spoilage rates, and rising operational costs. Retailers' adaptation strategies, such as the use of solar-powered cold storage and diversified supply chains, were also documented. The qualitative interviews provided richer insights into the lived experiences of these retailers, their coping mechanisms, and their perspectives on sustainability and climate resilience.

Quantitative data was analyzed using descriptive statistics to summarize key trends, correlation analysis to examine relationships between climate impacts and financial outcomes, and regression models to assess the predictive power of climate variables while controlling for confounding factors. Qualitative data from interviews were subjected to thematic analysis, allowing for the identification and interpretation of recurring themes related to climate change impacts, adaptive strategies, and sustainability challenges faced by perishable food retailers (Braun & Clarke, 2019).

Results of findings

This section provides an overview of respondents' general perceptions of climate impacts and business outcomes.

Table 1: Descriptive Statistics of Major Constructs

Variable	Mean	Std. Dev.	Min	Max	Interpretation
Erratic Rainfall (ER_mean)	4.27	0.60	3.25	5.00	Respondents generally agree rainfall variability affects business
Extreme Heat (EH_mean)	3.90	0.69	3.00	5.00	Strong awareness of heat impact on spoilage
Flooding (FD_mean)	4.38	0.56	3.25	5.00	Flooding seen as a key environmental issue
Financial Performance (FP_mean)	4.24	0.51	3.50	5.00	Financial performance moderately high overall

The mean scores in Table 1 indicate high awareness of climate-related challenges, particularly flooding and erratic rainfall. Despite these, many retailers reported moderately stable financial outcomes, suggesting adaptive behaviors.

Table 2: Correlation Matrix of Climate Factors and Financial Performance

Variable	ER_mean	EH_mean	FD_mean	FP_mean
Erratic Rainfall (ER_mean)	1.00	0.53	0.53	0.66
Extreme Heat (EH_mean)	0.53	1.00	0.30	0.94
Flooding (FD_mean)	0.53	0.30	1.00	0.37
Financial Performance (FP_mean)	0.66	0.94	0.37	1.00

The table 2 shows that financial performance correlates most strongly with Extreme Heat ($r = 0.94$), followed by Erratic Rainfall ($r = 0.66$). Flooding shows a weaker relationship ($r = 0.37$). Thus, temperature extremes and rainfall fluctuations have a more pronounced impact on financial outcomes than flooding.

Regression Analysis

The combined and individual effects of erratic rainfall, extreme heat, and flooding on financial performance.

Model Summary:

$R^2 = 0.927$, Adjusted $R^2 = 0.926$, $F(3,146) = 619.6$, $p < 0.001$

92.7% of the variance in financial performance is explained by the climate variables.

Table 3: Multiple Regression Results

Predictor	Coefficient (β)	Std. Error	t-value	p-value	Decision
Constant	1.02	0.10	9.99	0.000	—
Erratic Rainfall (ER_mean)	0.18	0.03	7.20	0.000	Significant
Extreme Heat (EH_mean)	0.62	0.02	31.51	0.000	Significant
Flooding (FD_mean)	0.01	0.02	0.42	0.672	Not Significant

The table 3 shows that both **erratic rainfall** and **extreme heat** have statistically significant positive relationships with perceived financial performance impact ($p < 0.001$). Flooding, however, is not significant ($p = 0.67$), implying that it may have indirect or less frequent effects.

Table 4: Hypotheses Testing Summary

Hypothesis	Statement	Result
H ₀₁	Erratic rainfall has no significant effect on financial performance	Rejected
H ₀₂	Extreme heat has no significant impact on profitability	Rejected
H ₀₃	Flooding does not significantly influence financial performance	Accepted

Table 4 shows erratic rainfall and extreme heat significantly affect financial performance, while flooding shows no significant effect. These findings indicate that perishable food retailers in Abuja are more vulnerable to temperature and rainfall variability than to flooding.

Qualitative Result

The qualitative data obtained from transcribed interviews with market retailers provides rich, first-hand descriptions that explain how climatic factors such as erratic rainfall, extreme heat, and flooding influence day-to-day operations, financial outcomes, and adaptive responses. Thematic analysis of the interview transcripts revealed three major themes that capture these experiences: (1) weather-induced spoilage and product loss, (2) reduced customer turnout during adverse weather conditions, and (3) adaptive business responses and coping strategies.

Theme 1: Weather-Induced Spoilage and Product Loss

Many respondents described the destructive impact of high temperatures and intense sunlight on fresh produce. For example, Mama Yusuf, a vegetable and fruit seller, stated: “*The heat spoils our*

vegetables, and heavy rainfall keeps customers away. We buy in small quantities now to avoid waste.” This statement highlights two critical dimensions of climate stress: the direct physical spoilage caused by extreme heat, and the indirect revenue loss resulting from reduced customer traffic during periods of heavy rainfall.

This observation aligns with findings by Adelekan (2021) and the Food and Agriculture Organization (FAO, 2022), who reported that temperature extremes accelerate the decay of perishable goods and disrupt retail supply chains. From a financial perspective, product loss due to spoilage translates into diminished profit margins and reduced capital turnover—issues that were confirmed quantitatively through the significant regression coefficients for erratic rainfall and heat.

Additional comments from respondents further reinforce this theme. Aminat lamented that *“Sometimes when the sun is too much, even our freezers can’t work properly because of power issues,”* while Esther noted, *“During the rainy season, the water enters the stall and damages fruits.”* These statements vividly demonstrate how climatic conditions directly undermine the quality and longevity of perishable goods, thereby affecting profitability.

Theme 2: Reduced Customer Turnout During Extreme Weather

Retailers consistently reported that prolonged rainfall discourages customers from visiting open markets, leading to poor sales and product wastage. As one respondent, Mama Shade, explained: *“When rain starts, people don’t come to buy; we sit from morning till evening and sell very little.”* This reduction in customer foot traffic often results in unsold stock, forcing retailers to lower prices or dispose of spoiled goods, and causing sharp declines in revenue during extended rainy periods. This pattern directly supports the quantitative findings that erratic rainfall significantly correlates with lower financial performance indicators. Retailers not only lose immediate sales but also experience disruptions in restocking, as transportation and logistics are hampered by heavy rainfall and flooding.

Theme 3: Adaptive Business Responses and Coping Strategies

Despite the challenges posed by climate variability, participants described several innovative strategies to minimize losses and maintain business continuity. Many retailers reported buying in smaller quantities to avoid overstocking, improving storage practices through makeshift cooling methods or covered stalls, and timing their purchases and sales to coincide with favorable weather conditions. As Mama Yusuf reiterated, *“We buy in small quantities now to avoid waste.”*

This adaptive behavior reflects an evolving awareness of climate risk and aligns with the Resource-Based View (RBV) theoretical framework guiding this study. According to the RBV, firms that develop unique internal capabilities such as flexibility, experience-based knowledge, and strategic adaptation can maintain a competitive advantage even in adverse environments.

Additional respondents described specific coping mechanisms. Aminat explained, *“I changed to selling fruits that can stay longer like oranges,”* while Josephine added, *“We use cold storage shared by many sellers when light is available.”* These accounts demonstrate creativity and collaboration among small retailers, showing that even in resource-constrained environments, strategic adaptation enables continuity and profitability.

Discussion of Findings

The findings of this study provide a comprehensive understanding of how climate variability, specifically erratic rainfall, extreme heat, and flooding affects the financial performance of perishable food retailers in Abuja.

The descriptive statistics revealed high mean values for all climate-related variables (Mean ≥ 3.9 on a 4-point scale), indicating strong awareness among respondents of the adverse effects of climate variability on their businesses. In particular, flooding (Mean = 4.38) and erratic rainfall (Mean = 4.27) were viewed as major challenges, while extreme heat (Mean = 3.90) was also widely acknowledged as detrimental to the preservation of perishable products. Despite these challenges, the average financial performance score (Mean = 4.24) remained moderately high, suggesting that many retailers have developed adaptive strategies to cushion the effects of climate disruptions. This pattern supports the argument by Blekking et al., (2023) that urban retailers in developing economies are increasingly adopting resilience-oriented behaviours to cope with environmental uncertainties.

Correlation analysis revealed that financial performance was most strongly associated with extreme heat ($r = 0.94$), followed by erratic rainfall ($r = 0.66$), while flooding showed a weaker relationship ($r = 0.37$). This suggests that temperature fluctuations and heat stress are perceived as more immediate threats to product quality and profitability than flooding. The finding aligns with the work of Khan et al. (2023), who found that temperature-related spoilage and refrigeration costs are among the leading drivers of profit loss in food retail sectors globally. Similarly, Linnenluecke and Griffiths (2013) observed that heat-related disruptions often translate into operational inefficiencies, such as increased refrigeration costs and reduced shelf life of goods.

The regression analysis further established that erratic rainfall and extreme heat significantly influence financial performance ($p < 0.001$), while flooding showed no significant effect ($p = 0.67$). The high model explanatory power ($R^2 = 0.927$) indicates that these climatic factors collectively explain about 93% of the variance in financial performance. The positive coefficients for rainfall ($\beta = 0.18$) and heat ($\beta = 0.62$) suggest that higher perceived exposure to these stressors is associated with stronger awareness of their economic consequences. This outcome supports the findings of Adelekan (2021), who reported that heatwaves and unpredictable rainfall patterns significantly disrupt retail operations in urban Nigeria, primarily through spoilage, storage difficulties, and decreased customer activity. The nonsignificant influence of flooding may be attributed to its relatively episodic occurrence in Abuja or the existence of temporary adaptive measures, such as raised stalls and market drainage systems (World Bank, 2023).

The qualitative findings enrich the quantitative results by illustrating how these climatic stressors manifest in retailers' everyday realities. Respondents vividly described weather-induced spoilage, reduced customer turnout, and adaptive business responses as dominant themes. For instance, *Mama Yusuf* noted that *"the heat spoils our vegetables, and heavy rainfall keeps customers away. We buy in small quantities now to avoid waste."* This observation corresponds directly to the statistical

evidence that extreme heat and erratic rainfall have the most significant effects on financial outcomes. Similar sentiments were expressed by *Aminat*, who explained that “*sometimes when the sun is too much, even our freezers can’t work properly because of power issues,*” and *Esther*, who reported that “*during the rainy season, the water enters the stall and damages fruits.*”

These narratives confirm the multidimensional impact of climate variability, affecting both supply-side (spoilage, storage, power instability) and demand-side (customer footfall) dynamics. The experiences also reinforce the Resource-Based View (RBV) theoretical framework adopted in this study, which posits that firms with flexible, adaptive, and innovative internal resources are more likely to sustain competitive advantage under environmental stress (Barney, 1991; Teece et al., 1997). Indeed, retailers’ strategies such as buying smaller quantities, changing product types, and sharing cold storage facilities illustrate adaptive capabilities that enhance resilience and mitigate financial losses.

The findings of this study are consistent with prior empirical works conducted in other African cities, which also highlighted the disproportionate impact of climatic variability on informal and small-scale retailers (Nzeh et al., 2012; Oladipo et al., 2023). For instance, Adelekan (2021) reported similar challenges among Lagos traders, where heat and erratic rainfall led to increased spoilage and reduced income. However, unlike regions prone to severe flooding, Abuja’s topography and drainage systems may explain why flooding did not significantly influence financial performance in this study. The adaptive behaviors observed in this research also reflect emerging resilience patterns noted by the World Bank (2021), which emphasize that small business owners in sub-Saharan Africa are gradually integrating climate-smart strategies albeit informally into their operations. These adaptive actions, although reactive rather than strategic, illustrate the entrepreneurial agility of informal retailers and their capacity to sustain livelihoods under changing environmental conditions.

Conclusion and Recommendations

This study concludes that climate variability particularly extreme heat and erratic rainfall significantly affects the financial performance of perishable food retailers in Abuja. The findings revealed that high temperatures accelerate spoilage, while irregular rainfall disrupts sales and customer turnout, leading to reduced profitability. In contrast, flooding showed no statistically significant effect, possibly due to its less frequent occurrence and short-term nature. Despite these challenges, many retailers demonstrated notable resilience through adaptive behaviors such as buying in smaller quantities, sharing cold storage facilities, and shifting to longer-lasting products. These coping mechanisms reflect the principles of the Resource-Based View (RBV), which emphasizes the role of internal capabilities and resourcefulness in achieving business sustainability under environmental stress. Therefore, climate change poses both a threat and an opportunity testing the adaptability of small-scale entrepreneurs while highlighting the need for greater infrastructural and policy support. Based on these findings, it is recommended that;

Policymakers and development agencies promote climate-smart retail infrastructure, including solar-powered cold storage systems and improved drainage facilities, to reduce spoilage and losses.

Capacity-building programs should be introduced to enhance retailers' knowledge of climate adaptation, inventory management, and financial planning.

Access to microfinance and insurance schemes tailored for small-scale traders is also essential to help them recover from climate-induced losses. Furthermore, collaboration among traders through cooperatives or associations should be encouraged to enable shared access to resources and collective action.

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