Exploring the Lived Experiences of Informal Horticulture Market Traders in the Era of Climate Change: A Qualitative Study of Masala Market, Ndola, Zambia

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ABSTRACT

Background: Climate change is increasingly affecting livelihoods and food systems globally, particularly among vulnerable populations within the informal economy. While existing climate change research has largely concentrated on agricultural production and rural farming communities, limited scholarly attention has been directed toward informal horticulture traders operating within urban food systems despite their critical contribution to food distribution and household economies.

Aim: To explore the lived experiences and adaptive responses of informal horticulture traders to climate variability and its effects on their livelihoods in Zambia.

Methods: The study employed a qualitative research approach with phenomenological research design. Purposive and Snowball non-random sampling methods were used to recruit 27 participants who were active informal horticulture traders and key stakeholders. Data were collected through in-depth interviews, focus group discussions, and key informant interviews involving informal horticulture traders and relevant stakeholders at Masala Market in Ndola District. Qualitative data was analysed using thematic analysis.

Findings: The findings reveal that traders experience climate variability through unpredictable rainfall patterns, extreme temperatures, prolonged dry spells, and seasonal market disruptions that affect the supply, quality, preservation, and pricing of horticultural commodities. These climate-related disruptions negatively influenced traders' livelihoods by reducing daily income, increasing food insecurity, weakening business sustainability, and limiting their ability to meet essential household obligations such as rent, school fees, and healthcare costs. The study further established that traders employed multiple adaptation strategies, including income diversification, modification of trading practices, reliance on social support networks, participation in informal savings groups, and flexible sourcing of produce. However, the effectiveness of these coping mechanisms was constrained by limited financial capital, inadequate market infrastructure, weak institutional support systems, and broader socio-economic inequalities.

Conclusion: The study concludes that climate variability poses a significant threat to the livelihood security and well-being of informal horticulture traders despite their important role in sustaining urban food systems. The study recommends the formulation of inclusive climate adaptation policies, improved market infrastructure, strengthened social protection mechanisms, enhanced access to financial services, and climate-responsive urban planning initiatives aimed at improving the adaptive capacity and resilience of informal traders in Zambia.

Keywords: Climate variability, informal horticulture traders, livelihoods, adaptation strategies, resilience, urban food systems

BACKGROUND TO THE STUDY

Climate change has become one of the most significant global threats to environmental sustainability, food systems, and socio-economic livelihoods. Recent scientific evidence indicates that global temperatures have risen by approximately 1.1°C above pre-industrial levels, contributing to increased occurrences of droughts, floods, heatwaves, erratic rainfall, and extreme weather events across many regions of the world (IPCC, 2023). Although climate change affects both developed and developing countries, its impacts are disproportionately severe in sub-Saharan Africa due to high dependence on climate-sensitive livelihoods, weak infrastructure systems, and limited adaptive capacity (UNEP, 2024). Consequently, climate variability is increasingly undermining food security, income generation, public health, and livelihood sustainability among vulnerable urban and rural populations.

Contemporary climate change debates have shifted beyond environmental degradation toward understanding how climatic shocks affect socio-economic systems and everyday livelihoods. Increasingly, scholars argue that climate change disrupts food production systems, labour markets, transportation networks, and informal economies, particularly within rapidly urbanising regions of the Global South (World Bank, 2023). Urban informal workers are especially vulnerable because their livelihoods depend on unstable daily incomes, limited institutional protection, and climate-sensitive supply chains. Informal food markets, which play a central role in food distribution in many African cities, are increasingly affected by supply shortages, commodity price fluctuations, transportation disruptions, and food spoilage linked to climate variability (FAO, 2022).

Globally, informal food systems remain essential for urban food accessibility and affordability, especially among low-income populations. Battersby and Watson (2021) note that informal markets distribute a substantial proportion of fresh produce consumed in African cities and provide critical employment opportunities for marginalised urban households. However, climate-related disruptions increasingly threaten these systems through declining agricultural productivity, irregular supply flows, and deteriorating market conditions. Informal horticulture traders are particularly exposed because they trade highly perishable commodities that are sensitive to temperature increases, poor storage conditions, and transportation delays. In many developing countries, these traders operate without access to insurance, formal credit systems, social protection mechanisms, or climate adaptation support, thereby increasing their vulnerability to environmental and economic shocks (World Bank, 2023).

In sub-Saharan Africa, the effects of climate change are intensified by rapid urbanisation, structural inequalities, weak governance systems, and dependence on rain-fed agriculture (WMO, 2024). Southern African countries, including Zambia, Zimbabwe, Malawi, and Mozambique, have experienced recurrent droughts, floods, cyclones, and prolonged dry spells associated with climate variability and El Niño conditions (IPCC, 2023). These climatic disturbances have disrupted agricultural production systems, weakened food supply chains, and increased urban food insecurity. Existing studies further demonstrate that climate-related shocks significantly affect informal urban economies through rising food prices, reduced agricultural output, declining consumer purchasing power, and unstable trading environments (Skinner & Watson, 2021). Despite their contribution to urban food security and employment generation, informal traders are frequently excluded from urban planning frameworks and climate adaptation policies (Resnick, 2021).

The informal economy constitutes the dominant source of employment across sub-Saharan Africa. According to the International Labour Organization (ILO, 2022), approximately 85% of employment in the region occurs within informal economic activities. Informal horticulture traders therefore occupy a strategic position within urban food systems because they facilitate the movement of fruits and vegetables from rural producers to urban consumers while supporting household incomes and local economic circulation (FAO, 2022). Nevertheless, these traders commonly operate under precarious conditions characterised by poor sanitation, inadequate storage facilities, insecure trading spaces, and limited financial support. Such structural challenges increase their susceptibility to climate-induced livelihood disruptions.

In Zambia, climate change has emerged as a major developmental concern due to the country's heavy dependence on agriculture, hydropower, and natural-resource-based livelihoods (World Bank Group, 2023). Over recent years, Zambia has experienced increasing incidences of droughts, flash floods, erratic rainfall

patterns, and prolonged dry spells, all of which have negatively affected agricultural production, food availability, and socio-economic well-being (Ministry of Green Economy and Environment [MGEE], 2023). The severe 2023-2024 drought significantly reduced crop yields across several provinces and contributed to rising food prices and worsening urban food insecurity (FAO, 2024). Although policy responses have largely focused on rural farming communities, relatively limited attention has been directed toward urban informal traders whose livelihoods depend heavily on climate-sensitive agricultural supply systems.

The informal sector remains central to Zambia's urban economy. The Zambia Statistics Agency (2023) estimate that approximately 78.6% of employed individuals operates within the informal economy. Urban markets such as Masala Market in Ndola therefore serve not only as centres of employment and income generation but also as critical food distribution spaces linking peri-urban producers with urban consumers. However, informal horticulture traders remain highly vulnerable to climate variability because fluctuations in agricultural production directly affect commodity availability, prices, transportation costs, and product spoilage (Ngoma & Chapoto, 2023). Extreme heat conditions, seasonal flooding, inadequate drainage systems, and poor market infrastructure further intensify traders' exposure to environmental risks. Kalaba and Haambote (2022) observe that many informal markets in Zambia lack climate-resilient infrastructure such as cold storage facilities, proper sanitation systems, drainage networks, and protective trading shelters, thereby increasing livelihood insecurity among traders.

Despite these challenges, informal traders continue to develop coping and adaptation strategies aimed at sustaining their livelihoods under increasingly uncertain climatic conditions. Research within African informal economies suggests that traders frequently rely on social networks, rotating savings groups, flexible sourcing arrangements, livelihood diversification, and informal credit systems to manage climate-related shocks (Skinner & Watson, 2021). However, the effectiveness of these strategies is often constrained by poverty, weak institutional support, and inadequate urban governance structures.

This study is guided by the Sustainable Livelihoods Framework (SLF) and the Capability Approach (CA). The Sustainable Livelihoods Framework developed by Chambers and Conway (1991) and later refined by Scoones (2022) provides a useful lens for examining how individuals utilise livelihood assets, including financial, social, physical, human, and natural capital, to respond to external shocks such as climate change. Complementing this perspective, the Capability Approach advanced by Sen (1979) and further developed by Robeyns and Byskov (2021) emphasises human agency, freedoms, and well-being. The approach highlights how climate change affects not only material livelihoods but also people's capabilities to maintain dignity, health, mobility, and meaningful socio-economic participation. Integrating these frameworks provides a comprehensive understanding of the structural and human dimensions of climate vulnerability among informal horticulture traders.

Although climate change scholarship in Zambia has expanded in recent years, existing studies have predominantly focused on rural agriculture, environmental sustainability, and national climate policy. Limited empirical attention has been directed toward understanding how climate variability affects urban informal food traders and how these actors navigate everyday livelihood disruptions within urban market spaces. This gap is significant because informal traders remain central actors within urban food systems and local economies. Furthermore, current climate adaptation policies in Zambia continue to prioritise agricultural production and rural resilience while overlooking the experiences and vulnerabilities of urban informal workers. The absence of context-specific evidence on climate vulnerability among informal horticulture traders constrains the development of inclusive urban adaptation policies and climate-resilient market systems.

Against this background, the present study explores the lived experiences of informal horticulture traders at Masala Market in Ndola, Zambia, within the context of climate change. Specifically, the study examines traders' perceptions of climate variability, the effects of climate change on their livelihoods, and the coping and adaptation strategies they employ to sustain their economic activities. By foregrounding the experiences of informal traders, the study contributes to emerging debates on climate change, urban informality, and livelihood resilience in African cities. The findings are expected to generate evidence capable of informing inclusive climate adaptation policies, climate-resilient urban planning, and sustainable livelihood interventions targeting vulnerable informal workers in Zambia and similar developing-country contexts.

MATERIALS AND METHODS

Research design

The study adopted a qualitative research approach grounded in phenomenology and informed by a Sustainable Livelihoods Approach and the Capability Approach. Phenomenology emphasises interpretation of lived experience, recognising that meaning is co-constructed through social interaction and contextual understanding rather than merely described (Addeo, 2013; Qazi and Rashidi, 2018b). This design was appropriate for exploring how men, women, and youth enganged in informal horticultural trading interpret their participation in trading activies and its implications for economic and social development.

Study Site

The research was conducted at Masala Main Market in Ndola District in Copperbelt Province, Zambia. Ndola an urban district characterised by intensive informal trade and mining activities. The town is a commercial centre for the country and all the men, women and the youth dominate informal trading activities, including food vending, agricultural produce sales, vegetables, fresh fruits and small-scale retail, making the site particularly suitable for exploring lived experiences of hortuclural traders within informal market contexts.

Target Population

The main study population comprised men, women, and youths engaged in informal horticulture trading at Masala Market in Ndola District. The key informants included the market chairperson and the local authority representative. These traders rely heavily on selling of fresh fruits and vegetables such as tomatoes, onions, cabbages, okra, bananas, apples, and oranges for their daily businesses, family needs, and long-term goals. Creswell (2013:155) confirms this by stating that "It is essential that all participants have [similar lived] experience of the phenomenon being studied". Thus, qualitative research aims to allow participants with similar experience to begin a process of reflection and engagement with the meaning of their personal experience of engaging in informal horticulture trading (Biggerstaff and Thompson, 2008).

Sampling Methods

The goal of this study was not to recruit a representative sample, but rather to focus on participants who possessed similar characteristics that were relevant to the study (Creswell and Creswell, 2017). The researcher employed a purposive and Snowball non-random sampling methods in recruiting the participants for the study. These sampled participants have similar attributes, experiences and characteristics among others (Bryman, 2016). In this regard, purposive and Snowball non random sampling techniques were employed as features of qualitative research in order to enable the researchers to select knowledgeable participants.

Sample size

In qualitative research, Smith and Osborn (2008) have advocated for a small sample size. This is because qualitative research is not aimed at making generalizations but having a holistic picture of the perspectives of people experiencing a similar phenomenon. Creswell and Poth (2017) have recommended a sample size of 5 to 25 participants who have similar experience with the phenomenon being studied in qualitative research. As such, the commonality of their experiences can be captured and interpreted. Thus in this study, the researchers did in-depth interviews, focus group discussions and key informant interviews with 27 participants as women market traders at Masala Main Market.

Data Collection Methods

This research employed the semi-structured interviews in-Depth interviews (IDIs), focus group discussions (FGDs), key informant interviews (KIIs), and direct observations to explore the lived experiences and adaptive responses of informal horticulture traders to climate variability and its effects on their livelihoods in Zambia. Smith et al (2009) suggested that semi-structured interviews are well-suited to the task of capturing people's lived experiences and through which a phenomenon could be interpreted in terms of the meanings interviewees bring to it. This type of interview was used to create a space in which the researcher and participants constructed

the knowledge together (Birks and Mills, 2011). The interviews were conducted in participants' preferred languages (i.e., English and Bemba). Each participant was identified by pseudo names which were different from the actual names of the participants. The researchers preferred the IDIs, FGDs, KIIs, and direct observations because it enabled them to have more clarifying, probing, and cross-checking questions, where the interviewers have the freedom to alter; rephrase and add questions according to the nature of the responses from interviewees (Best and Kahn, 2003). The semi-structured interviews also provided an opportunity for recording all the responses from participants.

Data Analysis and interpretation

Data analysis was done using qualitative thematic analysis following Braun and Clarke's (2006) six-step model. Braun and Clarke recommended that qualitative research focuses on the following steps, namely: familiarization with the data, generating initial codes; searching for themes; reviewing themes; defining and naming themes, and producing the report. In phenomenological research, the analysis of data begins as soon as the first data are collected (Kings and Horrocks, 2010). In this study, interviews were recorded with the consent of the participants. The audios were then transcribed and uploaded into the qualitative research software called Nvivo version 12 pro to assist in organizing and coding data. Themes were interpreted using theoretical lenses, including Sustainable Livelihoods Approach and the Capability Approach. The researchers read through the transcripts identifying open codes using the qualitative software Nvivo. Coding aided in identifying concepts, categories and sub-categories that were further broken down. Open coding involves reading the texts 'word-by-word', 'line-by-line', and repeatedly to identify phrases that interviewees were using to describe things and issues. The coded data was then categorised (grouped) according to different characteristics to better understand the data. The categories were then grouped to form sub-themes and then eventually, the sub-themes were grouped to come up with the main themes. This enabled the researcher to categorize items according to what description they offered (Bryman, 2012). This analysis method had its weakness as it was lengthy and time consuming.

Reflexivity and Positionality

The principle of reflexivity means that the researcher should be conscious about his/her own position, values, biases and decision in constructing knowledge of the social world in the research process right from designing the tools, data collection and interpretation of the findings (Hesse-Biber and Johnson, 2015). Being qualitative research, the researchers were aware that their background, values, beliefs, and experiences could influence the research process (Floyd and Arthur, 2012). To overcome the problem of positionality, researchers applied Greenbanks (2003) recommendation that reflexivity requires explicit self-consciousness and self-assessment about the researchers' views and positions and how these might influence the design, execution, and interpretation of research findings. Thus, researchers had put aside any preconceived ideas or what they may have personally observed about the lived experiences of informal horticulture market traders at Masala Market in Ndola.

Ethical Considerations

In any research conducted, ethical issues must be taken into consideration by the researcher (Bryman, 2016). The researchers ensured that ethics of social research were upheld. The main ethical issues addressed in the course of the research were; approval, permission, access and acceptance, informed consent, confidentiality, right to privacy and anonymity, right to withdrawal, beneficence, justice and fairness. The ethical approval number for the study is MU/DRI/REC/2026/012.

Study Findings (Results)

Introduction

This section presents the findings of the study on the lived experiences and adaptive responses of informal horticulture market traders to climate variability at Masala Market in Ndola District, Zambia. The findings are based on data generated through in-depth interviews (IDIs), focus group discussions (FGDs), and key informant interviews (KIIs). Consistent with the phenomenological research design, emphasis was placed on understanding

how traders themselves experience, interpret, and respond to climate-related disruptions within their everyday trading environments.

The findings are presented thematically and reflect context-specific realities of informal horticulture traders operating within a climate-vulnerable urban market system. Rather than making universal claims, the findings illuminate how climate variability interacts with pre-existing socio-economic and institutional conditions to shape livelihood experiences, business practices, and survival strategies among traders at Masala Market.

Background Characteristics of Participants

The study revealed that informal horticulture traders at Masala Market constitute a socially and economically diverse population differentiated by gender, age, trading experience, and type of commodities traded. Participants ranged between 25 and 67 years of age, while trading experience ranged from five to thirty-eight years, demonstrating that informal horticulture trading functions both as a long-term livelihood pathway and a survival-based economic activity.

Three broad categories of traders emerged from the findings. The first group comprised vegetable traders, predominantly women, whose trading activities were closely linked to household food provisioning and caregiving responsibilities. The second category consisted mainly of fruit traders, where youth participation was relatively higher due to lower entry barriers and flexible trading arrangements. The third category included traders dealing in both fruits and vegetables and reflected a more economically diversified group involving both men and women across different age groups.

The findings further demonstrate the gendered nature of informal horticulture trading. Women were more concentrated in vegetable trading activities, reflecting broader socio-cultural roles associated with household survival and care work. In contrast, younger traders were more active within fruit trading due to its mobility and lower capital requirements. Traders engaged in both fruits and vegetables appeared relatively more economically stable because diversification reduced dependence on single-product sales.

From the presentation above, the socio-demographic characteristics suggest that informal horticulture trading remains a critical source of employment, income generation, and livelihood sustenance for urban low-income households within Ndola's informal economy.

Emerging Themes from the Study

Thematic analysis generated four major themes and several interrelated subthemes reflecting the lived experiences of traders under conditions of climate variability. These themes included: climate variability and unpredictability; climate-induced livelihood and economic effects; informal and survival-based adaptation strategies; and cross-cutting structural vulnerabilities.

The findings reveal that climate change is not experienced merely as an environmental phenomenon, but as a multidimensional livelihood crisis affecting economic stability, household wellbeing, mobility, food security, and social relations within informal urban economies.

Table 1: Emerging themes and subthemes

Themes	**Sub-themes**
Climate Variability and Unpredictability	*Disruption of seasonal cycles*
	Disruption of trading activities
Climate-Induced Livelihood and Economic Effects	*Income Instability and Capital Loss*
	Declining Product Quality and Reduced Shelf Life

	Supply Shortages and Reduced Product Diversity
	Debt Cycles and Financial Dependency
	Household and Social Impacts
	Increased Competition and Market Pressure
Informal and Survival-Based Adaptation Strategies	*Market Mobility and Flexible Trading Practices*
	Informal Financial Coping Mechanisms
	Product Diversification and Seasonal Adjustment
	Use of Informal and Household Labour
	Loss Minimization and Product Management Strategies
Cross-Cutting Issues Emerging from the Study	*Limited Policy and Institutional Exclusion*
	Inadequate Infrastructure and Governance Failures
	Institutional Disconnect and Weak Accountability Structures
	Social Vulnerability and Structural Inequality

Climate Variability and Unpredictability

Participants consistently described climate variability as one of the most significant challenges affecting everyday trading activities at Masala Market. Traders experienced climate change primarily through prolonged rainfall, flooding, excessive heat, irregular rainfall patterns, drought conditions, and disruptions in previously predictable seasonal cycles. Participants explained that weather conditions had become increasingly unstable and difficult to predict compared to previous years, thereby complicating business planning and increasing livelihood uncertainty.

Disruption of seasonal cycles

A dominant concern among participants was the erosion of seasonal predictability. Traders explained that weather patterns that were previously stable and reliable for planning procurement and sales activities had become inconsistent. One participant explained:

"Each year comes with different weather changes… last year it was drought and heat, this year it is too much rain and floods. It is very difficult these days to plan how to manage one's activities especially during the rainy season" (FGD1-2).

This finding demonstrates how climate variability has disrupted the seasonal knowledge systems upon which traders historically depended for organizing trading activities. The unpredictability of weather conditions has increased uncertainty surrounding procurement decisions, product preservation, customer flow, and pricing strategies. Consequently, traders operate within increasingly unstable market environments characterized by heightened exposure to risk.

Disruption of trading activities

Participants further explained that prolonged rainfall and excessive heat directly disrupt daily trading operations by reducing customer movement and delaying transportation of horticultural products into the market. One participant stated:

"The weather is unpredictable… sometimes prolonged rains keep me out of business for hours… there are days it rains continuously and customers do not come" (IDI-3).

The findings suggest that climate variability affects both long-term livelihood planning and immediate income-generating activities. Since horticultural products are highly perishable, disruptions in trading hours frequently translate into direct financial losses. Reduced customer turnout during periods of heavy rainfall or extreme temperatures weakens traders' capacity to recover invested capital and maintain business continuity.

Key informants further highlighted that the impacts of climate variability are intensified by infrastructural deficiencies within the market environment. One key informant explained:

"Over the past years we have experienced flooding, prolonged rainfall and extreme heat, but flooding is worsened by lack of drainage systems in the market" (KII-2).

This finding demonstrates that traders' vulnerability is not solely environmentally produced but is also structurally embedded within broader governance and infrastructural failures. Climate-related risks are intensified by inadequate urban planning, poor drainage infrastructure, and lack of climate-resilient market facilities. The findings therefore reveal an interaction between environmental stressors and institutional neglect in shaping vulnerability among informal traders.

From the presentation above, the findings indicate that informal horticulture traders operate within increasingly unstable climatic conditions characterized by uncertainty, unpredictability, and heightened exposure to livelihood risks. Climate variability has transformed the operational environment of informal markets, increasing economic insecurity and weakening livelihood stability.

Climate-Induced Livelihood and Economic Effects

The findings revealed that climate variability has generated profound economic and livelihood disruptions among informal horticulture traders. Participants consistently described climate change as a major factor affecting income stability, product preservation, supply systems, household wellbeing, and long-term business sustainability.

Income Instability and Capital Loss

One of the most significant effects identified in the study was unstable income and repeated loss of business capital due to product spoilage caused by excessive heat, prolonged rainfall, and unstable temperatures. Participants explained that climatic conditions directly reduce the quality and marketability of perishable products.

One participant explained:

"I have lost my capital due to spoilage of tomatoes… when temperatures become too high the tomatoes go bad quickly" (FGD2-4).

Another participant stated:

"Within two days my tomatoes got rotten and cabbage leaves turned yellow. I reduced prices but still failed to recover my capital" (FGD1-2).

These findings demonstrate how climate variability undermines financial sustainability within informal horticulture trading systems. Since traders depend heavily on daily sales and rapid product turnover, repeated spoilage directly weakens their ability to accumulate savings, reinvest capital, or expand business operations.

Key informants further confirmed that many traders now survive through supplier credit systems because previous climate-related losses depleted their working capital. Consequently, trading activities are increasingly

shifting from profit-oriented enterprises toward survival-based livelihood systems characterized by financial precarity and dependence.

Price Fluctuations and Market Instability

The findings further revealed that climate variability contributes significantly to unstable market prices and unpredictable supply-demand dynamics. Participants explained that prolonged rainfall, flooding, droughts, and excessive heat frequently disrupt supply chains and alter product availability, resulting in sudden price increases or collapses.

One participant narrated:

"We had prolonged rainfall for three days and business was slow… then suddenly many suppliers came and prices dropped. I lost K2800 within two days" (IDI-8).

Another participant stated:

"Today you buy tomatoes at K500 and tomorrow prices drop to K300. Vegetable business has become very risky" (IDI-9).

The findings indicate that climate variability has destabilized horticultural market systems by disrupting the predictability of supply patterns. Traders now operate within volatile market environments where oversupply and shortages emerge rapidly depending on weather conditions. Such instability limits traders' ability to plan procurement, estimate profits, or maintain stable incomes. The findings therefore demonstrate that climate change affects not only agricultural production but also urban food distribution systems and informal retail economies. Market instability has become a central feature of climate vulnerability within informal trading systems.

Declining Product Quality and Reduced Shelf Life

Participants consistently reported that fruits and vegetables now spoil much faster than before, particularly during periods of extreme heat and prolonged rainfall. Traders attributed declining product quality partly to climate conditions and partly to changing agricultural production practices involving chemical growth boosters.

One participant explained:

"Vegetables now get rotten very quickly because farmers use chemical boosters that affect shelf life" (FGD2-5).

Another participant stated:

"When there is prolonged rainfall and heat, cabbage and rape become yellow and damaged" (FGD2-3).

The findings indicate that climate variability interacts with agricultural production practices to intensify post-harvest losses within informal market systems. Rapid spoilage weakens traders' bargaining power because deteriorating products must be sold quickly at reduced prices to avoid total losses. Consequently, traders prioritize rapid disposal of products rather than profit maximization. The findings therefore reveal how climate-related vulnerabilities extend beyond agricultural production into post-harvest systems, urban food markets, and retail distribution networks.

Supply Shortages and Reduced Product Diversity

The study further established that climate variability disrupts horticultural supply chains, resulting in shortages of vegetables and fruits within the market. Participants explained that flooding, drought conditions, poor roads, and transport disruptions negatively affect product movement from rural farming areas to urban markets.

One participant explained:

"Suppliers from rural areas complain about bad roads and transport problems during rainy seasons. That is why we face shortages" (IDI-3).

Participants also noted declining availability of some vegetables traditionally common within local markets. Reduced product diversity negatively affects customer preferences and limits income opportunities for traders who depend on selling multiple commodities.

The findings therefore demonstrate that climate variability affects the entire horticultural value chain from production and transportation to retail distribution and consumer access.

Debt Cycles and Financial Dependency

Repeated financial losses and declining incomes were found to push many traders into cycles of debt dependency. Participants explained that they increasingly rely on supplier credit systems because they no longer possess sufficient working capital. One participant stated:

"We borrow products from suppliers and pay after sales because we no longer have enough capital" (FGD1-3).

These findings demonstrate how climate-related livelihood disruptions weaken financial resilience among informal traders. Although informal credit arrangements help sustain business continuity, they simultaneously reinforce long-term dependency and economic insecurity. The findings therefore suggest that climate variability is gradually eroding traders' economic independence while reproducing survival-oriented livelihood systems.

Household and Social Impacts

Beyond economic losses, participants described severe household and social consequences arising from climate-induced livelihood instability. Declining profits contributed to food insecurity, housing instability, educational disruptions, and deteriorating household wellbeing.

One participant explained:

"Some of us now sleep in the market because we cannot afford rent anymore" (FGD1-1).

Another participant added:

"We now survive on one meal per day because business is very poor" (IDI-5).

The findings indicate that climate vulnerability extends beyond business activities into household welfare systems. Economic instability among traders contributes to broader social challenges including child labour, educational interruptions, and deepening urban poverty.

Increased Competition and Market Pressure

Participants further explained that rising unemployment and growing participation in informal trading have intensified competition within horticulture markets. Traders also highlighted increasing competition from supermarkets with better storage facilities and fresher products. One participant stated:

"Many people now sell fruits and vegetables even in residential compounds. We reduce prices just to survive" (FGD2-4).

The findings suggest that climate-related product spoilage and unstable supply systems weaken the competitiveness of informal traders relative to formal retail systems. Traders are therefore forced to operate with reduced profit margins within increasingly saturated market environments.

Informal and Survival-Based Adaptation Strategies

The study revealed that traders employ multiple adaptation strategies aimed at minimizing losses and sustaining livelihoods under increasingly unstable climatic conditions. However, the findings demonstrate that most adaptation responses remain short-term, survival-oriented, and reactive rather than transformational.

Market Mobility and Flexible Trading Practices

Traders reported moving between market spaces, roadsides, and residential compounds in response to customer flow and weather conditions. One participant explained:

"In the morning we move into compounds to sell quickly before products spoil" (FGD2-3).

These findings demonstrate that mobility functions as an important coping mechanism enabling traders to reduce spoilage and increase market access. However, such practices also reflect precarious survival conditions characterized by insecure trading spaces and infrastructural inadequacies.

Informal Financial Coping Mechanisms

Informal savings groups locally known as chilimba emerged as critical financial support systems. Participants explained that these groups help traders cope with declining incomes, rent obligations, and household expenses. The findings reveal strong social solidarity among traders. However, the financial capacity of such groups remains limited due to small contributions and vulnerability to defaulting and mistrust.

Product Diversification and Seasonal Adjustment

Participants explained that they increasingly diversify products by incorporating relatively durable commodities such as onions, beans, potatoes, and groundnuts during hot seasons. One participant explained:

"During hot seasons I reduce vegetables and add potatoes and onions to avoid losses" (FGD1-1).

The findings suggest that traders possess substantial experiential knowledge regarding seasonal risks and product management. However, diversification does not completely eliminate vulnerability because unpredictable weather conditions continue to generate losses.

Use of Household and Informal Labour

The findings further revealed that traders rely heavily on household labour, including children and hired youths, to increase sales coverage and reduce spoilage. One participant stated:

"I send my children to sell after school so that products finish quickly before they spoil" (FGD2-1).

These findings reveal how climate-related livelihood pressures produce additional social vulnerabilities, particularly concerning child welfare, educational continuity, and labour exploitation risks.

Loss Minimization and Product Management Strategies

Participants described several loss-reduction strategies including reducing prices, sprinkling water on vegetables, and drying vegetables for resale. One participant explained:

"Reducing prices saves me from total losses because products spoil very fast" (FGD2-3).

The findings demonstrate traders' creativity and resilience in managing highly perishable commodities under difficult conditions. Nevertheless, participants acknowledged that such strategies remain insufficient during periods of extreme climatic stress.

From the presentation above, adaptation among traders is characterized largely by short-term coping mechanisms aimed at survival rather than long-term resilience building.

Cross-Cutting Structural Vulnerabilities

The study further revealed that traders' vulnerability is deeply shaped by broader institutional and structural conditions including governance failures, infrastructural neglect, and social inequalities.

Policy Exclusion and Institutional Marginalization

Participants consistently reported exclusion from government support programmes despite their critical role within urban food systems. One participant explained:

"Farmers receive support through FISP but traders receive nothing" (IDI-12).

The findings demonstrate a structural policy bias prioritizing agricultural production while neglecting informal market systems and food distribution actors.

Infrastructural Deficiencies and Governance Failures

Participants identified lack of electricity, cold storage facilities, drainage systems, and climate-resilient shelters as major contributors to vulnerability. One participant explained:

"This market has no cold storage, no electricity and no proper drainage" (FGD2-2).

The findings reveal that infrastructural neglect significantly weakens traders' adaptive capacity and intensifies climate-related losses.

Institutional Disconnect and Weak Accountability

Traders described local governance systems as unresponsive and primarily focused on revenue collection rather than welfare and service delivery. The findings indicate weak participation mechanisms and limited accountability regarding market management and infrastructure provision.

Social Vulnerability and Structural Inequality

Women traders were found to experience heightened vulnerability due to caregiving responsibilities, unsafe working conditions, and economic insecurity. One participant explained:

"Women suffer more because we work in difficult conditions and still carry household responsibilities" (FGD2-2).

The findings demonstrate that climate vulnerability is unevenly distributed and shaped by intersecting inequalities related to gender, poverty, and informal sector exclusion.

From the presentation above, the findings reveal that climate variability has profoundly transformed the livelihood experiences of informal horticulture traders at Masala Market. Traders operate within increasingly unstable climatic, economic, and institutional environments characterized by uncertainty, infrastructural deficiencies, and limited policy support. Although traders demonstrate resilience through various adaptation strategies, most responses remain short-term and survival-oriented due to persistent structural constraints. Climate vulnerability within informal urban economies therefore emerges not only as an environmental issue but also as a broader socio-economic and governance challenge requiring inclusive, climate-responsive, and socially sensitive interventions.

DISCUSSION AND INTERPRETATION OF FINDINGS

This discussion chapter critically interprets the empirical findings of the study on the lived experiences of informal horticulture market traders operating at Masala Market in Ndola, Zambia, within the context of climate change. The discussion is organised according to the major themes emerging from the study and interpreted through the Sustainable Livelihoods Framework (SLF) and the Capability Approach. The findings demonstrate that climate change has evolved beyond an environmental concern into a multidimensional socio-economic challenge affecting informal urban livelihoods, household wellbeing, and adaptive capacity. The discussion further situates the findings within recent empirical literature on climate vulnerability, urban informality, and livelihood resilience in sub-Saharan Africa.

Climate Variability and Disruption of Informal Livelihood Systems

The findings revealed that informal horticulture traders increasingly experience irregular rainfall patterns, flooding, prolonged heat, and seasonal unpredictability, all of which disrupt procurement systems, transportation, customer flows, and trading operations. These findings confirm recent evidence that African urban informal economies are becoming increasingly vulnerable to climate variability and extreme weather events (IPCC, 2022; Finn & Cobbinah, 2023). Climate variability was not perceived by participants as an occasional disturbance, but rather as a persistent structural challenge affecting daily livelihood activities.

Participants reported difficulties in predicting supply availability, prices, transport conditions, and customer turnout due to unpredictable weather patterns. Similar findings were reported by Zenda and Rudolph (2024), who found that climate variability disrupted livelihood planning and income stability among climate-dependent populations in Southern Africa. The findings further align with Phiri (2023), who observed that climate uncertainty weakened traditional livelihood planning systems among informal traders in Zambia. These findings suggest that climate change increasingly undermines environmental predictability upon which informal market systems traditionally depend.

The study further established that poor drainage systems and inadequate market infrastructure intensified climate vulnerability, particularly during periods of heavy rainfall and flooding. Traders reported destruction of produce, restricted mobility, and reduced customer access due to water accumulation within the market environment. These findings support Michael (2024), who argues that weak urban infrastructure significantly amplifies climate vulnerability among informal workers in African cities. Similarly, the IPCC (2022) reports that informal workers are disproportionately exposed to climate risks because they commonly operate within poorly serviced environments lacking climate-resilient infrastructure and institutional protection.

From the Sustainable Livelihoods Framework perspective, climate variability represents a vulnerability context characterised by shocks and external stresses that undermine livelihood assets and strategies (Scoones, 2022). The findings demonstrate that climate-related disruptions weaken financial, physical, and human capital through product losses, declining sales, and disrupted market operations. The Capability Approach further explains that although traders possess entrepreneurial skills and social networks, climate uncertainty constrains their ability to convert available resources into sustainable wellbeing outcomes (Robeyns & Byskov, 2021). Climate change therefore affects not only economic productivity, but also human freedoms, opportunities, and livelihood security.

From the discussion above, the findings indicate that climate vulnerability within informal horticulture markets is shaped through the interaction between environmental uncertainty, infrastructural deficiencies, and socio-economic inequalities. The study therefore highlights the importance of climate-responsive infrastructure, improved drainage systems, and inclusive urban planning interventions to strengthen resilience among informal traders.

Climate-Induced Economic Insecurity and Household Vulnerability

The study established that climate change has generated severe economic and livelihood effects among informal horticulture traders at Masala Market. Participants reported declining income stability, accelerated spoilage of

perishable products, supply shortages, unstable pricing systems, and recurring losses of business capital. These findings correspond with recent studies showing that climate change increasingly disrupts informal food economies, urban supply chains, and income-generating activities in developing countries (UNDP, 2024; Tschakert et al., 2023).

Prolonged heat and excessive rainfall were reported to accelerate spoilage of highly perishable products such as tomatoes and vegetables, forcing traders to sell products at lower prices or incur complete losses. Similar findings were reported by Affognon et al. (2021), who established that rising temperatures significantly increase post-harvest deterioration in tropical environments lacking adequate storage technologies. The findings further align with Sepadi et al. (2025), who observed that climate-related spoilage and transport disruptions reduced profitability and weakened business sustainability among informal traders across Africa and Asia.

An important finding emerging from the study was the increasing dependence on supplier credit and informal borrowing arrangements following repeated climate-related losses. Traders explained that declining profits and capital erosion forced them into debt dependency in order to sustain business operations. While previous studies have identified climate-induced income instability among informal workers (Mkhize & Cele, 2025), the present study extends existing knowledge by demonstrating how climate-related shocks contribute to long-term financial dependency within informal horticulture markets. These findings suggest that repeated environmental shocks gradually transform informal enterprises from growth-oriented activities into survival-based livelihood systems.

The findings further revealed that climate variability disrupted agricultural supply chains through reduced crop productivity, poor rural road accessibility, and transportation interruptions during periods of flooding. These disruptions contributed to reduced produce availability, unstable prices, and declining product diversity within the market. Similar observations were reported by Ayanlade et al. (2023) and Naicker et al. (2025), who found that climate change increasingly undermines urban food distribution systems and market stability across sub-Saharan Africa.

Beyond economic losses, the study established that climate-related livelihood disruptions extended into broader dimensions of household wellbeing. Participants reported food insecurity, inability to pay school fees, reduced meal frequency, and housing instability. These findings indicate that climate vulnerability among informal traders is multidimensional, affecting education, nutrition, housing security, and social dignity. Similar findings were reported by Phiri (2023), who found that climate-induced livelihood disruptions negatively affected household wellbeing among informal traders in Zambia.

The findings also revealed significant gender dimensions associated with climate vulnerability. Women traders, particularly widows and single mothers, experienced disproportionate livelihood pressures due to caregiving responsibilities, limited financial resources, and unequal access to institutional support. These findings support UN Women (2022), which reports that women within informal economies experience intensified climate vulnerability because of structural gender inequalities and unequal access to productive assets.

From the Capability Approach perspective, the findings demonstrate that climate-induced financial dependency and livelihood insecurity constrain individuals' freedoms to pursue valued livelihood opportunities and sustainable wellbeing outcomes (Robeyns & Byskov, 2021). The study therefore confirms that climate change within informal urban economies should be understood not merely as an environmental challenge, but also as a driver of economic insecurity, social vulnerability, and constrained human capability.

Survival-Based Adaptation and Constrained Resilience

The findings revealed that informal horticulture traders employ multiple adaptation strategies to cope with climate-related disruptions, including mobility, product diversification, participation in informal savings groups, flexible trading practices, and loss-minimisation techniques. Although these strategies reflect resilience and adaptive agency, most responses remained short-term, informal, and survival-oriented rather than transformative.

Mobility and flexible trading practices emerged as important coping mechanisms, with traders relocating between roadside spaces, residential areas, and alternative market locations depending on weather conditions and customer movements. Similar findings were reported by Finn and Cobbinah (2023) and Vy et al. (2025),

who observed that mobility has become a common adaptation strategy among informal traders responding to environmental uncertainty across African cities. However, while mobility supports livelihood continuity, it simultaneously exposes traders to regulatory insecurity, unstable customer flows, and occupational health risks associated with extreme temperatures.

Participation in informal savings groups (chilimba) also emerged as an important coping mechanism during periods of low sales and climate-related losses. These findings highlight the significance of social capital in sustaining informal livelihoods during periods of crisis and correspond with studies by Murendo et al. (2022), which found that informal savings systems strengthen short-term financial resilience among vulnerable urban populations. Nevertheless, the study revealed that such savings groups primarily function as coping mechanisms rather than pathways towards long-term economic transformation because low contributions and declining incomes limit meaningful capital accumulation.

The study further established that traders increasingly engage in product diversification and seasonal adjustment practices by shifting towards more durable products such as onions, potatoes, and groundnuts during periods of extreme heat. These findings align with Gebre et al. (2021), who found that livelihood diversification reduces exposure to climate-related risks among informal workers. Similarly, Phiri (2023) reported that informal traders in Zambia increasingly diversify products in response to supply chain disruptions and fluctuating demand.

Another important adaptation strategy involved rapid price reductions, sprinkling water on vegetables, and drying products for later resale in order to minimise spoilage losses. These practices indicate a shift from profit maximisation towards loss avoidance under conditions of recurring climate stress. Affognon et al. (2021) similarly observed that informal traders in sub-Saharan Africa increasingly rely on low-cost preservation methods where cold-storage technologies remain inaccessible.

The findings further revealed growing reliance on household labour, including children and youths, to sustain sales and reduce product losses. Although this strategy strengthened short-term household coping capacity, it also reflected deepening household vulnerability and risks of educational disruption among children. These findings suggest that climate-related livelihood insecurity may unintentionally contribute to intergenerational vulnerability and social inequality.

The Sustainable Livelihoods Framework explains that adaptation strategies are shaped by access to livelihood assets and institutional conditions (Scoones, 2022). However, because traders operate within environments characterised by weak infrastructure, poverty, and institutional exclusion, their adaptation strategies remain constrained and largely insufficient for long-term resilience building. Recent adaptation literature describes this condition as “constrained resilience,” where vulnerable groups continuously absorb shocks without achieving sustainable transformation (Eriksen et al., 2021).

From the discussion above, the findings demonstrate that while informal horticulture traders exhibit resilience, flexibility, and adaptive knowledge, long-term climate adaptation remains limited by structural inequalities, inadequate infrastructure, and financial exclusion. The study therefore highlights the need for integrated interventions focusing on financial inclusion, climate-resilient infrastructure, storage technologies, and institutional support systems.

CONCLUSION

The study findings revealed that traders experience climate change through erratic rainfall, prolonged dry spells, flooding, excessive heat, and unpredictable seasonal patterns that disrupt daily trading activities and horticultural supply chains. These climatic changes negatively affect the availability, quality, transportation, and preservation of produce, thereby increasing uncertainty and weakening business sustainability. The study further established that climate variability has significant economic and social consequences for traders and their households. Reduced income, commodity spoilage, declining customer turnout, and unstable market supplies contribute to food insecurity, limited access to healthcare and education, and increased household vulnerability. Women traders and low-income households were found to experience disproportionate impacts due to limited financial resources and caregiving responsibilities. Despite these challenges, traders employ various coping and

adaptation strategies, including product diversification, adjustment of trading hours, informal savings schemes, temporary relocation, and basic produce preservation methods. However, most adaptation practices remain short-term and constrained by inadequate infrastructure, limited institutional support, and restricted access to formal financial services. Generally, the study concludes that climate change is both an environmental and socio-economic challenge affecting informal urban livelihoods. Strengthening resilience among informal horticulture traders requires integrated interventions that combine climate-responsive infrastructure, financial inclusion, social protection, inclusive urban planning, and institutional support systems that recognise the importance of informal traders within urban food and livelihood systems.

RECOMMENDATIONS

The study recommends that local authorities, policymakers, financial institutions, and development partners should strengthen climate resilience within informal urban markets through integrated and inclusive interventions. Priority should be given to climate-responsive market infrastructure such as improved drainage systems, durable shelters, sanitation facilities, and storage spaces to reduce losses associated with flooding, heat, and spoilage of perishable produce. Financial inclusion initiatives, including affordable credit facilities, savings schemes, adaptation grants, and financial literacy programmes, should be expanded to improve traders' adaptive capacity and livelihood security, particularly among women and low-income households. The study further recommends strengthening social protection programmes, promoting climate-smart agricultural practices within horticultural supply chains, and enhancing collaboration among local authorities, trader associations, NGOs, and community organisations. Finally, informal traders should also be actively included in climate adaptation planning and urban governance processes to ensure that policies reflect their lived realities and livelihood needs. This study contributes to knowledge by extending climate change scholarship beyond agricultural production to include informal horticulture traders operating within urban markets.

Limitations of the Study

This study was limited to informal horticulture traders operating at Masala Market in Ndola District; therefore, the findings may not fully represent the experiences of traders in other urban markets or regions of Zambia where environmental, economic, and infrastructural conditions may differ. The qualitative research design provided detailed insights into participants' lived experiences but did not permit statistical generalisation to the wider population of informal traders. In addition, some participants may have experienced challenges recalling long-term climate patterns and livelihood changes, creating the possibility of recall bias and subjective interpretation of experiences. The study also focused primarily on traders and did not extensively incorporate perspectives from policymakers, agricultural producers, financial institutions, and market authorities whose insights could have strengthened understanding of institutional responses to climate-related livelihood challenges. Despite these limitations, credibility was enhanced through triangulation, prolonged engagement with participants, and careful thematic interpretation of narratives. Future research should undertake comparative studies across multiple urban markets in Zambia to generate broader understanding of climate vulnerability and adaptation among informal traders. Further studies should also examine gender dimensions of climate resilience, particularly among women-headed households and vulnerable groups within informal economies. Longitudinal research is necessary to assess the long-term impacts of climate variability on livelihoods, household wellbeing, and adaptation sustainability. Additionally, future studies should investigate the role of governance systems, climate policies, and institutional support mechanisms in strengthening resilience and inclusive urban development within informal market systems.

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