Internal Migration, Climate Adaptation, and Food System Resilience in Namibia

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Abstract

As one of sub-Saharan Africa's most arid countries, Namibia serves as a crucial example for studying the interactions between climate vulnerability, migration, and food systems. This study investigates how internal migration flows to Windhoek and northern towns (Oshakati, Ongwediva, Ondangwa) transform urban food networks while creating new patterns of risk and adaptation. Through household surveys, policy analysis, and stakeholder interviews, we uncover a paradox: despite escaping rural climate stressors, migrants often encounter new vulnerabilities such as precarious employment, inadequate housing, and unstable food access. However, they develop sophisticated adaptive strategies that span urban-rural divides: maintaining rural agricultural production through family networks, adapting urban farming to water scarcity, and creating informal food distribution systems connecting rural and urban markets. These resilience mechanisms face mounting pressure from intensifying droughts and institutional constraints. While remittance economies and informal networks help buffer shocks, climate impacts compound vulnerabilities across migrant and host populations. The study demonstrates how formal and informal systems mediate these challenges. We recommend policies that recognise internal migration as a climate adaptation strategy, strengthen urban-rural food linkages, and improve urban food governance. The Namibian case offers valuable lessons for other arid, urbanizing African regions facing similar climate-migration-food system dynamics.

Keywords

migration-driven urbanization, informal food economies, climate vulnerability, urban resilience, policy synergies

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Cover Image

Informal vendors operating outside a Shoprite supermarket in Oshakati, Northern Namibia. Photo credit: Maria Salamone

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Introduction

Combined scientific and political efforts have converged on a growing consensus regarding the conceptual frameworks and impacts of climate change on migration and food security (Dasgupta & Robinson, 2022; Escribano & Pons Ganddini, 2024). Often, climate change has been regarded as the cause, with migration and food security considered as outcomes (Adjei & Oyebamiji, 2024; Gebeyehu et al., 2025). In some cases, food security has been seen as a mediating factor, or intermediary outcome, resulting in migration as a coping strategy for climate adaptation (Pickson & Boateng, 2022). Changing climatic conditions and anomalies can particularly affect the livelihoods of people living in rural and agriculturally dependent areas and pose threats to food security, water availability, and health (Adjei & Oyebamiji, 2024; Gebeyehu et al., 2025; Pörtner et al., 2022). When other adaptation options become limited, households may choose or be forced to migrate in response to increasing livelihood insecurity (Escribano & Pons Ganddini, 2024; Hunter et al., 2015; McLeman & Smit, 2006; McLeman & Hunter, 2010).

Some studies have shown that aridity levels, other climate change impacts and migration flows are correlated. For example, Hoffman et al. (2024) examined how increased aridity and drought influence internal migration using novel census-based data for 72 countries covering the period 1960-2016. They found that drought and aridity have a significant impact on human mobility, especially in the hyper-arid and arid areas of Southern Europe, the Middle East and North Africa, and Southern Asia. Accordingly, other recent studies (Czaika & Weisner, 2025; Flahaux & Haas, 2016) indicate that migration aspirations are particularly pronounced in rural areas, where livelihoods face increasing pressures from land degradation and climate change (Hoffman et al., 2024). This is especially critical in sub-Saharan Africa, where severe land degradation has been linked to higher rates of migration (Abel et al., 2022). Empirical evidence also suggests that climate-induced migration is more likely to involve short-distance moves within national borders rather than international relocation (Abel et al., 2022).

Understandably, migration is shaped by a complex interplay of economic, political, social, and environmental factors. Although the multicausal nature of migration is widely acknowledged, significant gaps remain in understanding how these drivers interact and jointly influence human mobility. This issue is particularly pertinent in the African context, where communities face overlapping challenges affecting livelihoods, security, and well-being (Czaika & Weisner, 2025; Hoffmann & Zens, 2024). The evidence regarding the influence of environmental and climatic factors on migration is mixed: adverse climatic conditions may trigger migration in some contexts but constrain it in others (Borderon et al., 2019; Cattaneo et al., 2019; Hoffmann et al., 2020). Moreover, many of these studies focus on a limited number of countries or specific regions, restricting the generalizability of their findings. Reviewing this evidence in sub-Saharan Africa, particularly with a focus on Namibia, will help fill the gap in this literature.

As one of the most arid countries in sub-Saharan Africa, Namibia faces profound challenges due to climate change, including prolonged droughts, erratic rainfall, and rising temperatures (Kapuka & Hlasny, 2020; Shikangalah, 2020). These environmental stressors disproportionately affect rural livelihoods, particularly agriculture, which is a cornerstone of food security and economic stability for many Namibians (Siririka et al., 2025; Steenkamp & Thebuho, 2022). Climate-induced migration has emerged as a critical adaptation strategy, with rural populations increasingly relocating to urban centers such as Windhoek, Oshakati, Ongwediva, and Ondangwa (Moses, 2022). This migration is reshaping urban food systems and creating vulnerabilities for both migrants and host communities.

The interaction between migration, climate adaptation, and food system resilience in Namibia thus forms a complex paradox (Escribano & Pons Ganddini, 2024). On one side, migration offers an escape from rural climate stressors; on the other, it often exposes migrants to new urban vulnerabilities, including precarious employment, inadequate housing, and unstable food access. Despite these challenges, migrants develop innovative adaptive strategies, including maintaining rural agricultural ties through family networks, engaging in urban farming under water-scarce conditions, and establishing informal food distribution systems that bridge rural and urban markets. These strategies demonstrate the resilience of migrant communities but also highlight the mounting pressures from intensifying climate impacts and institutional constraints.

The main objective of this paper is to investigate how climate-induced migration in Namibia—driven by environmental stressors such as droughts and erratic rainfall—reshapes urban food systems and influences the resilience strategies of migrant households, particularly in cities like Windhoek and the northern towns of Oshakati, Ongwediva, and Ondangwa. Aligned with the literature on environmental migration, informal economies, and adaptive capacity, the study examines the dual role of migration as both an adaptation strategy and a source of new vulnerabilities, exploring how migrants navigate urban food insecurity through informal trading, rural-urban linkages, and reciprocal food and cash transfers, while also assessing the institutional and policy gaps that constrain long-term resilience in the face of climate and socio-economic pressures.

Literature Review

The relationship between climate change and migration has been extensively studied, especially in the context of sub-Saharan Africa. Research indicates that environmental stressors, such as droughts and desertification, are significant drivers of rural-urban migration (Black et al., 2011). In Namibia, where over 70% of the population depends on rain-fed agriculture, climate variability severely disrupts rural livelihoods, forcing many to seek alternative opportunities in urban areas (Newsham & Thomas, 2011). This aligns with the "environmental migration" theory, which posits that climate-induced resource scarcity can trigger displacement (McLeman & Hunter, 2010). However, migration is not

merely a passive response to climate stress; it is also an active adaptation strategy of affected households and communities. Studies highlight the agency of migrants in navigating environmental challenges, such as maintaining rural farming activities through remittances and familial labour exchanges (Tacoli, 2011). In Namibia, this is evident in the way migrants sustain agricultural production in their home regions while simultaneously engaging in urban livelihoods, creating a hybrid system of resilience.

The rapid urbanization of Namibian cities has profound implications for food systems. As migrants settle in urban areas, they contribute to the growth of informal food economies, which often serve as critical safety nets for low-income populations (Crush & Frayne, 2011). Informal markets, street vending, and urban agriculture become essential avenues for food access, particularly for migrants who face employment instability. Urban food systems in Namibia are characterised by a duality: formal markets dominated by supermarkets and informal food networks that rely on rural-urban linkages. Research by Peyton et al. (2015) demonstrates that informal food systems are more adaptable to shocks, such as price volatility or supply disruptions, due to their decentralised nature. However, these systems are also vulnerable to climate-related risks, such as water scarcity for urban farming or disruptions in rural food supply chains.

The concept of resilience is central to understanding how migrant communities navigate climate and food system challenges. Resilience theory emphasises the capacity of systems to absorb shocks and adapt to changing conditions (Folke, 2006). In Namibia, migrants employ a range of adaptive strategies to enhance food security, including:

1. *Urban agriculture:* Despite water scarcity, migrants engage in small-scale farming in peri-urban areas, often using innovative techniques like drip irrigation or drought-resistant crops (Dhillon & Moncur, 2023).

2. *Rural-urban linkages:* Migrants maintain strong ties to rural areas, facilitating the flow of food and remittances. These linkages act as shock absorbers during periods of climate stress (Tacoli, 2011).

3. *Informal food networks:* Migrants create and participate in informal distribution systems, such as selling home-grown produce or trading rural-sourced goods in urban markets (Crush & Frayne, 2011).

While these strategies demonstrate resilience, they are not without limitations. Institutional barriers, such as a lack of land tenure for urban farmers or inadequate policy support for informal markets, often constrain their effectiveness (Haysom & Tawodzera, 2018). Effective policy responses to climate migration and food system resilience require a nuanced understanding of both formal and informal systems. Current policies in Namibia often overlook the role of migration as an adaptation strategy, focusing instead on rural development or emergency relief (Newsham & Thomas, 2011). This gap highlights the need for integrated approaches that recognise urban-rural interdependencies and support informal food economies.

Moreover, existing research provides valuable insights into climate migration and food systems, but gaps remain. Few studies explore the vulnerability dimensions of these dynamics, particularly how migrants navigate food insecurity and employment precarity (Gebeyehu et al., 2025; Pickson & Boateng, 2022). There is also limited empirical evidence on the long-term sustainability of informal food networks under escalating climate pressures (Mulwa & Visser, 2020). This study aims to address these gaps by examining the lived experiences of migrants in Namibia and the institutional frameworks that shape their resilience strategies.

The literature underscores the complex relationship between climate change, migration, and food systems in Namibia. Migration acts as both a survival strategy and a source of new vulnerabilities, while informal food networks and urban-rural linkages play a critical role in building resilience. However, systemic challenges, including institutional constraints and intensifying climate impacts, threaten these adaptive mechanisms. Addressing these challenges requires holistic policies that bridge formal and informal systems, support migrant communities, and enhance food system resilience. The Namibian case offers broader lessons for arid, urbanizing regions facing similar dynamics, emphasizing the importance of context-specific, inclusive approaches to climate adaptation and food security.

Conceptual Framework

A robust conceptual framework is necessary to understand how migration serves as both a response to climate stress and a driver of urban food system transformations. This study is grounded in an integrated conceptual framework that examines the compound and heterogeneous interlinkages between climate-induced migration, urban food systems, and resilience in Namibia. It draws upon three key theoretical domains: environmental migration and climate adaptation, urban food systems and informal economies, and resilience and adaptive capacity. Together, they can provide a comprehensive understanding of how internal migration reshapes food security in Namibia's rapidly urbanizing landscape.

Environmental Migration and Climate Adaptation

Environmental stressors, particularly climate variability, deeply influence migration in Namibia. The Environmental Push-Pull Theory (Hugo, 1996) helps explain these dynamics: droughts, land degradation, and crop failures act as "push" factors, driving rural populations toward cities, while urban employment opportunities serve as "pull" factors. However, migration is not merely a reactive response—it is increasingly recognised as a deliberate adaptation strategy (Black et al., 2011). Rather than signalling failure, migration allows households to diversify livelihoods, reducing dependence on climate-vulnerable agriculture. Yet, not all populations can migrate. The concept of "trapped populations", first introduced in the 2011 Foresight Report, describes those who

lack the financial or social capital to leave high-risk rural areas (Ayeb-Karlsson et al., 2018). Conversely, migrants who relocate to cities often encounter "urban traps"—precarious employment, inadequate housing, and food insecurity—that limit their ability to thrive. This duality underscores the need to examine migration not just as movement, but as a complex livelihood strategy with varying outcomes.

Urban Food Systems and Informal Economies

Namibia's urban food systems are characterised by a dual structure: formal systems, including supermarkets and government food programs, coexist with informal food networks, such as street vending and rural-urban trade. Informal markets play a crucial role in migrant food security, acting as flexible and accessible sources of affordable nutrition (Crush & Frayne, 2011). These markets are particularly vital for low-income migrants who face barriers to formal employment and stable food access.

A key aspect of these systems is their reliance on urban-rural linkages. Migrants maintain strong ties to their rural origins, facilitating the flow of food, remittances, and labour between regions (Tacoli, 2011). These connections enhance resilience by allowing households to draw on both urban and rural resources during crises. However, this model also raises questions about food sovereignty—the degree to which communities control their food production (Byaruhanga & Isgren, 2023). While Namibia's migrants engage in urban farming and informal trade, their access to land and water remains precarious, limiting their ability to achieve true food self-sufficiency.

Resilience and Adaptive Capacity

Resilience theory (Folke, 2006) provides a valuable perspective for understanding how migrant households navigate shocks such as droughts and economic instability. At its core, resilience refers to a system's ability to absorb disturbances while maintaining essential functions. For migrants, resilience often hinges on livelihood diversification (Ellis, 2000)—combining urban wage labour, rural farming, and informal trade to spread risk. However, adaptive strategies are frequently constrained by institutional barriers. Weak urban governance, lack of land tenure, and inadequate support for informal markets (Haysom & Tawodzera, 2018) hinder migrants' ability to build long-term food security. For example, urban agriculture—a key adaptive practice—is often illegal or unsupported, leaving migrants vulnerable to eviction and crop failure. These structural obstacles underline the need for policies that recognise and strengthen informal resilience mechanisms.

Integrated Conceptual Model

The guiding conceptual framework used here is a dynamic model that maps the intricate interplay between climate change, migration, and food system resilience. It begins with climate stressors like droughts and erratic rainfall disrupting rural livelihoods, forcing households to reassess their survival options. These environmental pressures interact with socioeconomic push-pull factors to shape migration decisions, whether families choose to relocate permanently, become trapped in vulnerable rural areas, or adopt circular migration patterns. Upon arriving in urban areas, migrants encounter new challenges, including precarious employment and limited access to affordable, nutritious food. In response, they develop various adaptation strategies such as sending remittances to maintain rural farming operations, engaging in urban agriculture, or participating in informal food economies. However, these coping mechanisms face dual pressures from institutional gaps in urban policy and intensifying climate impacts, creating feedback loops that either strengthen or weaken overall resilience. The model's final outcomes bifurcate between positive adaptation - characterised by stable food access and livelihood diversification - and maladaptation scenarios where households become trapped in cycles of poverty and dependence on fragile food systems. This framework highlights how climate-induced migration both responds to and reshapes food security dynamics across rural and urban spaces. It also highlights the cyclical nature of these interactions. For instance, while remittances sent to rural areas may enhance agricultural productivity, urban food insecurity can persist if migrants earn insufficient incomes. Similarly, informal food networks may provide temporary solutions but remain vulnerable to climate shocks and policy neglect.

Another important phenomenon is informal trading, which serves as an adaptive survival strategy for migrant households in urban areas like Windhoek. This aspect is explored through the combined conceptual frameworks that involve urban food systems, informal economies, and resilience and adaptive capacity. These frameworks illustrate how informal economies function as both a coping mechanism and a potential pathway to long-term food security—though their sustainability depends on broader systemic support and climate adaptation policies.

Materials and Methods

Data Sources

This study consolidates key findings of selected studies that were conducted between 2016 and 2022 in Windhoek, Namibia, that focused on urban food security, supermarket revolution and informal traders. In this context, we isolate households that were in informal settlements, from which most participants were drawn. Studies included here are the Hungry Cities Partnership (HCP) Survey in Windhoek (2016) (Crush et al., 2019; Nickanor et al., 2019a), the Consuming Urban Poverty Survey (2018) in secondary cities conducted in Oshakati-Ongwediva-Ondangwa (OOO) (Kazembe et al., 2022; Nickanor et al., 2019b), and the Informal Traders Survey (2019) in Windhoek (Crush et al., 2023; Nickanor et al., 2021a). These three cross-sectional and representative surveys targeted traders or households in the study area, with participants selected using a cluster stratified survey design. More details on these surveys can be found in the above-cited study reports. We supplemented these materials with key informant interviews (KII) carried out for the *State of City Food System Report – Windhoek* (Crush et al., 2024), and the Nourishing Spaces Study (Nickanor et

al., 2021b). Interviews were conducted in 2019 with policymakers in various ministries and the City of Windhoek for these studies. Further, secondary data on climate change (Kapuka & Hlasny, 2020) and migration patterns from the 2023 Namibia Population and Housing Census (NSA, 2023) have been used for the analysis.

Research Questions

This paper is structured to explore the dynamics of climate-induced migration, urban adaptation, and resilience in the form of urban food security. The following questions were analyzed, which guided our review of empirical research, policy analysis, or interdisciplinary studies on climate change-migration-food security linkages in Namibia.

1. *Climate Stressors and Rural Disruption:* How do droughts and erratic rainfall alter rural livelihood strategies, and what specific thresholds trigger migration decisions?

2. *Migration Decisions:* What are the dominant push-pull factors (e.g., economic, environmental, social) influencing households to migrate, stay, or adopt circular migration? How do gender, age, or wealth disparities shape differential migration outcomes (e.g., trapped populations vs. seasonal migrants)?

3. *Urban Arrival and Precarious Living:* What are the immediate barriers migrants face in securing stable employment and affordable food in urban areas? How do urban informal settlements exacerbate or mitigate vulnerabilities for climate-displaced populations?

4. *Adaptation Strategies:* How effective are hybrid strategies (e.g., remittance-supported rural farming, urban agriculture) in sustaining food security for migrant households?

5. *Informal Food Network and Kinship Systems:* What role do informal food networks and kinship systems play in bridging gaps left by formal institutional support?

6. *Institutional and Climate Pressures:* How do policy gaps (e.g., lack of social protection, urban planning failures) amplify climate-induced vulnerabilities for migrants?

7. *Resilience Outcomes:* How can institutions better support migrant households to break cycles of poverty and build long-term resilience?

Analysis

Data analysis and interpretation followed the same pattern as that of the study objectives. For example, the analysis proceeded by generating bar charts and tables to show the frequency distributions of traders' characteristics in the informal economy. These were then cross-tabulated with some demographic variables, such as age and sex. Next, the researchers addressed objectives 2 and 3, which examine the vulnerabilities and risks of trading as an adaptive survival strategy amid employment precarity among migrants. Similarly, responses for each variable under each objective were analyzed. In all objectives, chi-square analysis of association was used to test differences or equality in the bivariate analysis. After the descriptive and bivariate analyses, some confirmatory analyses using regression analysis and profile analysis were performed, specific to the research objectives.

Results

Climate Change Vulnerability in Namibia

Namibia's climate is classified as dry to arid. The country has experienced rising average surface temperatures since 1901, and these are projected to increase, consistent with global trends. Climate change is expected to have significant impacts on key economic sectors and livelihoods within the country. Due to a combination of political, geographic, and social factors, Namibia is recognised as vulnerable to climate change impacts, ranking 104th out of 181 countries in the 2020 ND-GAIN Index (Kapuka & Hlasny, 2020). The ND-GAIN or Notre Dame Global Adaptation Index measures a country's exposure to climate impacts alongside its capacity to respond and adapt (Notre Dame Global Adaptation Initiative, n.d.). Staple crop production is expected to decline, and rangelands deteriorate, thereby affecting livestock production and rural livelihoods and incomes. Furthermore, climate change trends in Namibia are projected to increase the risk and severity of extreme events and natural hazards, such as heat waves, droughts, floods, and wildfires. Figure 1 illustrates how the country has endured various natural hazards, including droughts, floods, landslides, epidemics, and storms (top panel), with maps (lower panel) depicting regional risks for river and urban flooding, water scarcity and wildfires. While flooding is the most common hazard, drought remains the most devastating for Namibia in terms of people affected and damage costs. Over 2 million people have been affected, and previous droughts have cost the country an estimated $175 million each year. Similarly, flooding frequency has increased in recent years and is estimated to impact 70,000 people annually (Figure 1).

Urbanisation in Namibia: The Growing Shift from Rural to Urban Living

Climate change has become an increasingly important factor driving migration patterns across Namibia. Faced with recurring droughts, erratic rainfall patterns, and extreme weather events, particularly in the northern and central regions, as depicted below, the environmental changes have forced many rural communities to migrate in search of better living conditions and more reliable sources of water and food. A key demographic trend in Namibia is the ongoing movement of people from rural areas to urban centres, driven by the pursuit of better employment, healthcare, education, and overall living standards. According to the 2023 census, urbanization is accelerating, with most Namibians now living in cities. Major urban hubs, including Windhoek, Walvis Bay, Swakopmund, and Rundu, have experienced notable population growth due to this trend. As the capital, Windhoek remains the largest and most populous city, attracting a significant share of the country's residents. However, this rapid urbanization has strained housing, infrastructure, and public services, highlighting the need for effective urban planning to manage the expanding population sustainably (Figure 2).

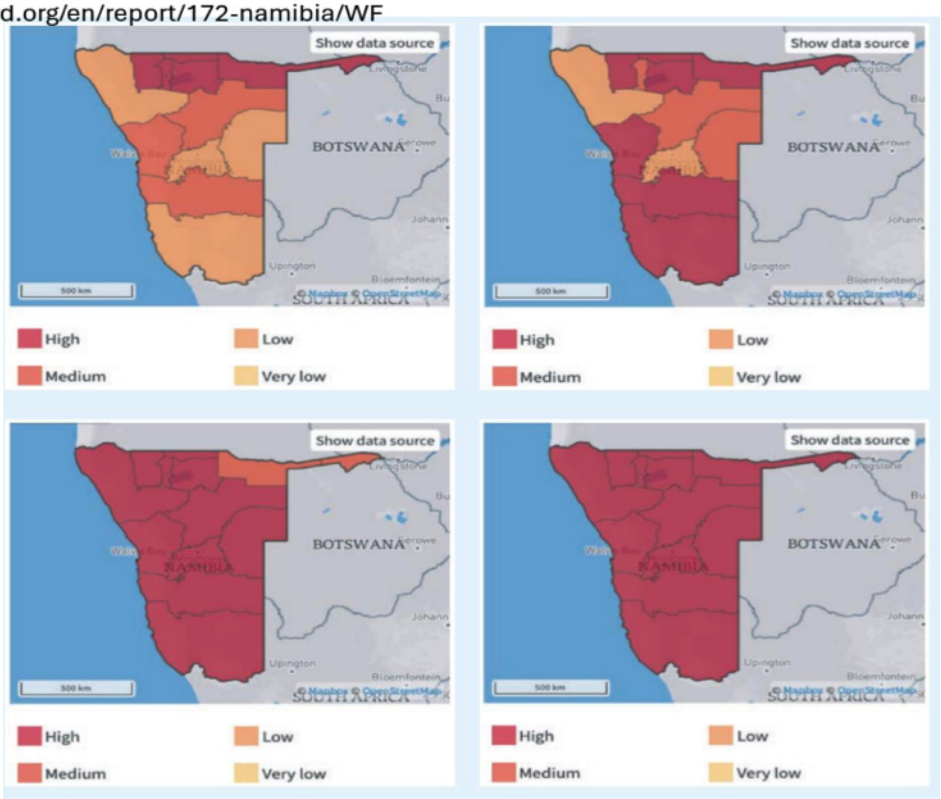
Figure 1: Impacts of Climate Change in Namibia, 1900-2020

Natural Hazard 1900–2020	Subtype	Events Count	Total Deaths	Total Affected	Total Damage ('000 USD)
Drought	Drought	8	0	2,143,200	175,000
Epidemic	Bacterial Disease	4	47	1,029	0
	Parasitic Disease	2	234	12,098	0
	Viral Disease	1	10	47	0
Flood	Flash Flood	1	2	12,000	20,490
	Riverine Flood	11	262	1,082,450	20,490

**https://thinkhazard.org/en/report/172-namibia/WF

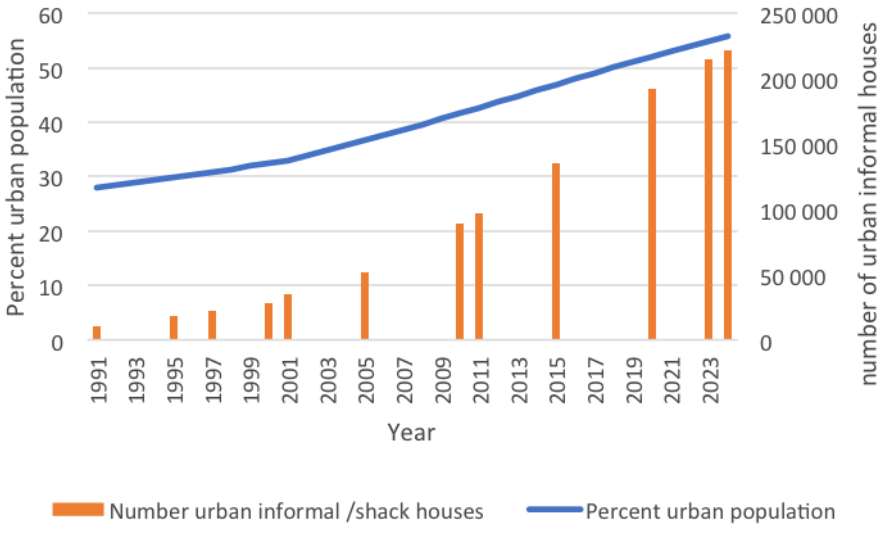
Key**

- **Risk of River Flood (upper left);**
- **Risk of Urban Flood (upper right);**
- **Risk of Water Scarcity (lower left);**
- **Risk of Wildfires (lower right)**



Source: Kapuka & Hlasny (2020)

Figure 2: Changing Patterns of Urban Population and Increasing Informal Housing in Namibia, 1991-2024



Source: World Bank (2025)

Table 1: Internal Out-Migration to Urbanized Regions (Erongo, Khomas, Oshana) in Namibia, 2023						
Originating Region	**Short-term migration to**			**Life-time migration to**		
	Erongo	**Khomas**	**Oshana**	**Erongo**	**Khomas**	**Oshana**
//Kharas	633	1,140	550	4,769	7,900	1,324
Erongo	-	2,630	1,064	-	11,942	2,904
Hardap	721	1,764	156	5,648	12,086	546
Kavango East	445	1,181	172	3,831	9,858	630
Kavango West	292	941	96	2,339	7,072	365
Khomas	2, 811	-	2,118	17,685	-	7,113
Kunene	882	1,082	340	7,740	5,328	1,120
Ohangwena	1,563	4,256	3,503	20,374	44,629	21,640
Omaheke	362	1,695	113	2,639	11,946	345
Omusati	1,540	3,718	3,556	20,444	45,776	20,676
Oshana	1,040	2,397	-	11,644	21,794	-
Oshikoto	1,209	2,693	3,295	12,449	25,440	15,069
Otjozondjupa	1,455	2,624	695	9,732	14,929	1,897
Zambezi	169	659	194	1,804	6,245	1,002
Source: Namibia Statistics Agency (2024)						

Regional Migration Patterns: Disparities in Population Distribution

Beyond rural-to-urban migration, internal movement between Namibia's regions has also shaped demographic changes. Census data indicate that Khomas, Erongo, and Oshana regions have seen the highest influx of migrants, primarily due to their stronger economies and better infrastructure (Table 1). Windhoek's location in Khomas Region has made it a major destination, whereas areas like Zambezi and Kunene have recorded lower migration rates. This uneven population distribution has created challenges, with high-growth regions facing increased demand for resources and services. Addressing these disparities will require targeted development strategies to promote balanced growth across the country.

The 2023 census offers valuable data on how climate-induced migration is transforming the demographic and socio-economic patterns of migrants in Namibia. Figure 3 illustrates the proportion migrating by age and sex for both short-term and lifetime migrants, as well as their education levels and occupations by sex. Figure 3.1 shows that lifetime migration peaks between ages 20–34, affecting over 60% of individuals, with women slightly more mobile than men. Short-term migration remains below 10% across all ages but rises modestly in early adulthood. By marital status, never-married individuals—especially men—exhibit the highest short-term migration, while separated and widowed persons record the lowest (Figure 3.2). Education shows a clear gradient: migration increases with schooling, reaching its highest among those with complete secondary or tertiary education, and lowest among those with no or incomplete primary education. Gender gaps persist but narrow at higher education levels (Figure 3.3). This contrasts with what is observed among those with no formal education or incomplete primary schooling, where it was established that more males migrate. Occupational patterns reveal that short-term migration is most common among those in elementary, clerical, and service jobs, while agricultural and craft workers are the least mobile. Men generally migrate more than women, though female clerks and service workers show comparable or slightly higher rates (Figure 3.4). Overall, migration is concentrated in young adulthood, facilitated by higher education and certain occupations, and constrained by marital commitments and less mobile forms of work.

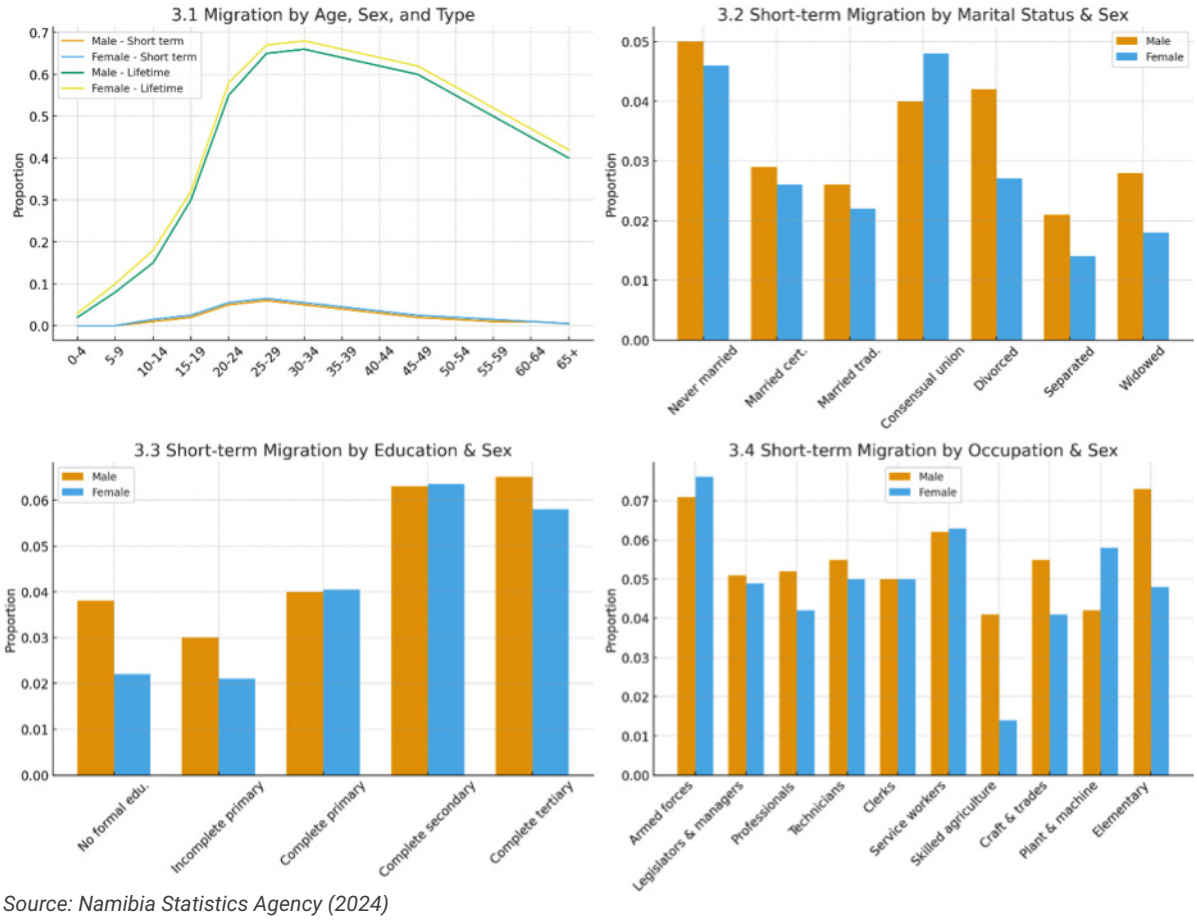
Survivalist Informal Trading and Entrepreneurship

Studies have shown that migration is an autonomous adaptation strategy as households pursue livelihood diversification (McLeman & Smit, 2006; Hoffman et al., 2024). Rural migrants often shift to informal urban jobs (e.g., vending, construction) to cope with climate-induced agricultural failures. The migrants in Windhoek rely on precarious work, but even low wages provide more stability than drought-affected farming. This section of the study examines migrants engaged in informal business for survival and was conducted in Windhoek, Namibia. Out of the targeted sample of 274, 230 traders were successfully interviewed across 12 markets, resulting in a response rate of 83.9%.

Based on the survey questions, survivalist entrepreneurship or trading is primarily driven by four reasons: (1) "I needed more money just to survive," (2) "I was unemployed and unable to find a job," (3) "I had a job but it did not pay enough," and (4) "I wanted to give my family greater financial security." Using these four indicators, we generated a binary index, which captures two outcomes: "likely to engage in survivalist trading" and "otherwise." Next, a binary logistic regression was performed to identify factors associated with survivalist informal trading. Table 2 shows that survivalist informal business owners tend to be younger (OR=1.339), although this is not statistically significant. Married people

tend to be more involved in informal businesses (OR=1.022). Ownership of informal businesses was also higher among those with primary education (OR=1.778) compared to those with secondary education or higher. Those without other occupations before starting a business were more likely to engage in survivalist informal trading (OR=3.843). Similarly, those who did not have any occupation after starting a business were three times more likely to continue in the survivalist informal business (OR=3.197). Moreover, an increase in household size raises the chance of engaging in informal trading (Table 2).

Figure 3: Demographic and Socio-Economic Characteristics of Migrants



Source: Namibia Statistics Agency (2024)

Table 2: Factors Associated with Survivalist Informal Trading

Characteristics		Coefficient	Odds ratio (OR)	95% confidence interval	
Age	Youth (<25 years)	0.292	1.339	0.594	3.019
	Young adults (25-39 yrs)	-0.455	0.635	0.41	0.982
	Old (40+ years) (REF)	0	1.00		
Gender	Female	-0.307	0.736	0.459	1.181
	Male (REF)	0	1.00		
Marital status	Married	0.022	1.022	0.638	1.639
	Single (REF)				
Education level	No formal	-0.008	0.992	0.549	1.793
	Primary	0.576	1.778	1.136	2.785
	Secondary (REF)	0	1.00		
	College/University	-0.297	0.743	0.308	1.795
Occupation before business	No	1.346	3.843	2.585	5.712
	Yes (REF)		1.00		
Occupation since starting business	No	1.162	3.197	1.415	7.222
	Yes (REF)		1.00		
Number of household members	(Continuous)	0.028	1.028	0.988	1.071

Vulnerabilities Faced by Traders

Vulnerabilities due to Shocks

The understanding of vulnerability in this context pertains to the probability of being unable to depend on informal sector work to support livelihoods in the event of a shock (Dasgupta & Lloyd-Jones, 2018; Hufschmidt, 2011; OECD/ILO, 2019; Linh, 2024). Put differently, vulnerability refers to the predisposition of an individual or household to withstand shocks. Shocks are occasional or seasonal events that happen to households or individuals that have implications on their rate of return, consumption, expenditure patterns and wellbeing (Aloysius, 2010; Hufschmidt, 2011). They can be classified as internal or exogenous, meaning those that derive from within the systems and processes in a household or of an individual, and those that derive from the external environment. Internal shocks include but are not limited to: (i) health-related problems like occasional sicknesses, chronic or terminal illnesses and death; and (ii) unexpected disability. Exogenous shocks may include: (i) economic events such as recession and inflation, (ii) events in the physical environment like floods, droughts, landslides, or earthquakes, and (iii) political events, for example, violence after or during elections, terrorist incidents. Shocks may also differ in duration, magnitude, or impact. Some shocks may be short-lived (like fires), while others, like droughts, can last for months. Amendah et al. (2014) categorise shocks as either covariate or idiosyncratic, where covariate shocks are those that affect the whole community and idiosyncratic shocks that affect a particular household or individual.

Figure 4 illustrates the most reported shocks faced by informal traders in the year preceding the survey date. About 52% of respondents did not experience any shocks; however, 21.8% lost their employment, and 21.6% saw a decrease in a household member's income, while others experienced a lack of refrigeration for food (14.1%) and higher water costs (10.1%). Death, accidents, insecurity, violence, floods, and fire were reported by less than 2% of households among those interviewed.

Table 3 displays the results from logistic regressions that systematically analyze how each shock correlated with the personal characteristics and workers' occupation history. The column on internal shocks shows the marginal coefficients for experiencing internal shocks versus experiencing none in the same year. Youth and being a young adult were negatively associated with experiencing internal shocks, while being married and having a college education were positively associated with internal shocks. Conversely, most of these associations were not significant for external shocks. Being female was negatively associated with external shocks, while having a college education was positively associated with external shocks.

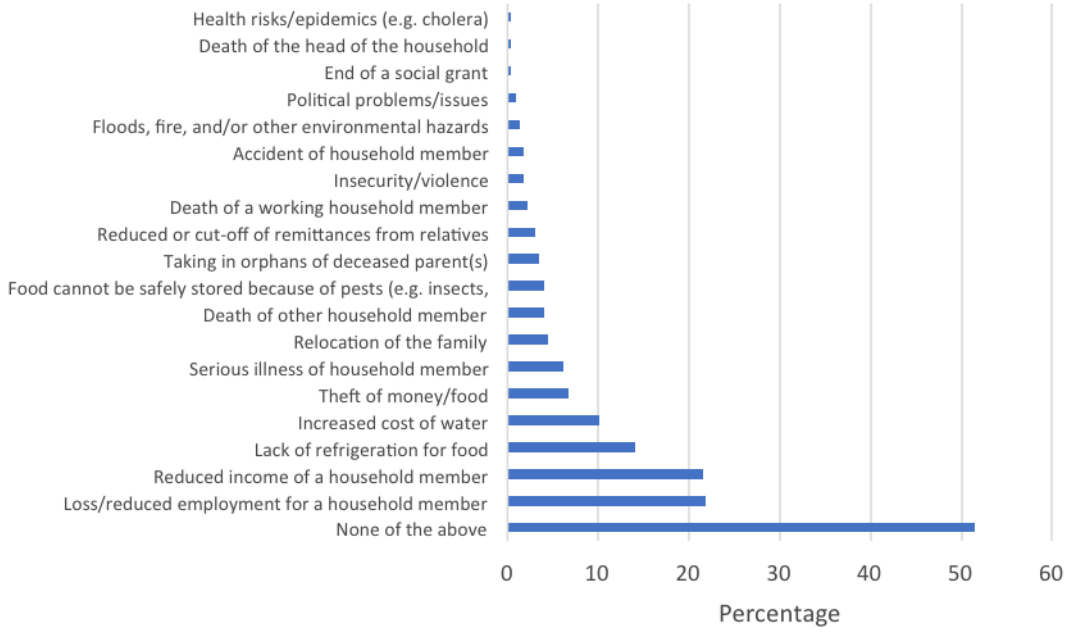
Vulnerability Driven by Inadequacies of Trading Location

This study examined how the existing spatial framework influences the livelihoods of informal sector traders in Windhoek City. It considers whether the existing physical planning framework offers informal sector operators (respondents) with sufficient and suitable space to carry out their productive activities. It also pays attention to the needs and circumstances of the small-scale traders in these areas and the extent to which it may be contributing to or addressing their vulnerability.

Figure 5 shows the available amenities at the different business locations. Trading outside supermarkets is associated with no viable amenity, with trading done on the floor. Other locations have freezers, coolers, and refrigeration, for example, those trading in an open market or an informal market. Among those trading outside the open market, few have access to a storage facility.

Sanitation and hygiene facilities are another source of vulnerability faced by informal businesses. Some businesses, such as those in the food industry, may not operate where these facilities are absent. Figure 6 displays locations that are reported to include or are in close proximity to basic sanitation and hygiene facilities. Overall, nearly 60% of business

Figure 4: Vulnerabilities due to Shocks



premises were protected from dust, dirt and insects, while a similar percentage had a toilet available. These toilets were of good hygiene (43.7%), with water and soap (41.9%). Some toilets charged a user fee (14.1%).

Logistic regressions for amenities challenges and background characteristics of business owners are presented in Table 4. Since the dependent variable is the availability of amenities with cooling and storage, or with water, sanitation and hygiene (WASH), the table reveals that traders who are youth or young adults are more likely to have premises which are without cooling/ storage or WASH facilities. Conversely, female traders are more likely to have trading locations with WASH facilities, which may suggest that females tend to trade in goods that require such facilities, such as food. Regarding education, those with no formal schooling are positively associated with having cooling and storage. In contrast, those with primary schooling or college/university education are negatively associated with having facilities with both cooling/ storage and WASH. The finding that people with no formal education have cooling and storage seems to indicate that they consider doing business as a more permanent position towards self-employment.

Table 3: Results from Logistic Regression on Shocks Experienced by Traders

Characteristics		Internal shocks	External shocks
Age (ref: Old aged - 40+ years)	Youth (<25 years)	-0.841** (0.628)	0.228 (0.627)
	Young adults (25-39)	-0.159* (0.323)	0.212 (0.378)
Gender (ref: male)	Female	-0.275 (0.352)	-0.514* (0.381)
Marital status (ref: single)	Married	1.317*** (0.352)	0.119 (0.404)
Education level (ref: secondary)	No formal	-0.274 (0.684)	-4.031 (11.501)
	Primary	0.112 (0.436)	-0.552 (0.514)
	College/university	0.508** (0.335)	0.519* (0.353)
Occupation before business (ref: yes)	No	0.074 (0.302)	-0.002 (0.335)
Occupation since starting business (ref: yes)	No	-0.422 (0.544)	-0.412 (0.577)
Number of household members	(Continuous)	-0.002 (0.028)	-0.044 (0.041)

*Significance levels: *10 percent; **5 percent; ***1 percent. Coefficients are marginal effects from the logistic regression, with standard errors given in parentheses*

Figure 5: Vulnerabilities due to Lack of Amenities at Business Location

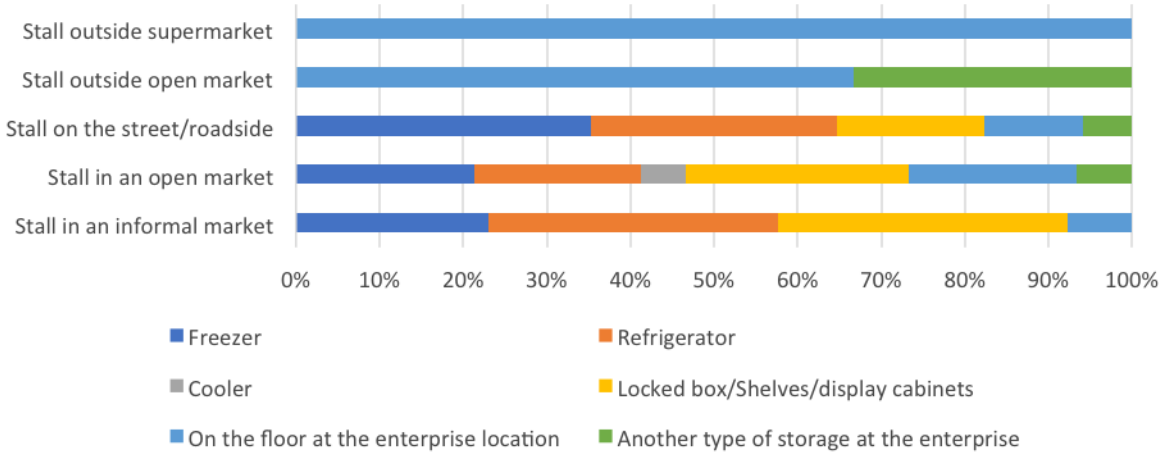
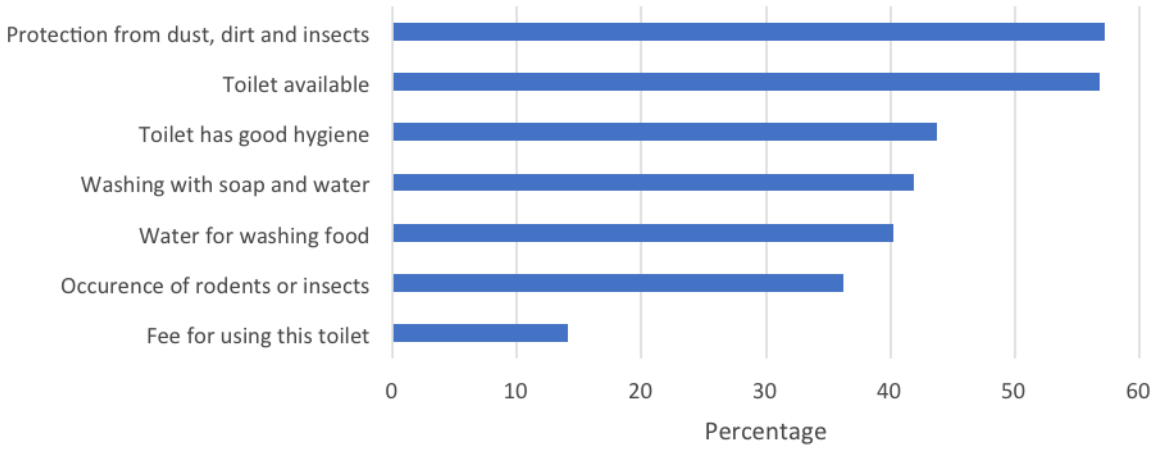


Figure 6: Sanitation and Hygiene Facilities Available for Informal Businesses



Vulnerability due to Economic, Operational and Social Challenges

A key issue associated with informal trading is the relationship between operational challenges and entrepreneurial activity, as this influences the conditions that determine survival (Crush et al., 2023; Djankov et al., 2002; Escribano & Pons Ganddini, 2024). In this study, vendors were given a list of potential challenges and were asked which, if any, they had experienced. The sources of vulnerability are categorised into economic, operational, and social challenges. Their distribution is shown in Figure 7. Business operators experienced more economic challenges, such as too few customers (59.8%), insufficient sales (43.7%), or suppliers charging too much (41.9%), and customers not paying debts (36.7%). Operational challenges came next, with just under one-third lacking refrigeration or adequate storage. A few business owners experienced social challenges, the highest being verbal insults (14.8%), while crime and theft were reported by less than 5% of operators.

To study the differential effects of background characteristics on experiencing economic, operational and social challenges (versus none experienced in the past twelve months preceding the survey date), we fitted logistic regressions. Results are shown in Table 5. Youth were less likely to experience both economic and social challenges, while young business owners were more likely to experience operational challenges. Similarly, married people had a higher likelihood of experiencing social challenges compared to those who were single.

Table 4: Logistic Regressions for Amenities Challenges (cooling, storage, sanitation and hygiene)

Characteristics		Amenities (cooling/ storage)	Sanitation and hygiene
Age (ref: Old aged - 40+ years)	Youth (<25 years)	-1.243** (0.737)	-0.951* (0.619)
	Young adults (25-39)	-0.800 ** (0.366)	-0.562* (0.397)
Gender (ref: male)	Female	-0.178 (0.41)	0.515* (0.376)
Marital status (ref: single)	Married	-0.468 (0.404)	-0.517 (0.409)
Education level (ref: secondary)	No formal	1.007 * (0.643)	3.199 (11.446)
	Primary	-0.794 * (0.536)	-1.015** (0.454)
	College/university	-0.674** (0.396)	-0.667** (0.376)
Occupation before business (ref: yes)	No	0.029 (0.337)	0.145 (0.346)
Occupation since starting business (ref: yes)	No	0.326 (0.684)	0.136 (0.595)
Number of household members	(Continuous)	0.007 (0.029)	0.029 (0.037)

*Significance levels: *10 percent; **5 percent; ***1 percent. Coefficients are marginal effects from the logistic regression, with standard errors given in parentheses*

Figure 7: Experiences of Economic, Operational and Social Challenges

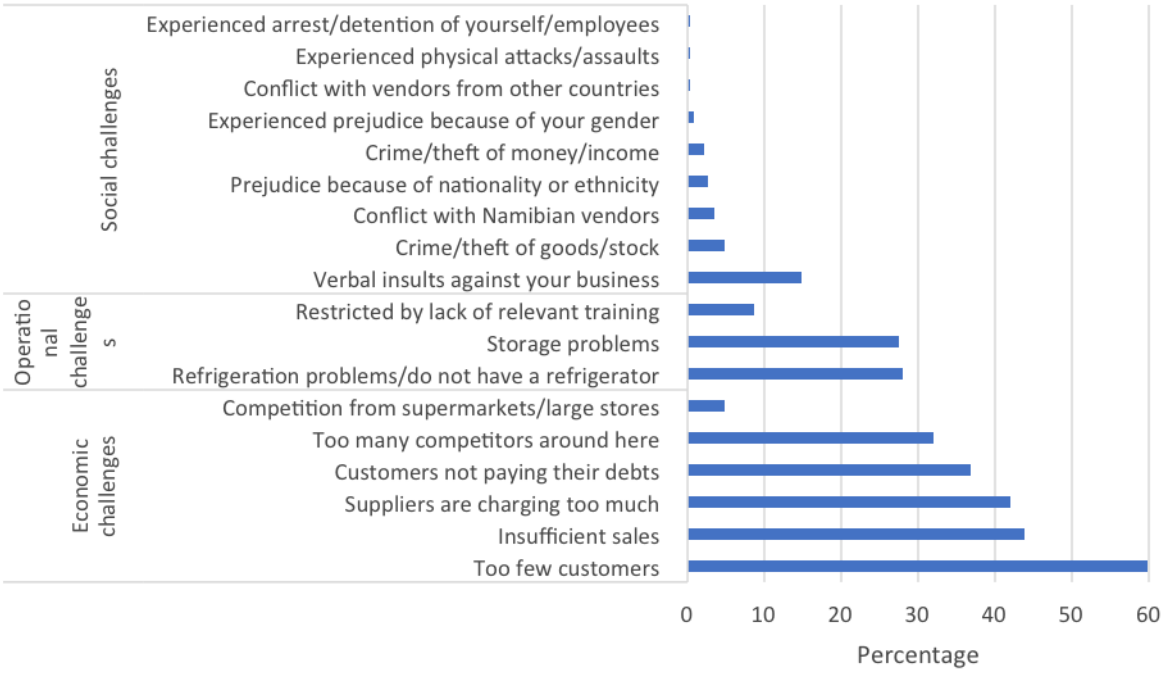


Table 5: Logistic Regressions for Economic, Operational and Social Challenges				
Characteristics		**Economic challenges**	**Operational challenges**	**Social challenges**
Age (ref: Old aged - 40+ years)	Youth (<25 years)	-1.522** (0.611)	-0.011 (0.61)	-1.739* (1.121)
	Young adults (25-39)	-0.249 (0.401)	0.496* (0.34)	-0.014 (0.39)
Gender (ref: male)	Female	-0.298 (0.41)	-0.400 (0.356)	-0.437 (0.441)
Marital status (ref: single)	Married	-0.226 (0.419)	-0.035 (0.365)	0.949** (0.392)
Education level (ref: secondary)	No formal	-0.207 (0.834)	-0.836 (0.715)	0.564 (0.664)
	Primary	-0.831** (0.49)	-0.627* (0.453)	-1.654** (0.69)
	College/university	-0.738** (0.393)	-0.52* (0.306)	-0.858** (0.422)
Occupation before business (ref: yes)	No	0.024 (0.356)	0.21 (0.345)	-0.066 (0.359)
Occupation since starting business (ref: yes)	No	-0.222 (0.684)	-0.788 (0.621)	1.465* (1.083)
Number of household members	(Continuous)	0.033 (0.039)	-0.05 (0.039)	0.045* (0.029)
*Significance levels: *10 percent; **5 percent; ***1 percent* *Coefficients are marginal effects from the logistic regression, with standard errors given in parentheses*				

Regarding education levels, individuals who had attained primary and college-level education were less likely to face economic, operational, and social challenges compared to those with secondary education. Furthermore, people who had no prior occupation since starting a business were more likely to experience social challenges. Similarly, experiences of social challenges rose with the increasing number of household members.

Reciprocity: Cash Remittances and Rural-Urban Food Transfers

There are well-established and widespread social linkages that persist between rural and urban households, which are central to the ability of poor urban households to survive. At the same time, there is some reciprocity, whereby migrant households remit cash to their rural households. Food transfers from rural households are an important food source and critical livelihood strategy in Windhoek (Frayne & Pendleton, 2001; Pendleton et al., 2014). Frayne & Pendleton (2001) found that 62% of lower-income households in Windhoek receive food transfers from relatives in rural areas. The 2008 AFSUN baseline survey reported that 72% of poor urban households receive food transfers (Pendleton et al., 2014). In the secondary cities of Oshakati, Ongwediva, and Ondangwa, more than half of the households (55%) receive food from relatives in rural areas. Mahangu flour is the most crucial food item received by two-thirds of the recipient households and 38% of all households.

This section further presents a comparative analysis of cash remittances and household characteristics between Windhoek (2016) and the Oshakati-Ongwediva-Ondangwa (OOO) towns (2018), highlighting notable differences in economic conditions, migration patterns, and vulnerability. In terms of remittances, OOO had more households (226) sending cash to rural areas compared to Windhoek (154), with a higher proportion of households in OOO (26.7%) participating in remittance activities than in Windhoek (22.5%). However, the average amount remitted was higher in Windhoek (1,022.2 NAD) than in OOO (881.22 NAD), though the median remittance was slightly lower (600 NAD vs. 700 NAD) (Table 6). This suggests that while remittance frequency is more in OOO, Windhoek experiences larger individual transfers, possibly due to higher urban incomes. Indeed, the income disparity between the two regions is stark: the mean monthly income in Windhoek (12,042.74 NAD) far exceeds that of OOO (1,815.46 NAD), highlighting the economic divide between urban and semi-urban areas.

Table 7 shows characteristics for remitting households. Overall, household profiles contrast sharply between Windhoek and Oshakati–Ongwediva–Ondangwa (OOO). Formal employment is much more common in Windhoek (63.6% of households) than in OOO (16.4%), where a significant portion of households rely on informal work, pensions, or student support (42.9%). Household structures also differ markedly. Female-headed households are slightly more prevalent in OOO (51.8%) than in Windhoek (48.1%), and female-centred households are more common in OOO (31%) than in Windhoek (20.8%). Additionally, unmarried individuals dominate both regions, though more so in OOO (81.4%) than in Windhoek (66.2%). Overall, Windhoek households are more strongly anchored in formal employment and extended family arrangements, while OOO households reflect greater economic precarity and a higher prevalence of single-headed structures.

Vulnerability indicators reveal contrasting challenges (Table 8). Nearly half of Windhoek's remitting households (48.7%) live in informal settlements, compared to about a third (32.3%) in OOO. Dependency ratios are higher in Windhoek (40.3%), indicating greater economic strain, while OOO faces higher rates of income loss (46.5%) and informal employment (39.8%). Education levels are also a concern, with nearly half of Windhoek's households (47.4%) having incomplete primary education or no formal schooling, compared to a third (33.6%) in OOO.

Table 6: Nature of Remittances to Rural Households		
	Windhoek (2016)	**Oshakati-Ongwediva-Ondangwa [OOO] (2018)**
Cash remittance to rural areas		
No of households	154	226
% of households	22.5	26.7
Amount remitted		
Mean	1,022.2	881.22
Median	600	700
Min	50	100
Max	8,000	3,000
Income per month		
Mean	12,042.74	1815.46
Median	4,850	700
Min	200	100
Max	39,500	12,000

Table 7: Remitting Household Characteristics				
	Windhoek		**Oshakati-Ongwediva-Ondangwa (OOO)**	
	No. of households	**%**	**No. of households**	**%**
Occupation				
Formal	98	63.6	37	16.4
Informal/Casual	23	14.9	8	3.6
Business	16	10.4	22	9.7
Unemployed	36	23.6	49	21.7
Others (students/pensioners)	13	8.4	97	42.9
Sex of household head				
Female	74	48.1	117	51.8
Male	80	51.9	109	48.2
Household structure				
Female-centred	32	20.8	70	31.0
Male-centred	30	19.5	58	25.7
Nuclear	40	26.0	49	21.7
Extended	48	31.2	42	18.6
Marital status				
Unmarried	102	66.2	184	81.4
Married	18	11.7	24	10.6
Cohabiting	29	18.5	5	2.2
Widowed	2	1.3	3	1.3

Food security presents another critical disparity (Table 9). Despite higher incomes, Windhoek has a higher prevalence of severe food insecurity (55.8%) compared to OOO (33.3%). Household dietary diversity is poorer in Windhoek (79.2% with low diversity) than in OOO (49.2%), and more households in OOO experience year-round food shortages (42% for 12 months) compared to Windhoek (27.3%). This suggests that although urban households in Windhoek earn more, higher living costs and economic pressures may erode their food security. In contrast, OOO's challenges mainly stem from income instability and rural-urban dynamics.

Overall, the data underscores the complex relationship between migration, remittances, and household welfare. Windhoek's households, though economically better off on paper, face significant vulnerabilities in housing and food security, while OOO contends with lower incomes and greater employment instability. Policymakers need to develop targeted interventions to address these specific challenges targeting urban poverty and cost-of-living pressures in Windhoek and supporting income stability and rural-urban linkages in OOO.

Table 8: Vulnerability of Remitting Households

	Windhoek		Oshakati-Ongwediva-Ondangwa (OOO)	
	No. of households	**%**	**No. of households**	**%**
Informal settlements	75	48.7	73	32.3
Dependency ratio	62	40.3	51	22.6
Informal income	42	27.3	90	39.8
Loss of income/ employment	27	17.5	105	46.5
Incomplete primary or no formal education	74	47.4	76	33.6
Lived poverty				
<=1.0	52	58.2	84	37.2
1.01–2.0	24	15.6	23	10.1
2.01–3.0	12	7.8	18	8.0
3.01–4.0	2	1.3	38	16.8

Table 9: Food Security in Remitting Households

	Windhoek		Oshakati-Ongwediva-Ondangwa (OOO)	
	No. of households	**%**	**No. of households**	**%**
Food insecurity prevalence				
Food secure	33	21.4	67	29.6
Moderately food insecure	35	27.7	83	36.9
Severely food insecure	86	55.8	76	33.3
Household dietary diversity				
Low HDDS	122	79.2	112	49.2
High HDDS	31	28.1	109	48.2
Month of inadequate food provisioning				
9th months	19	12.3	16	6.2
10 months	31	20.1	45	19.9
11 months	39	25.3	62	27.4
12 months	42	27.3	95	42.0

**Missing values – not adding to 100% for some variables*

Policy and Governance Challenges on Migration and Urban Food Insecurity Interventions

The following section introduces a thematic analysis to examine structural drivers of migration in conjunction with policy interventions. This approach draws on migration systems theory, outlined earlier, which emphasises the interaction between structural conditions and institutional responses in shaping mobility patterns (Ayeb-Karlsson et al. 2018; Black, 2011), as well as resilience frameworks that highlight adaptive capacities in the face of environmental and socio-economic stressors (Folke, 2006; Tacoli, 2011). In Namibia, this could involve strengthening urban food governance, providing legal recognition for informal markets, and investing in climate-resilient infrastructure for urban agriculture.

The KII on governance conducted in Windhoek offers critical insights into the challenges and gaps in urban food system governance, particularly concerning climate change-induced migration, food security and nutrition. These interviews, held with various government officials and stakeholders in the city, reveal a complex landscape of policy fragmentation, rural bias, and inadequate coordination in addressing urban food insecurity. This thematic analysis uses direct quotes to highlight key themes and narratives from the interviews and is divided into three parts.

The analysis focuses on four main themes: (1) rural bias in national development planning, (2) fragmented governance and policy silos, (3) challenges in urban food security interventions, and (4) the role of local government and community efforts.

Rural Bias in National Development Planning

A recurring theme in the interviews is the rural-centric focus of Namibia's national development policies, particularly the National Development Plan 5 (NDP5). The official interviewed at the National Planning Commission (NPC) explicitly stated that urban food security "*was not something we have picked up or looked up*" (Monitoring and Evaluation at NPC). This admission underscores a major oversight in national planning, where food security is framed as a rural issue, despite rapid urbanization and growing urban poverty. It was observed that the "*emphasis was to develop rural areas as a way to cap urbanization*," reflecting a policy stance that prioritises rural development over urban needs.

This rural bias is further evident in the exclusion of urban food security from NDP5. As reported, "*The framework is rural-focused, there is no focus on urban food security because the government aimed to develop the rural areas as a means to curb urbanization*." Such an approach neglects the realities of urban poverty and food insecurity, which are exacerbated by droughts and economic instability. The interviews reveal a disconnect between policy and the lived experiences of urban residents, particularly migrants and low-income households, as highlighted in migrant studies among Zimbabweans in Windhoek (Tawodzera & Crush, 2024). The lack of attention to urban food security in national planning has tangible consequences. The food bank policy, mentioned by an NPC official as a government initiative, was described as unsustainable due to nationwide droughts. This suggests that urban food security interventions are often reactive rather than integrated into long-term planning. The rural bias in NDP5 thus perpetuates a cycle of neglect for urban populations, leaving them vulnerable to food insecurity.

Fragmented Governance and Policy Silos

Another dominant theme is the fragmentation of governance and the lack of coordination among ministries and agencies responsible for food security and nutrition. NPC acknowledged the "*big headache*" in coordinating nutrition policy implementation, while a senior official from the Ministry of Health and Social Services (MoHSS) highlighted the challenges of cross-departmental collaboration. "*We are reluctant to be involved in multi-departmental reporting and monitoring*," citing the difficulty of coordinating health-related policies across government silos. MoHSS further pointed out that the NDP5 indicators for health-related issues such as NCDs were disconnected from the multi-sectoral NCD plan due to the exclusion of relevant ministries during the planning stage. The Ministry of Industrialization, Trade, and SME Development (MIT) identified a systemic issue where ministries operate in isolation, leading to disjointed policy implementation. "*Maybe we can start implementing parts of this*," when asked about the NCD strategy, indicating a lack of awareness and engagement.

The absence of a unified monitoring and evaluation framework exacerbates this fragmentation. The official from NPC mentioned that the NPC's framework was "*based on focus areas, rather than being sectoral,*" which may contribute to gaps in accountability and implementation. The lack of convergence among line ministries, as described by MoHSS, undermines efforts to address complex issues like urban food security and NCDs, which require multi-sectoral collaboration.

Challenges in Urban Food Security Interventions

The KII highlighted several challenges in implementing effective urban food security interventions. The official from the Office of the Prime Minister (OPM) noted the expansion of Livelihood Vulnerability and Assessment analyses to urban areas, revealing "*general chronic vulnerability*" in these settings. However, it also pointed to the absence of food safety standards and the difficulty of regulating risk factors like sugar intake, stating, "*How does one even start to regulate risk factors such as sugar intake, physical inactivity, etc.?*" (OPM). This reflects the broader struggle to address the nutritional quality of food in urban areas, where processed foods dominate diets. The Ministry of Poverty's Food Bank Initiative, while a step toward addressing urban food insecurity, was criticised for its lack of sustainability. As recorded, "*The whole country is affected by droughts*," implying that food banks alone cannot solve systemic issues. Similarly, the Ministry of Industry and Trade (MIT) highlighted policy gaps in food standards, such as the unregulated brine content in poultry, calling it a "*serious policy failure.*" These examples illustrate the ad-hoc nature

of interventions and the urgent need for comprehensive, enforceable policies. The discussion with MIT also revealed a lack of consumer protection in the food system. The 2016 Retail Charter was considered a failure as it was voluntary and ineffective in promoting local procurement. "*In Namibia, we didn't move on this*," referring to the lack of progress in regulating processed foods. This regulatory vacuum leaves urban consumers, particularly low-income households, vulnerable to unhealthy and unsafe food options.

Role of Local Government and Community Initiatives

The City of Windhoek takes proactive measures to improve urban food security, despite limited resources. The Head of Social Welfare described the city's efforts to join the Milan Urban Food Pact and establish community gardens. However, she admitted that there is no official food policy: "*We don't even know where the food is coming from. We have done no food mapping and need research partners*" (CoW). This statement highlights the challenges faced by local governments in the absence of national support. The city's Community Gardens Initiative, which trained 24 members in permaculture and hydroponics, was highlighted as a step toward empowering residents. CoW official emphasised, "*The only way to address food insecurity and food poverty is to engage the community to grow food in their own backyards*". However, the low participation rate in urban agriculture, attributed to water shortages, reflects the limitations of such initiatives without broader systemic changes. The interviews also reveal the city's reliance on NGOs and external support for social protection programs, such as soup kitchens and child feeding programs. The official noted, "*Food is provided by supermarkets but collected by NGOs,*" indicating a patchwork approach to addressing food insecurity. While these efforts provide immediate relief, they are not scalable or sustainable without integrated policy frameworks.

Migration and Climate Change as Contributing Factors to Urban Food Security in Windhoek

Although climate change was not the primary focus of the interviews, its effects were suggested through discussions about drought and agricultural challenges. The representative from NPC mentioned that droughts and the lack of modern farming practices impede food production, saying: "*Agriculture is the main sector of employment [for] 70% of the population... [but faces] 3 years of consecutive droughts (2017, 2018, 2019).*" This rural agricultural crisis indirectly worsens urban food insecurity by lowering supply and increasing prices, while also driving rural-to-urban migration. Other officials highlighted the expansion of vulnerability assessments to urban areas due to "*general chronic vulnerability*" (Disaster Risk Management, Office of the Prime Minister [OPM]). While not explicitly linking this to climate change, their focus on disaster risk aims to align with climate-induced shocks (e.g., droughts) that destabilise both rural and urban food systems. The same office noted that the food bank policy is considered unsustainable because "*the whole country is affected by droughts*," underscoring how climate-related disruptions weaken urban safety nets.

Further in the discussion, it was evident that migration is an overlooked factor. It was acknowledged that urbanization pressures in Windhoek may lead to food insecurity. NPC officials remarked that the government aims to "*develop rural areas as a way to cap urbanization*," which suggests that migration is seen as a problem to be controlled rather than a reality to be integrated into food policies. This approach also ignores migrants' specific vulnerabilities, such as dependence on expensive, processed foods.

The issue of informal settlements and food access also emerged in the discussions with the City of Windhoek (CoW). The CoW's community gardens and food programmes (e.g., soup kitchens) are concentrated in low-income areas like Katutura, where many migrants settle. The CoW noted: "*The challenge is the water crisis, but all households need to make gardens in their own backyards*." This highlighted resource constraints exacerbated by urban population growth, including migrant inflows.

In our analysis, we identified some indirect overlaps on the issues of climate, migration, and urban food security. The policy discussions collectively suggested that climate-driven rural crises lead to urban migration. "*Droughts disrupt rural livelihoods*", "*unaffordable prices in urban areas*," "*lack of urban agriculture support*" (OPM) - pushing people into cities where food systems are unprepared. There was also migrant marginalization. The urban policies (e.g., food banks, nutrition programs) fail to address migrants' unique needs, perpetuating insecurity. Furthermore, we also observed systemic fragmentation where climate and migration are treated as separate issues, rather than interconnected drivers of urban food insecurity.

Internal Migration as a Climate Adaptation Strategy in Namibia

The interviews revealed that internal migration in Namibia acts as an informal climate adaptation strategy. NPC highlights that "*droughts and land degradation undermine rural livelihoods*." These climate change processes push rural households to seek alternative incomes in cities. Migration is an autonomous adaptation strategy as households diversify their livelihoods. Rural migrants often transition to informal urban jobs (e.g., vending, construction) to cope with climate-induced agricultural failures. Migrants in Windhoek depend on precarious work, but even their low wages offer more stability than drought-ravaged farming. While urban life presents new challenges (like high food prices and water scarcity), cities provide alternatives to access resources for the climate-dependent rural livelihoods. For example, the City of Windhoek's community gardens (though limited) offer some migrants a way to grow food. Similarly, migrant households provide remittances as a form of resilience to rural households.

Discussion and Conclusion

This study has explored how internal migration, shaped by climate stressors and economic precarity, intersects with urban food systems and resilience mechanisms in Namibia, particularly in Windhoek. Drawing from a rich mix of household surveys, policy interviews, and secondary climate data, the findings provide a nuanced picture of how climate-driven migration, informal urban livelihoods, and precarious food access co-evolve in Windhoek's rapidly urbanizing context. The central narrative emerging from this research is that migration in Namibia is not a failure of adaptation, but rather an adaptation strategy—though one that unfolds within deeply constrained institutional and urban environments (McLeman & Hunter, 2010; Tacoli, 2011).

Our investigation affirms the conceptual framework presented in the early part of the paper. Migration serves as a rational and proactive response to the increasing unpredictability and severity of climate impacts in Namibia's rural areas (Black et al., 2011; Newsham & Thomas, 2011). Persistent droughts, declining agricultural productivity, and land degradation have pushed many Namibians to urban centres in search of alternative livelihoods (Kapuka & Hlasny, 2020). For these migrants, particularly those arriving in Windhoek, migration becomes an autonomous adaptation strategy aimed at securing food, employment, and social stability. Nonetheless, the move to the city often replaces one set of vulnerabilities with another (Crush & Frayne, 2011; Frayne, 2004).

Migration thus emerges as both an escape valve and a vector of vulnerability. While cities like Windhoek offer opportunities unavailable in rural regions, such as diversified income sources, educational access, and proximity to services, they also expose migrants to precarious housing, informal employment, and unstable food access (Nickanor et al., 2019a; Tawodzera & Crush, 2024). This duality underscores the importance of viewing migration not just as demographic change but as a form of climate resilience that requires institutional recognition and support (Folke, 2006; Haysom & Tawodzera, 2018).

The study further illustrates the connections between urban food insecurity and informality as part of migrants' coping mechanisms. Findings, especially from the Hungry Cities Partnership and Nourishing Spaces surveys, revealed that migrants settling in Windhoek's informal settlements depend heavily on informal economic activities to survive (Crush et al., 2019; Pendleton et al., 2014). Informal trade, particularly food vending, serves both as a source of livelihood and a critical node in the urban food system. These findings align with our conceptual lens which presents the informal food economy as a crucial adaptive mechanism (Battersby & Crush, 2014; Crush & Frayne, 2011). Migrant traders, largely operating from makeshift stalls and roadside setups, act as intermediaries between rural food production and urban food demand. Informal food networks, built on social capital and kinship ties, allow urban households to access relatively affordable, familiar, and culturally appropriate foods (Frayne & Pendleton, 2001). These networks also maintain rural-urban flows through the remittance of both cash and food, particularly staples like mahangu flour (Frayne, 2004; Pendleton et al., 2014).

However, the informal sector is not without its limitations. As shown in the logistic regression analyses in this study, these traders face numerous vulnerabilities: economic (e.g., low customer volume), operational (e.g., lack of refrigeration and storage), and spatial (e.g., inadequate trading infrastructure). Female traders, although more likely to trade in food and use hygiene-friendly spaces, remain exposed to specific gendered risks such as verbal abuse and household burdens (Chen et al., 2006; Crush et al., 2020). Youth and unskilled workers, who are most likely to migrate due to climate stress, are also the most likely to engage in survivalist trading with limited capital and job stability (Song et al., 2016). Despite these challenges, the informal food economy emerges as a dynamic system of resilience. It adapts quickly to supply shocks, offers culturally appropriate nutrition, and extends the benefits of urban livelihoods back to rural households (Haysom & Tawodzera, 2018). However, its sustainability is increasingly threatened by policy neglect and biases in urban planning (Drescher et al., 2018).

Our results outlined the multi-layered vulnerabilities that migrants face upon arriving in Windhoek. These include exposure to external shocks such as drought-related price hikes and socioeconomic disruptions like COVID-19, along with infrastructural deficits (sanitation, water, storage) and institutional oversight regarding the specific needs of migrant communities (Tawodzera & Crush, 2024). Informal traders frequently operate in suboptimal environments, with few protections from environmental stressors or policy interventions. Systemic governance failures exacerbate these challenges. Stakeholder interviews reveal that Namibia's urban policy frameworks, especially under the fifth National Development Plan (NDP5), remain heavily rural-biased, often viewing migration as a problem to be mitigated rather than an integrated development issue (Nickanor et al., 2019b; NPC interview excerpts). National planning does not adequately reflect the realities of urban poverty and food insecurity, leaving municipalities like Windhoek ill-prepared to manage climate-displaced populations. Governance fragmentation, where ministries operate in silos, further weakens the coordinated response needed to address food insecurity, climate adaptation, and inclusive urban growth (MoHSS and MIT interviews). This policy vacuum is perilous given the accelerating pace of climate change and urbanization. Our study highlights a persistent disconnect between migration drivers (e.g., rural droughts) and urban outcomes (e.g., food insecurity, housing shortages), which are treated as separate rather than interconnected issues in current planning systems. Urban agriculture, for example, while a viable adaptation strategy, is constrained by insecure land tenure and lack of access to water—challenges rooted in policy neglect (Dhillon & Moncur, 2023; City of Windhoek interviews).

Migration-Food Linkages: Reciprocity and Rural Resilience

A key contribution of this study is the empirical documentation of rural-urban reciprocity. Contrary to dominant narratives framing migration as a unidirectional flow, our data show that more than half of households in Windhoek and the northern towns of Oshakati, Ongwediva, and Ondangwa receive food transfers from rural relatives, while also remitting cash back to them (Frayne, 2000; Pendleton et al., 2012). This bidirectional flow supports both rural and urban resilience. Urban incomes, while often unstable, provide crucial lifelines for climate-impacted rural households, and rural food transfers—particularly of traditional staples—sustain urban diets in the face of high prices and limited dietary diversity. Yet, this hybrid food system remains largely invisible to planners and is highly vulnerable to inflation, climate shocks, and logistical breakdowns.

Implications for Urban Food Governance

Stakeholder interviews further revealed promising, albeit fragmented, local efforts to bolster food system resilience in Windhoek. The City of Windhoek's initiatives, such as community gardens, soup kitchens, and permaculture training, showcase local responsiveness to food insecurity. However, these programs lack formal integration into national development plans and are often limited by resource constraints, particularly water scarcity (CoW interviews, 2019). The Milan Urban Food Pact, which Windhoek has joined, offers a framework for improving urban food systems. Yet, without dedicated policy, funding, and institutional support, such global commitments remain aspirational. Effective food governance requires broadening food security beyond calorie intake to include access, affordability, nutritional value, and cultural relevance. Migrants should be viewed as active contributors to food system transformation, not as burdens. Moreover, informal markets need legal protection, suitable infrastructure, and integration into national and municipal food planning. Likewise, urban agriculture must be supported through secure land access and climate-resilient practices. Policies should be grounded in lived experiences and developed through inclusive, cross-sector collaboration.

Migration, climate adaptation, and food system resilience are interconnected challenges that affect Namibia's development future. Windhoek is at the centre of these pressures and must pursue a transformative agenda that positions internal migration as part of the solution rather than the problem. Migrants are already building adaptive networks—from informal food economies to reciprocal rural-urban flows—and their efforts must be recognised and supported. To achieve a food-secure and climate-resilient urban future, Namibia must act decisively by integrating migration into national development frameworks (Black et al., 2011), strengthening informal systems (Crush & Frayne, 2011), and bridging the rural-urban divide through investment and inclusive governance. Migration, if well managed, can indeed "feed hope," not just for the migrants themselves but also for the resilience of the entire Namibian food system.

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