ISSN: 2958-2326

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Publisher's Home Page: https://ijcsacademia.com/

AFRICAN JOURNAL OF COMMERCIAL STUDIES

Research Paper | Peer Reviewed | Open Access

Exploration of the Effects of Poor Drainage Systems on Perishable Goods Trading in City and Soweto Markets in Lusaka, Zambia

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Article Info

Volume 7, Issue 3

Publication history:
Accepted on 19 February 2026;
Published: 29 April 2026

Key Words:
City Market, Drainage Systems, Flooding, Perishable Goods, Soweto Market, Zambia

Article Doi:
10.59413/ajocs/v7.i3.12

Abstract

This study explores the effects of poor drainage systems on perishable goods trading at City and Soweto Markets in Lusaka, Zambia. The study is motivated by persistent flooding and waterlogging in these markets, particularly during the rainy season, which disrupts trading activities, compromises the quality of perishable goods, and threatens trader livelihoods. The general objective of the study was to examine the effects of poor drainage systems on perishable goods trading in City and Soweto markets. The specific objectives were to examine how flooding affects perishable goods trading in City and Soweto Markets, to assess the condition of drainage systems in City and Soweto Markets, and to examine the coping strategies used by traders in response to flooding. An exploratory qualitative research design was adopted to provide an in-depth understanding of stakeholder experiences. Data were collected through semi-structured interviews, focus group discussions, and non-participant observations from purposively selected participants, including traders, customers, and officials from the Lusaka City Council and other relevant institutions. The data were analysed using thematic analysis to identify key patterns and relationships between drainage conditions and market outcomes. The findings reveal that poor drainage systems contribute to frequent flooding, which leads to spoilage of perishable goods, restricted customer access, and disruptions in daily trading activities. Traders reported that flooding creates unsanitary conditions, limits mobility within the markets, and negatively affects the quality and sale of goods. Although traders employ coping strategies such as raising goods and using protective materials, these measures are temporary and do not adequately address the underlying infrastructural challenges. The study further found that institutional responses are largely reactive and insufficient in preventing recurring flooding. The study concludes that poor drainage systems significantly affect perishable goods trading in Lusaka's major markets. It is therefore recommended that Lusaka City Council and relevant authorities prioritise the rehabilitation and maintenance of drainage infrastructure, strengthen waste management practices to prevent blockages, and incorporate trader experiences into market planning in order to enhance market resilience, protect livelihoods, and support urban food security.

1. Introduction and Background

Informal markets play a critical role in the economic and social fabric of urban centres in developing countries, particularly in Sub-Saharan Africa. In Zambia, markets such as Soweto Market and City Market in Lusaka serve as key distribution hubs for perishable goods and important sources of livelihood for a significant proportion of the urban population. These markets contribute to food security and local economic activity by providing access to affordable fresh produce. Despite their importance, they continue to operate under significant infrastructural constraints, particularly in relation to drainage systems.

Seasonal flooding and waterlogging remain persistent challenges in Lusaka's major informal markets. During the rainy season, inadequate and poorly maintained drainage systems result in stagnant water, mud, and waste accumulation within trading spaces. These conditions disrupt market activities, limit accessibility for traders and customers, and expose perishable goods to contamination and rapid spoilage. Given the sensitivity of goods such as vegetables, fruits, and fresh fish to environmental conditions, exposure to excess moisture significantly reduces their quality and shelf life, leading to economic losses for traders.

Existing studies have examined the relationship between urban infrastructure and economic activity, particularly in relation to flooding, sanitation, and market performance in developing contexts. Research by Gadaga et al. (2005) and Mwango et al. (2019) highlights the vulnerability of informal food markets to infrastructural deficiencies, demonstrating how poor environmental conditions affect food safety and trader income. However, much of this research adopts a broad perspective and pays limited attention to the lived experiences of traders and the micro-level economic impacts of drainage inefficiencies.

This study addresses this gap by providing a context-specific analysis of how poor drainage systems affect perishable goods trading in Lusaka's informal markets. It focuses on the relationship between drainage inefficiencies and market performance, particularly in terms of product spoilage, customer accessibility, and income stability. The study adopts a qualitative exploratory design, using semi-structured interviews, focus group discussions, and observations to capture the experiences and coping strategies of traders in Soweto and City Markets.

The findings indicate that drainage inefficiencies significantly disrupt market operations. Flooding contributes to product deterioration, reduces customer turnout, and leads to income instability, particularly during the rainy season. Although traders employ coping strategies such as elevating goods and temporary relocation, these measures are largely insufficient in addressing the structural nature of the problem. Institutional responses were also found to be predominantly reactive rather than preventive.

This study contributes to urban infrastructure and informal economy literature in three key ways. First, it extends existing research on urban flooding by demonstrating how drainage inefficiency operates as a direct economic shock mechanism in informal perishable goods markets, rather than merely a physical infrastructure challenge. Second, it contributes empirical evidence on micro-level trader responses, showing how coping strategies such as product elevation, relocation, and adaptive packaging function as short-term resilience mechanisms that do not resolve structural vulnerabilities. Third, the study advances understanding of the governance-infrastructure nexus by illustrating how reactive institutional maintenance practices intensify rather than mitigate market disruptions. By focusing on City and Soweto Markets in Lusaka, the study provides context-specific evidence from a rapidly urbanising African city, thereby enriching comparative urban studies on infrastructure inequality and informal market resilience.

The remainder of this paper is structured as follows. Section Two reviews relevant literature, Section Three outlines the methodology, Section Four presents the findings, Section Five discusses the results, and Section Six concludes the study and provides recommendations.

2. Literature Review

Urban drainage systems play a critical role in managing stormwater, preventing flooding, and maintaining the functionality of market infrastructure, particularly in environments where perishable goods are traded (Parkinson et al., 2007; Tucci, 2007). However, in many developing countries, rapid urbanisation, climate change, and inadequate infrastructure investment have led to inefficient drainage systems. These inefficiencies contribute to frequent flooding, infrastructure damage, and supply chain disruptions, particularly in informal markets where resources are limited. Seasonal variations further exacerbate these challenges, resulting in recurring flooding, water stagnation, and sanitation concerns.

Studies across different contexts highlight the structural drivers of drainage inefficiency. Urban expansion increases impervious surfaces, reduces natural water absorption, and places pressure on outdated drainage systems (Lapiński & Wiater, 2018; Limthongsakul et al., 2017). Comparative research from Scandinavia and Brazil identifies climate change, rapid urbanisation, and poorly designed sewer systems as key contributors to urban flooding (Torgersen et al., 2014; Junior et al., 2020). Despite growing recognition of these issues, drainage infrastructure remains under-prioritised in many developing regions, largely due to financial and institutional constraints (Assumpção et al., 2017; Novaes & Marques, 2022).

In the African context, rapid urban growth and inadequate planning have intensified flooding risks, particularly in informal settlements. Evidence from Nigeria, South Africa, and Mali demonstrates that poor drainage systems contribute to recurring floods, infrastructure damage, and economic losses (Chukwuocha et al., 2015; Malulu, 2016; Ongoma & Dike, 2023). At the same time, improvements in drainage infrastructure, such as those implemented in markets in Mali, have been shown to enhance market access and economic activity (Arcade, 2020). These findings suggest that drainage efficiency is closely linked to market performance and resilience.

Within Lusaka, drainage challenges are shaped by both physical and institutional factors. The city's geology, increasing rainfall intensity, and limited infrastructure development contribute to persistent flooding, while weak policy implementation and maintenance further exacerbate the problem (Tembo, 2025; Siame, 2023). Informal markets such as City and Soweto Markets are particularly vulnerable, as they operate within densely populated environments with inadequate infrastructure and waste management systems. Flooding in these markets disrupts trading activities, reduces accessibility, and increases spoilage of perishable goods.

From an economic perspective, poor drainage systems directly affect the performance and profitability of perishable goods traders. Flooding damages goods, disrupts supply chains, and reduces customer turnout, leading to significant revenue losses (Mwango et al., 2019; Siame et al., 2023). Evidence indicates that highly perishable goods such as vegetables, meat, and dairy products are most affected, with losses driven by exposure to moisture and inadequate storage facilities (Gadaga et al., 2005). Markets with relatively better drainage infrastructure, such as Woodlands Market, experience fewer disruptions and more stable trading conditions, highlighting the importance of infrastructure quality in shaping market outcomes.

Efforts to address flooding in Lusaka have included drainage unblocking, infrastructure upgrades, and broader flood mitigation strategies. However, these interventions remain largely reactive and insufficient to address the underlying causes of drainage inefficiency (Mundungani, 2025; Siame, 2022). While proposed measures such as drainage upgrades, improved water management, and flood resilience strategies have the potential to reduce flood impacts, their effectiveness is limited by inconsistent implementation, poor maintenance, and weak institutional coordination.

Regulatory frameworks, such as the Solid Waste Regulation and Management Act No. 20 of 2018, provide a legal basis for waste management and drainage protection. However, enforcement challenges and rapid urbanisation continue to undermine their effectiveness. Poor waste disposal practices contribute to blocked drainage systems, increasing the likelihood of flooding in major markets. Strengthening enforcement, improving institutional coordination, and enhancing public awareness are therefore critical for reducing drainage-related challenges.

Overall, the literature demonstrates that drainage inefficiency is a persistent challenge in urban markets, particularly in developing countries. While existing studies highlight the causes and impacts of flooding, there is limited focus on how these challenges specifically affect perishable goods trading at the market level. This study addresses this gap by examining the relationship between drainage systems and market performance in City and Soweto Markets in Lusaka, with particular emphasis on seasonal variations, economic impacts, and the effectiveness of existing mitigation measures.

3 Methodology

This study adopted a qualitative case study design focusing on two flood-prone markets, namely City Market and Soweto Market in Lusaka, in order to answer the research questions and address the study objectives. The qualitative approach was selected to enable an in-depth exploration of the complex relationship between seasonal variations, drainage system efficiency, and the performance of perishable goods markets.

The study employed methodological triangulation to enhance the validity and credibility of findings. As noted by Creswell (2009), triangulation involves examining a research problem from multiple data sources and perspectives to strengthen the robustness of qualitative inquiry. In this study, triangulation was achieved through the integration of interviews, focus group discussions, observations, and document analysis, including policy documents and

institutional reports.

While qualitative data may present inconsistencies across sources, these variations were not treated as weaknesses but rather as opportunities to uncover deeper insights into the complexity of drainage challenges and market dynamics. This approach allowed for a more nuanced and context-specific understanding of the problem.

The qualitative methodology was particularly appropriate for this study because it facilitated the exploration of participants' lived experiences, perceptions, and adaptive strategies dimensions that are often not fully captured through quantitative approaches. As emphasized by Creswell (2013) and Thorne (2016), qualitative research is well suited to investigating complex social phenomena within their natural settings. Furthermore, the study employed thematic analysis, guided by Braun and Clarke (2006), to systematically analyse patterns within the data, while insights from Guest, MacQueen, and Namey (2012) informed the data analysis process.

3.1 Research Philosophy and Approach

This study was guided by an interpretivist research philosophy, which focuses on understanding the meanings individuals attach to their experiences and social realities (Howell, 2013; Rashid, 2023). Interpretivism was appropriate for this study because it allowed the researcher to explore how traders, customers, and institutional actors perceive and respond to drainage-related challenges within Lusaka's informal markets.

Rather than seeking universal generalisations, the study aimed to generate context-specific insights into how seasonal flooding and drainage inefficiencies affect trading activities, economic outcomes, and coping mechanisms. The qualitative approach adopted in this study is therefore consistent with interpretivist principles, as it prioritises depth, meaning, and lived experience.

3.2 Research Design

The study employed an explanatory qualitative research design to examine how and why seasonal variations and drainage system efficiency affect the performance of perishable goods markets in Lusaka. According to Yin (2009), a research design provides the logical structure that links empirical data to research questions and conclusions, while Bryman (2008) emphasises its role in guiding data collection and analysis.

The explanatory design was particularly appropriate because the study sought to move beyond description and provide interpretive explanations of the causal relationships between drainage conditions, flooding, and market performance. As noted by Creswell (2014), qualitative explanatory designs are well suited to uncovering underlying mechanisms and contextual factors influencing social and economic phenomena.

This design also enabled the study to examine institutional responses, including the roles of the Lusaka City Council, the Ministry of Local Government and Rural Development, and the Disaster Management and Mitigation Unit (DMMU). By doing so, the study traced the link between governance practices, drainage infrastructure, and their effects on trader livelihoods.

3.3 Study Area

The study was conducted at City and Soweto Markets in Lusaka, selected for their large concentration of perishable goods traders and frequent flooding during the rainy season. Both markets experience persistent drainage problems, including blocked channels, waterlogging, and waste accumulation, making them suitable case studies for examining how drainage inefficiency affects market performance.

3.4 Target Population and Sample Size

The target population for the study comprised 330 individuals, drawn from five key stakeholder groups: Perishable goods traders (Soweto and City Markets), Market customers, Lusaka City Council officials, Ministry of Local Government and Rural Development officials and Disaster Management and Mitigation Unit (DMMU) officials.

A purposive sample of 30 participants was selected to ensure depth of analysis and alignment with qualitative research principles of thematic saturation. As noted by Morse (1994) and Guest et al. (2006), smaller samples are appropriate in qualitative studies where the objective is to achieve depth rather than statistical generalisation.

The sample was distributed as follows:

- 6 traders
- 6 customers
- 6 Lusaka City Council officials
- 6 Ministry officials
- 6 DMMU officials

This distribution ensured stakeholder diversity while allowing for in-depth exploration within each category.

3.5 Sampling Technique

The study employed purposive sampling, a non-probability technique used to select information-rich participants based on their relevance to the research objectives (Palinkas et al., 2015; Ahmad & Wilkins, 2024).

Participants were selected based on:

- Direct experience with flooding and drainage challenges
- Involvement in perishable goods trading
- Institutional roles related to urban infrastructure and market management

This approach was appropriate because it ensured that the data collected was context-specific and deeply informed, even though it does not allow for statistical generalisation. As highlighted by Hennink et al. (2017), purposive sampling is particularly effective in studies focusing on specialised knowledge and lived experience.

3.6 Data Collection Methods and Procedure

Data were collected using multiple qualitative methods to enhance triangulation and depth of analysis.

Semi-Structured Interviews

Semi-structured interviews were conducted with traders and institutional stakeholders using an interview guide consisting of open-ended questions and probing prompts. The interviews explored: Experiences of seasonal flooding, Effects on perishable goods (spoilage, losses), Customer accessibility and sales performance, Coping strategies and Institutional responses.

The flexible format allowed participants to provide detailed, context-specific responses.

Focus Group Discussions

Focus group discussions were conducted with traders to capture shared experiences and collective perspectives on drainage challenges. These discussions enabled interaction among participants and provided deeper insights into common patterns and coping strategies.

Non-Participant Observations

Non-participant observations were conducted to capture real-time physical conditions within the markets. An observation checklist was used to systematically record:

- Drainage infrastructure condition
- Blocked or damaged drains
- Evidence of waterlogging and flooding
- Waste accumulation
- Customer movement patterns

These observations provided visual and contextual evidence to support interview findings.

Document Review

Secondary data were collected through document analysis, including: Government reports, Policy documents, Institutional records, and Previous studies on drainage and market performance. The document review provided historical and policy context, strengthening the interpretation of primary data.

3.7 Data Analysis

All qualitative data were analysed using thematic analysis following Braun and Clarke (2006). The process involved transcription, familiarisation with the data, coding, theme development, review and refinement of themes, and interpretation of findings. A combined deductive–inductive approach was used to capture both predefined and emerging patterns. NVivo software supported systematic coding and data organisation.

3.8 Trustworthiness of the Study

The rigor of the study was ensured through the criteria of credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985).

Credibility was enhanced through triangulation and prolonged engagement. Transferability was ensured through detailed contextual descriptions. Dependability was supported by an audit trail and peer review. Confirmability was achieved through reflexivity and data triangulation.

3.9 Ethical Considerations

Ethical approval was obtained from the University of Zambia, and permission was granted by relevant authorities, including the Lusaka City Council, Ministry of Local Government, and DMMU. Participants were informed of: The purpose of the study, their right to withdraw and Confidentiality measures.

Anonymity was maintained through coding (e.g., p11). All data were securely stored in accordance with research guidelines.

4 Research Findings and Data Analysis

This section analyzes qualitative data from 30 interviews, focus groups, and observations at Lusaka's City and Soweto Markets. Thematic analysis reveals how seasonal variations and drainage inefficiency impact perishable goods performance, identifying themes like rainfall effects, infrastructure gaps, coping strategies, and market outcomes. Findings align with study objectives and literature on urban flooding's economic toll.

4.1 Demographics of Interviewees

Gender

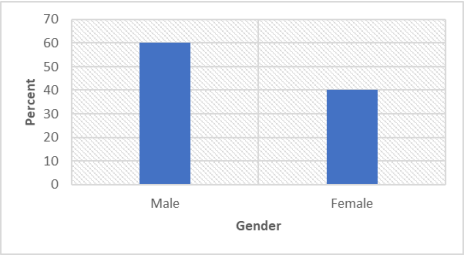

Figure 1: Gender Distribution

Out of the 30 interviewees, 18 (60%) were male and 12 (40%) females. This balanced representation captures gender-specific experiences in trading roles amid drainage challenges.

Occupation

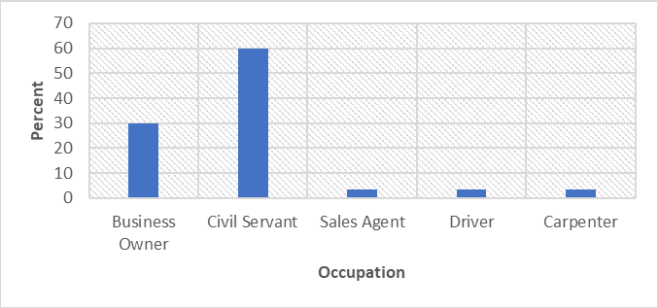

Figure 2: Occupation Distribution

Most (18, 60%) were civil servants; 9 (30%) business owners; others (3.3% each) sales agents, drivers, carpenters. Diversity enriches perspectives on market exposure beyond direct trading.

Educational Level

Tertiary-educated dominated: Bachelor's (33.3%), Diplomas (30%), Master's (20%), PhDs (6.7%), GCE (10%). This informs nuanced views on seasonal and drainage issues.

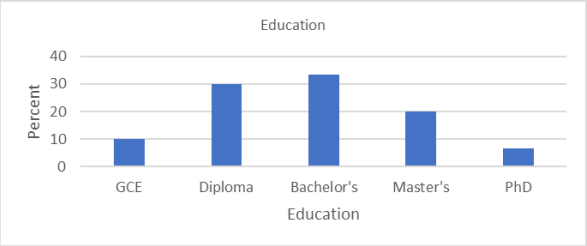

Figure 3: Educational Level

4.2 Thematic analysis

Thematic analysis involved transcription, coding (e.g., rainfall, blockages), categorization, and theme development tied to objectives. Below is a summary table of emergent themes and codes.

Main Themes That Emerged During Interviews

Table 1: Themes Derived from the Interviews

Theme	Code 1	Code 2	Code 3
Seasonal Variations	Heavy rainfall	Extreme heat	Unpredictable weather
Drainage System Efficiency	Blocked drains	Poor maintenance	Overflow during rains
Infrastructure Challenges	Inadequate stalls	Poor road networks	Lack of storage facilities
Market Sanitation	Waste accumulation	Flooding-induced contamination	Poor waste disposal
Perishable Goods Spoilage	Water damage	Heat exposure	Shortened shelf-life
Traders' Coping Strategies	Relocating stalls	Using raised platforms	Improvised packaging
Economic Implications	Loss of income	Price fluctuations	Increased operational costs
Institutional Support	Local council interventions	Government policy gaps	Lack of disaster preparedness
Health and Safety Concerns	Waterborne diseases	Slippery walkways	Exposure to unhygienic conditions
Customer Behaviour	Reduced market visits	Shifts in buying patterns	Preference for alternative markets

Triangulation of Themes and Their Codes

Theme One: Influence of Seasonal Variations on Market Operations

Heavy rainfall causes flooding and spoilage via poor drainage; extreme heat shortens shelf life for fish/vegetables, forcing price cuts. Unpredictable weather disrupts stock planning, amplifying income losses and infrastructural vulnerabilities.

Theme Two: Drainage System Efficiency and Flooding Mechanisms

Blocked drains (waste-clogged) and poor maintenance (cracked channels) cause overflows, turning markets unsanitary and halting trade. Reactive governance worsens rainy-season flooding, linking to governance failures in literature.

Theme Three: Infrastructure Constraints and Market Vulnerability

Inadequate stalls expose goods to runoff; poor roads delay supplies; no storage forces same-day sales at losses. These amplify seasonal/drainage risks, heightening vulnerability.

Theme Four: Market Sanitation and Environmental Conditions

Waste buildup, rain-mixed contamination, and drain disposal create odors/flies, slashing turnout. Sanitation-drainage interplay erodes confidence and boosts losses.

Theme Five: Perishable Goods Spoilage and Economic Implications

Perishable goods spoilage was identified as the most direct and economically significant outcome of seasonal variations and poor drainage conditions in City and Soweto Markets. Traders reported frequent losses of vegetables, fish, fruits, poultry, and groundnuts, particularly during heavy rainfall and extreme heat. Flooding caused waterlogging that damaged 20–50% of daily stock, especially for goods displayed at ground level, while high temperatures accelerated deterioration within hours due to lack of refrigeration. These conditions consistently reduced shelf life, compressed selling time, and forced price reductions, resulting in unstable incomes and lower profit margins.

Theme Six: Traders' Coping Strategies and Adaptive Responses

Relocation to dry spots, raised platforms, and plastic/ice packaging mitigate risks reactively but fail in severe floods, underscoring need for structural fixes.

Theme Seven: Economic Implications and Market Performance Outcomes

Income loss emerged as the most significant and recurring impact of seasonal variations and poor drainage in City and Soweto Markets. Traders reported frequent reductions in daily earnings due to spoilage, flooding, reduced customer turnout, and rising coping costs, with losses often reaching up to half of expected income during heavy rainfall or extreme heat. Price instability and additional operating expenses further reduced already narrow profit margins. Overall, the findings show that seasonal and infrastructural constraints generate predictable income volatility, embedding financial vulnerability into informal perishable goods trading in Lusaka.

Theme Eight: Institutional Support

Lusaka City Council acts reactively post-flood; policy-implementation gaps and no early warnings leave traders exposed. (Image: Blocked drains with debris highlight waste-maintenance failures.)

Theme Nine: Health and Safety Concerns

Stagnant water spreads diarrhea; slippery paths cause falls/goods damage; waste attracts pests, cutting sales and confidence.

Theme Ten: Customer Behaviour

Customer behaviour significantly shaped market performance in City and Soweto Markets, with adverse weather and poor drainage conditions directly reducing customer turnout. Traders consistently reported that flooding, muddy pathways, and stagnant water discourage market visits, leading to sharp declines in daily sales. In addition, customers tended to purchase smaller quantities during rainy periods, while extreme heat increased bargaining behaviour due to fears of spoilage. Some traders also reported customer migration to formal retail outlets such as supermarkets during severe flooding, driven by perceptions of better hygiene and accessibility.

Cross-Thematic Synthesis and Analytical Integration

Interlinked challenges form a cycle: seasonal rains exploit drainage/infrastructure gaps, spurring spoilage, coping, customer flight, and reactive support. Sanitation/blockages feedback into flooding. This perpetuates poor performance, aligning with literature on urban informality; interventions must target drainage, storage, and governance for resilience.

4.3 Discussion of Findings

This section discusses the study findings in relation to existing literature, the conceptual framework, and theoretical expectations. It interprets how seasonal variations, drainage efficiency, and infrastructure shape perishable goods traders at Lusaka's City and Soweto Markets, considering implications for handling, resilience, and planning.

Seasonal Variations and Drainage System Efficiency

Rainfall impact mediated by drainage condition blocked, shallow, poorly maintained channels. Consistent with Parkinson et al. (2007), Tucci (2007) on drainage for urban functionality; Andrés-Doménech et al. (2021), Lapiński & Wiater (2018), Limthongsakul et al. (2017) on climate-urban growth pressures. Flooding = infrastructure management failure.

Drainage Efficiency and Perishables Handling

Flooding conditions significantly alter how traders handle and store perishable goods. Traders adopt adaptive practices such as elevating goods, wrapping produce, relocating stalls, and accelerating sales. These strategies reflect short-term resilience mechanisms aimed at minimizing immediate losses.

Consistent with Gadaga et al. (2005) and Siame (2023), the findings show that infrastructure limitations directly shape post-harvest handling decisions. However, the study further demonstrates that these responses are reactive and constrained, reinforcing rather than resolving structural vulnerability within informal market systems.

Drainage Inefficiency and Market Disruption

Drainage failure was found to directly reshape the physical and economic functioning of markets. Blocked systems result in water accumulation, muddy trading environments, and restricted mobility for both traders and customers. This creates a chain of disruption: blocked drains → flooding → reduced accessibility → lower sales and competitiveness.

These findings align with Chukwuocha et al. (2015), who link inadequate urban drainage to reduced economic activity in informal settlements. However, this study extends existing literature by demonstrating how drainage inefficiency operates not only as an environmental issue but as a direct market disruption mechanism affecting daily trade flows and customer interaction patterns.

Seasonal Operational Challenges

Rainy: flooding, delays, low turnout, spoilage. Dry: heat accelerates fish/vegetable deterioration sans storage. Compounded by drainage/roads; amplifies seasonal risk beyond typical urban food systems.

Economic Impact on Traders

The study finds that poor drainage systems translate into significant and recurring economic losses. These include spoilage-related losses, reduced sales, price instability, and increased operational costs such as transport, packaging, and preservation materials.

Supporting Ongoma & Dike (2023) and Siame (2023), the findings confirm that drainage inefficiency creates irreversible economic shocks for traders. However, this study adds that these losses are structurally embedded and predictable, rather than occasional disruptions, indicating chronic vulnerability in informal market economies.

Institutional Responses and Maintenance Practices

Traders described institutional interventions as reactive only occurring after flooding damage rather than through preventive maintenance. This aligns with Siame (2022) and Novaes & Marques (2022) on weak financing, coordination, and policy implementation in developing cities. The findings show drainage inefficiency as both technical and governance failure; market performance depends on maintenance consistency, not just infrastructure existence.

Trader Coping Strategies and Market Adaptation

Traders adopt covering, temporary relocation, raised stock, and reduced volumes during rains practical resilience against shocks. However, these defensive strategies don't address structural vulnerability (Malulu, 2016; Gadaga et al., 2005). Coping strategies moderate losses but normalises fragile trading where adaptation burden falls on individuals, not institutions.

Market Planning, Infrastructure Layout, and Spatial Differentiation

Market layout significantly influences drainage impacts: City Market's lower enclosed sections retain water due to narrow drains/poor gradients; Soweto's open congested areas spread flooding via waste/shallow roadside drains. Drainage performance shaped by spatial design beyond rainfall/maintenance. Requires integrated planning stalls, runoff paths, waste points, gradients not isolated repairs.

Flood Mitigation Measures and Their Adequacy

Existing measures (periodic drain clearing) provide short-term relief but fail to address structural defects, poor gradients, waste blockages, and maintenance gaps. Consistent with Mundungani (2025) and Millennium Challenge Corporation (2020) on need for integrated planning. Lusaka requires preventive, system-oriented management over episodic response to reduce future vulnerability.

Conceptual Framework in Relation to Findings

Findings strongly support section 1 framework. Poor drainage and seasonal variations interact through flooding/waterlogging, causing spoilage, restricted movement, reduced customer turnout, and income loss. Institutional responses, waste management, and trader coping strategies moderate these effects but don't eliminate them. Confirms market performance results from environmental, infrastructural, institutional, and behavioural interactions. Further, the framework explains how environmental stress translates into economic disruption.

4.4 Limitations of the Study

Sampling Limitations: Purposive sample of 30 participants (traders, customers, stakeholders) from City and Soweto Markets limits generalisability to Lusaka's other markets and informal trading contexts. Though appropriate for qualitative exploration, sample size means loss estimates (K200–K500 daily, 20–50% spoilage) reflect participant experiences, not market-wide averages. Underrepresentation of less perishable goods traders (e.g., grains) may limit full spectrum of drainage impacts across product categories.

Measurement Limitations: Self-reported losses (K200–K500, 20–50% spoilage) unverified by records/audits. Recall bias for episodic events; observations missed peak rainfall.

Temporal Limitations: Data collection occurred during the dry season, potentially missing peak rainy season dynamics. Traders' descriptions of flooding impacts rely on memory of prior events rather than real-time observation, which may affect accuracy of frequency and severity estimates.

Scope Limitations: The study focused on trader perspectives and market-level drainage conditions, excluding systematic analysis of upstream supply chain effects (farmers, transporters) or downstream consumer behaviour. Customer avoidance patterns were noted anecdotally rather than through direct interviews, limiting understanding of demand-side impacts.

Mitigation and Implications: Data triangulation (interviews, observations, focus groups) and cross-verification across trader types/market zones mitigated limitations. Qualitative approach provides rich drainage-trading insights as hypothesis foundation, not definitive estimates. Future studies need larger probability samples and real-time rainfall loss measurement to confirm economic impact scale.

4.5 Novelty and Contribution

This study provides market-specific evidence linking drainage inefficiency to traders' daily handling practices, business decisions, and income outcomes in Lusaka's City and Soweto Markets. Unlike prior Zambia flooding studies, it reveals governance failures, weak infrastructure management, waste control gaps, and institutional shortcomings as key drivers of persistent losses beyond weather alone.

4.6 Implications for Policy and Practice

Market infrastructure planning must prioritize preventive drainage maintenance, waste management, and integrated design. Drainage is core to market productivity/food system resilience, not peripheral. Lusaka City Council should shift from reactive clean-up to routine maintenance, structural upgrades, and coordinated planning. Trader experiences provide direct evidence for infrastructure decisions, strengthening City/Soweto Market resilience and reducing trader losses.

5 Conclusions and Recommendations

5.1 Conclusion

The analysis demonstrates that poor drainage systems constitute a critical structural constraint on the performance of perishable goods trading in City and Soweto Markets. The evidence indicates that recurrent flooding and waterlogging, driven by inadequate drainage infrastructure, directly disrupt market operations and generate substantial economic losses. These disruptions are not isolated events but recurring seasonal shocks that consistently affect trading cycles. Traders experience significant spoilage of perishable goods, ranging between 20 and 50 percent per flooding incident, alongside reduced customer access and declining sales volumes. These operational constraints translate into daily income losses estimated between K200 and K500

for most affected traders. Collectively, these findings confirm that drainage inefficiency functions as a key transmission mechanism through which seasonal rainfall is converted into predictable economic losses, manifested through reduced market efficiency, price volatility, and heightened trader vulnerability.

In relation to the condition of drainage infrastructure, the findings reveal persistent systemic deficiencies across both markets. The drainage systems are characterised by blocked channels, structural deterioration, inadequate hydraulic capacity, and inconsistent maintenance regimes. However, the spatial manifestation of these challenges differs between the two markets. City Market is primarily affected by concentrated flooding in low-lying and enclosed sections where water accumulation is constrained by poor outflow capacity. In contrast, Soweto Market experiences more dispersed surface runoff patterns, exacerbated by high congestion levels, weak spatial planning, and insufficient gradient control. These observed conditions reflect deeper governance and institutional shortcomings, particularly the dominance of reactive maintenance approaches over preventive infrastructure management. As a result, drainage failures are continuously reproduced rather than systematically resolved, leading to persistent seasonal flooding.

With regard to traders' coping strategies, the findings indicate the presence of adaptive but constrained resilience mechanisms. Traders respond to flooding through temporary relocation of goods, elevation of stock using improvised platforms, use of protective coverings, reduction of inventory volumes during rainy periods, and distress pricing strategies aimed at accelerating sales. While these strategies demonstrate practical agency and adaptive capacity at the micro-level, they remain largely informal, resource-limited, and structurally insufficient. Importantly, they address the symptoms rather than the causes of drainage failure. Consequently, these coping mechanisms do not significantly alter the underlying vulnerability of traders, but instead reinforce a cycle of repeated exposure to seasonal shocks.

Overall, the study concludes that poor drainage systems in City and Soweto Markets systematically transform predictable seasonal rainfall into recurring economic shocks that destabilise informal market performance. This dynamic is compounded by weak institutional maintenance systems, inadequate waste management practices, and predominantly reactive governance responses. The interaction of these factors produces sustained disruptions in trading activities, erodes income stability, and reinforces structural vulnerability among perishable goods traders. In broader terms, these outcomes undermine the efficiency of urban food distribution systems and weaken livelihood resilience within Lusaka's informal economy.

5.2 Research Recommendations

The findings of this study point to the need for a shift from reactive infrastructure management to a preventive and integrated drainage governance framework. At the municipal level, the Lusaka City Council should institutionalise mandatory quarterly drainage maintenance schedules, with strategic prioritisation of pre-rainy season desilting and clearing of drainage channels in and around market areas. In parallel, accelerated implementation of the Stormwater Management Master Plan is essential, with a specific focus on rehabilitating non-functional drainage systems that directly affect high-density trading zones. To ensure sustainability, dedicated financial allocations should be made for drainage infrastructure upgrades that incorporate local soil characteristics, urban growth pressures, and increasing rainfall intensity associated with climate variability.

At the level of market governance, there is a need to integrate drainage planning into broader market infrastructure design and spatial organisation. This includes the construction of raised trading platforms in flood-prone areas, improved stall layout to facilitate water flow, and the redesign of drainage pathways to reduce blockage risk. Waste management systems also require strengthening through the establishment of clearly designated disposal points and strict enforcement mechanisms to minimise solid waste accumulation in drainage channels. In addition, early-warning communication systems should be introduced to enable timely dissemination of flood risk information, allowing traders to safeguard perishable stock before flooding events occur. Routine participatory infrastructure assessments involving both authorities and traders should further be institutionalised to support early detection and timely response to drainage failures.

At the micro-level, traders should be encouraged to adopt more coordinated coping strategies that reduce individual exposure to risk. Collective mechanisms such as shared protective infrastructure, jointly developed raised platforms, and cooperative resource pooling can reduce the cost burden of adaptation. In addition, diversification of stock during high-risk rainy seasons should be promoted to reduce reliance on highly perishable commodities that are more vulnerable to flooding and heat exposure. Strengthening trader associations is also critical, as it enhances collective bargaining power and improves institutional engagement with municipal authorities on infrastructure planning and service delivery.

From a broader policy and institutional perspective, stronger coordination is required between the Lusaka City Council, the Disaster Management and Mitigation Unit, and relevant waste management agencies to ensure consistent drainage maintenance and effective response coordination. Furthermore, integrated urban market resilience frameworks should be developed, incorporating emergency support mechanisms such as micro-credit facilities, temporary relief interventions, and targeted recovery support during extreme flood events. Importantly, accountability systems must be strengthened to ensure a transition from reactive clean-up operations to structured, preventive drainage governance.

5.3 Suggestions for Further Research

Future research should prioritise large-scale quantitative studies across Lusaka's markets to generate statistically robust estimates of the economic costs associated with drainage inefficiency. Longitudinal research designs would also be valuable in assessing how improvements in drainage infrastructure influence market performance, trader income stability, and resilience over time. Comparative urban studies across different Zambian cities could further contribute to identifying scalable and context-sensitive drainage solutions applicable to diverse informal market environments.

In addition, future studies should explore the upstream and downstream effects of market flooding within the broader food supply chain, including impacts on farmers, transporters, and end consumers. There is also need for integration of climate modelling approaches to forecast future drainage capacity requirements under changing rainfall regimes. Finally, institutional performance assessments of agencies responsible for drainage governance should be conducted using implementation-focused evaluation frameworks to identify systemic bottlenecks and enhance service delivery effectiveness.

Declaration of Competing Interests

The author(s) declare that they are not aware of any competing financial interests or personal relationships that may have influenced the work described in this document.

Funding

This research did not receive specific grants from any public, commercial, or non-profit sector funding bodies.

Acknowledgements

The author expresses sincere gratitude to Dr. Joseph Phiri for his academic supervision, guidance, and valuable insights throughout the development of this study.

Ethical considerations

The article followed all ethical standards appropriate for this kind of research.

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