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DISCLAIMER

For the Record and to the Reader in Respectful Honour of late Mr Thithi Maseko:
It is hereby noted that the outcome of the external examination of the research report by the late Mr Thithi Maseko for the Master of Urban Studies in the School of Architecture and Planning, in 2025, was a distinction in the research report component, subject to minor corrections. It is therefore observed that a sombre and honourable memory of Mr Thithi Maseko's would be to publish the report as he submitted it for examination.

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG | SCHOOL OF ARCHITECTURE & PLANNING

The intersection of informality, migration and climate change: the case of Stjwetla informal settlement in Johannesburg

A research report submitted to the Faculty of Engineering and the Built Environment, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of master's in urban studies (Housing and Human Settlements) in the School of Architecture and Planning.

Master of Urban studies (Housing & Human settlements)

Thithi Maseko

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Johannesburg, 2024

Declaration

I ……. ……. hereby declare that this research report is my unaided work. It is being submitted in partial fulfilment for the degree of Master of Urban Studies (Housing and Human Settlements) in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other university.

Signature of Candidate

Date 02/27/2025

Abstract

Africa's urbanization is marked by significant challenges such as informality, migration, and climate vulnerability. This study investigates their intersection using Stjwetla informal settlement in Johannesburg as a case study. The research identifies how climate variability impacts residents' adaptive strategies, explores migration dynamics shaped by economic and environmental factors, and examines how informality mediates residents' coping mechanisms. A qualitative approach, incorporating interviews and photographic evidence, reveals nuanced insights into the interplay of these phenomena. Key findings include the vulnerability of informal settlements to climate impacts and the role of social networks in resilience. The study highlights the necessity of integrating climate adaptation into upgrading strategies, advocating for inclusive and context-specific interventions. Implications extend to urban policy and planning, emphasizing sustainability, resilience, and equity for marginalized communities

Dedication

I dedicate this work to my late “Tanci” Que and my Aunt T. Dabawo, your endless words of encouragement and the way you always tell me how proud you are of me continue to inspire me deeply. Here is another chapter of my life that I know would make you proud.

Continue to be beautiful beings in spirit, always guiding everything we do and everything we will do

A special dedication to Dr. Imboni Uzwilezwe Radebe: Your exemplary leadership and the endless wisdom you continue to impart have been instrumental in shaping my journey. I am where I am in life because of your guidance. Izandla zidlula ikhanda, Baba. Thank you

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My deepest thanks and gratitude to Prof. Marie Huchzermeyer, my supervisor and teacher. I truly believe I could not have crossed this finish line with anyone else, your guidance made this journey feel so much easier. Your unwavering support and patience have been invaluable. I deeply appreciate the insightful feedback you provided, which has greatly improved my writing and helped me grow as a researcher. Your dedication to going the extra mile has inspired me and for that, I am truly grateful. Thank you

To my family and friends, thank you for your support and words of encouragement. I could not have accomplished this without your help. A special shoutout to my colleagues/the MUS 2024 cohort, whom I met during the Urban Dialogues Week. Together, we walked each other to the finish line.

I extend my heartfelt gratitude to the community of Stjwetla, the leaders, the patrollers who accompanied me during my visits and everyone who welcomed me with openness. Your cooperation and generosity have been the cornerstone of my research. Thank you

Lastly, before the final submission of this report, I attended a show just to step out of my mind for a moment. It reminded me how easy it is to get lost amidst the busyness of life. This journey required resilience, hard work, and unwavering dedication to walk to the finish line. Moments like these served as a reminder to pause, reflect and regain perspective. “Ngime Ngisithunywa” I am grateful for the strength and support that made this achievement possible.

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1. Chapter 1: Introducing the research

1.1. Introduction

Africa is experiencing unprecedented urban growth with estimates indicating that the continent's urban population could increase twofold by the year 2050 (Kookana, Drechsel, Jamwal and Vanderzalm, 2020). Traditionally, cities are seen as centres of opportunity and engines of economic growth, drawing in migrants seeking access to better infrastructure, healthcare and services. Conversely, urbanization in Africa is often characterized by informality, inadequate infrastructure and widespread poverty, exacerbating issues of inequality and exclusion. Concurrently climate change is increasingly recognized as a significant driver of migration and displacement further complicating the urban landscape (Morales-Giner and Ramos, 2022). It is within this context that this research seeks to explore the interplay among these elements and their implications for upgrading strategies, focusing on the case of Stjwetla informal settlement in Johannesburg.

1.2. Background

In recent years, there has been growing evidence and widespread recognition that the Earth's climate is rapidly changing. Rising greenhouse gases, due to human activities, have led to a notable increase in global temperatures. The Inter-governmental panel on climate change (2023) and the National Oceanic and Atmospheric Administration (2024) have reported that 2023 was the warmest year on record, surpassing 2016 by 0.27 degrees Celsius. Since 1980, climate-related disasters such as extreme temperatures, severe storms, droughts, wildfires and cyclones have been on a steady increase claiming 1.6 million lives globally (CSIR, 2019; Ferreira, 2024). The damages caused by these disasters since 1980 have exceeded $4.6 trillion (R86.25 trillion), with global damages surpassing $100 billion (R 1.875 trillion) annually since 2010, and the last two years witnessing damages exceeding $200 billion (3.75 trillion) annually (Ferreira, 2024). The impacts of climate change can render certain areas less habitable, prompting people to migrate in search of safer and more sustainable living conditions (International Organisation for Migration, 2009)

Migration, climate change and urban informality are critical issues facing Africa today. Rapid urbanization presents significant economic and housing challenges for migrant-attracting cities, with migrants, using regular and irregular or informal means, migrating to urban areas at a scale that outpaces infrastructural and economic growth rates (Fox, 2017). Over the past half century, informality has significantly expanded, becoming a primary source of income, employment, and housing for poor urban households across the continent (Fraser, Moonga, and Wilkes, 2014). It is estimated that around 2 billion people (60% of the global labour force)

source their income within the informal economy, providing a new avenue for employment opportunities in developing countries (Cities Alliance, 2021). Understanding the intricate relationship between informality migration and climate change is essential for developing effective strategies to address these interconnected phenomena.

It is against this background that this research seeks to explore the intersectionality of informality, migration, and climate change through the case of Stjwetla informal settlement in Johannesburg. According to the City of Johannesburg (CoJ, 2014), Stjwetla was established in 1995 and has experienced rapid growth driven by economic migration. Situated adjacent to Alexandra township, Stjwetla is an in-part low-lying informal settlement along the western bank of the Jukskei River (Webster, 2020). Danielak (2022) notes that Stjwetla includes units within the river flood plain and others at the settlement's edges. The settlement, situated on a landfill, faces various disasters from natural and human-induced causes (ibid.). Additionally, the unsuitability of the land for conventional government development or upgrading exacerbates community challenges (ibid.). Stjwetla exemplifies deep-rooted spatial and structural vulnerability, a common feature characterizing disparities in South African human settlements (ibid.).

1.3. Problem statement

According to Stats SA (2023), there was a significant decline in the percentage of households residing in informal dwellings in South Africa, decreasing from 13.6% (approximately 7 million people) in 2011 to 8.1% (approximately 5 million people) in 2022. While analysists are still grappling with this finding, it is clear that many informal settlements, Stjwetla included, have grown. It is well established that factors that contribute to the expansion of informal settlements include migration and climate change. The driving force for migration is understood to be the perception or the aspiration of a better life (Bosch and Farre, 2013), with many forced to migrate and work predominantly in the informal sector (Stats SA, 2022). However, climate change contributes to expansion of informal settlements and the informal sector by prompting relocation from increasingly vulnerable areas. Informal settlements further intersect with climate change in that they often emerge in regions prone to climate vulnerability and hazards, primarily due to the limited availability of land accessible to extremely impoverished populations for habitation (Finn and Cobbinah, 2022). This research explores the intersection between informality, migration patterns and climate change focusing on understanding how these factors may shape the immediate and future growth, development and resilience-building efforts of informal settlements like Stjwetla, amidst intensifying climatic conditions.

1.4. Aim of the Research

The aim of the research is to use the case of Stjwetla to contribute to the understanding of how the phenomena of informality, migration and climate change interact, and influence one another in an informal settlement setting.

1.5. Objectives

a) To gain insight into how climate variability impacts the residents of Stjwetla and how have they responded to them.
b) To understand migration dynamics in Stjwetla as shaped by individual histories, reasons for movement and migration experiences.
c) To understand how informality facilitates migration while also articulated by the implications of climate change.
d) To draw out implications for informal settlement upgrading strategies

1.6. Main research questions

1.6.1. In what way does the intersection of informality, migration and climate change manifest in the case of Stjwetla informal settlement?

a) In what way does climate variability impact the residents of Stjwetla and how have they responded to them?
b) What are migration dynamics in Stjwetla as shaped by individual histories, reasons for movement and migration experiences?
c) In what way do different aspects of informality facilitate and limit residents' ability to cope with and adapt to climate change-related challenges in the presence of migration dynamics?
d) What implications can be drawn for informal settlement upgrading strategies?

1.7. Expected findings

This study sought to expand the knowledge of the interconnected phenomena how they interact and influence one another, which includes insights into adaptive strategies employed by residents of Stjwetla. This research initially anticipated that Stjwetla residents would rely on informal networks and community-led initiatives to adapt to the challenges of climate variability, migration, and informality. It was expected that these networks would foster

resilience and highlight predictable links between migration patterns and climate-driven settlement dynamics. However, as detailed in Chapter 4, the findings revealed a more complex reality. Informal networks, while present, were often constrained by systemic inequalities and limited institutional support. Migration was influenced not only by economic opportunities but also significantly by climate-induced displacement, with diverse implications across demographic groups

1.8. Research design and methods

This section delves into the overall approach and practical steps employed to answer the research questions. The research employed a qualitative research design in the intersection of informality migration and climate change in the case of Stjwetla informal settlement. The research study made use of both primary and secondary data sources. The research participants were selected based on their knowledge and proximity to the phenomenon under study.

1.8.1. Research Type

This research report draws on a diverse range of data sources and methods to provide a nuanced understanding of the intersection through the case study of Stjwetla. A qualitative and descriptive research design was adopted, which focused on capturing participants' experiences, perceptions, and behaviors. This approach aimed to provide rich contextual detail, with findings accurately reflecting the perspectives of the interviewees (Kuper, Reeves, and Levinson, 2008). The research utilized both primary data, collected firsthand for this specific research project, and secondary data, which comprised previously analysed information gathered by others for purposes other than the current research project (Ellram and Tate, 2016).

1.8.2. Data Collection Tools.

Primary data was gathered through individual, in-depth semi-structured interviews, which were audio-recorded with participants' permission. These qualitative methods enabled an exploration of perspectives, experiences, challenges and opportunities related to the intersections that this research explores. I designed an open-ended interview guide and initially anticipated each interview would last around 45 minutes to an hour. However, several interviews extended beyond this timeframe due to specific challenges in the process. For instance, some questions needed translation to ensure participants' full understanding, and for immigrant participants, a translator was sometimes required to convey questions accurately. I used one of the patrollers as a translator, who was able to speak Portuguese.

Additionally, the conversations often deviated from the original questions, as participants shared unexpected insights. These detours added depth but also lengthened the interviews, as I followed up with further questions to explore these new areas of discussion. Using photography as part of data collection further enriched the findings, providing a more holistic view of settlement dynamics. The images focused on capturing general aspects of the environment and interactions of the phenomena this study attempted to understand.

1.8.3. Sampling

The research employed a purposive sampling in determining the research participants for the qualitative interviews. According to Rubin & Babbie (2010), sampling is defined as the process of choosing a sub-section group of the population to symbolize an entire population to obtain data of the phenomenon under study. The target population for this study included residents and community leaders of Stjwetla, chosen based on their knowledge, proximity, and experiences related to the intersection of informality, migration and climate change. The primary group targeted were residents living along the Jukskei River, who are directly affected by flooding and have first-hand knowledge of how climate changes impact the area over time. Community leaders further assisted in identifying where immigrant residents live and provided insights into their practices, adding valuable perspectives to the study. These community leaders, along with residents, helped identify others within the community with close experience and understanding of the intersection of informality, migration and climate change. The sample size for this research study consisted of 6 community leaders inclusive of patrollers and 8 community residents. The patrollers, familiar with daily occurrences in the flood-prone areas and connected to local cleanup organizations like Water Warriors, were included for their awareness of environmental issues, such as illegal dumping around the Jukskei River. Their insights were integral to bridging connections within the phenomena under investigation. All participants were within the age range of 28 to 45 years.

1.8.4. Positionality, data collection and practicalities

As I explored the intersection of informality migration and climate change, my professional background, which is in the field of migration, was relevant. I have benefitted from being involved in writing regional research reports that gave insights into the profound societal impacts of human mobility and the complexities of environmental challenges. Having engaged directly with migrants, refugees, and internally displaced persons, I've observed the dual role migration plays in both contributing to economic development and in placing a strain on limited social services and infrastructure. I aimed to explore these intersections, mindful that my perspective may be influenced by my background. I tried, as far as possible, not let my previous experience taint my findings. I openly acknowledge my previous work in the field of

migration. As recommended by Holmes and Gary (2020), through reflexivity, I embraced subjectivity, aiming for transparency and thereby enriching the research process.

Data collection and analysis took place over two months, in September and October, ensuring both thorough data gathering and ample time for analysis. Access to resident participants was facilitated with the help of community leaders. My first interview, a test with a community leader, allowed me to begin initial analysis immediately, enabling refinement of my questions for subsequent interviews. This process applied to immigrant interviews as well. Due to language barriers, I either adjusted questions or selected alternative participants from different backgrounds. For example, after two interviews with Mozambican immigrants who provided limited insights, I substituted them with an interview with a Zimbabwean immigrant.

The research was embedded in the Kelvin-Alexandra-Frankenwald City Studio project, where a trusting relationship had already been established with the Stjwetla Leadership Committee by the project team, including my supervisor. There were no major obstacles, such as community resistance; however, minor logistical challenges did arise, like limited availability of interview dates and scheduling with community leaders. These issues were resolved through careful coordination and consistent communication to find suitable dates and times for each interview.

1.8.5. Limitations to the study

The study was limited to examining the practices and perceptions of only one informal settlement, Stjwetla, with a small sample size. Consequently, the personal views expressed by respondents do not represent the entire population of Stjwetla or other informal settlements. Additionally, the findings cannot be generalized to all informal settlements, as each community manages issues such as environmental challenges, informal practices, and socio-economic conditions differently, and the level of state involvement and support varies across settlements.

Another limitation encountered during the research was the need for translation. While I initially anticipated that respondents would be fluent in English, it became clear during the interviews that some questions needed to be translated into other languages to ensure clear understanding. This adjustment highlighted the importance of language flexibility in data collection to capture respondents' perspectives accurately. While I tried to keep the questions as simple as possible, in many cases, I had to translate them into isiZulu. The challenge arose when some technical terms did not have direct translations, and in two instances, I had to clarify the questions using examples. For example, when asking about "climate resilience," the term didn't have an equivalent in isiZulu. To ensure clarity, I explained it as "how the

community adapts to and recovers from floods or storms," which helped respondents understand the question better. This may have inadvertently influenced participants' responses, as the translation process may have led the questions to be somewhat leading or less neutral in some cases. During analysis, I flagged responses where examples or explanations might have influenced participants' answers and treated these cautiously, focusing on broader themes. To maintain authenticity, I included direct quotes to ensure participants' voices were accurately represented, allowing readers to interpret the nuance of their responses despite the translation.

1.9. Ethical Consideration

Ethical clearance and approval were obtained from the School Research Ethics Committee before conducting any research involving human subjects. In adherence to ethical standards, this study ensured that all ethics conventions were observed throughout the research process. Participants were fully informed about the purpose of the study and the nature of their participation. A participant information sheet was provided, outlining the scope and intent of the research, as well as the parameters of their involvement. All participants demonstrated a clear understanding of the research and its objectives, and each signed a consent form. There were no issues with comprehension, and every participant confirmed their understanding of the study's purpose, confidentiality, and their voluntary involvement. This ensured that all participants were fully informed and gave their consent willingly before taking part in the interviews. following which they signed a consent form.

Regarding potential risks, participants were assured that their real names would not be used in the reporting of the findings, ensuring confidentiality. Prior to the interviews, participants completed the approved consent form, which had the purpose of reinforcing respect for their rights and dignity (Muldoon, 2006). Given the complex nature of immigration dynamics in South Africa, I took particular care in my interactions with migrants, ensuring these were handled with sensitivity and respect. While the sample did not include vulnerable migrants, clear communication was prioritized to address any concerns about legal status. Participants were made fully aware that their involvement would have no legal implications. Confidentiality was rigorously maintained to protect the privacy and safety of participants. For example, in my analysis, if a community leader held a specific portfolio, I ensured that the name of the portfolio was omitted. This precaution prevented the identification of individuals, as certain roles within the community could easily be linked to the person being interviewed. By taking such measures, I ensured that participants' identities and positions within the community were not revealed, upholding ethical standards throughout the research and protecting their privacy and safety.

I tired as much as possible to adhere to ethical obligations and university standards, fostering an environment of trust and transparency. This careful approach ensured that the ethical dimensions of the research were responsibly managed, maintaining the integrity of the study.

1.10. Outline of the research report

This research is presented in five chapters. Building on the foundation of this chapter, Chapter 2 provides a literature review, exploring both international and South African perspectives on informality, migration, and climate change. This chapter traces the evolution of informal settlements, particularly as they relate to urban migration and climate variability. It also reviews relevant policies and global debates on upgrading strategies for informal settlements, emphasizing the integration of climate adaptation into these strategies to enhance resilience and sustainability.

Chapter 3 focuses on the specific case of Stjwetla informal settlement in Johannesburg. This chapter delves into the urban challenges faced by Stjwetla, particularly in the context of climate change, migration dynamics, and inadequate infrastructure. The chapter draws attention to Johannesburg's Climate Action Plan and its implications for flood management and the development of resilient housing. Migration and the socio-economic dynamics of Stjwetla are also discussed, providing a detailed background to the research setting.

Chapter 4 presents and discusses the research findings, directly addressing the research questions which ultimately leads to the exploration of the intersection of informality, migration and climate change. The chapter provides an in-depth analysis of the challenges faced by Stjwetla residents, such as flooding, limited infrastructure, and social dynamics within the community. It examines the coping mechanisms employed by residents, as well as the gaps in government responses to the settlement’s needs. Themes related to migration, informal housing strategies, and climate change impacts are explored, highlighting the vulnerabilities and adaptive strategies of the community.

The final chapter, Chapter 5, summarizes the key findings and conclusions of the research. It provides recommendations, emphasizing the importance of integrating climate resilience into informal settlement upgrading strategies. examines how migration, climate change, and informality intersect in Stjwetla, an informal settlement in Johannesburg. It highlights the vulnerability of residents to flooding and inadequate infrastructure, driven by migration for economic opportunities. The study finds that informality both aids and restricts resilience. Key recommendations include improving infrastructure, supporting micro-businesses, fostering

social cohesion, and integrating informal settlements into long-term urban planning. Future research should focus on climate-resilient infrastructure and migrant integration in urban environments.

2. Chapter 2: Drawing on literature towards a conceptual framework

2.1. Introduction

The rapid growth of informal settlements and land invasions in South Africa underscores a deepening crisis of landlessness and urban inequality. As cities expand at an unprecedented pace, urban land has become an increasingly contested resource, with escalating pressure on housing and infrastructure. However, this growth is occurring without clear and coordinated policies for land delivery, management, or development. As a result, informal settlements continue to multiply, becoming more complex and entrenched (White Paper on Land Policy, 1997). This literature review delves into the complex relationships between informality, migration, and climate change in urban settings. It examines how climate variability exacerbates challenges in informal settlements, explores the drivers of migration, and assesses how these dynamics interact to shape both migration patterns and urban informality. Ultimately, the review seeks to generate insights for improving the resilience and living conditions of informal settlements in the face of these intertwined challenges.

This chapter has four substantive sections. It begins by tracing the historical evolution of informal settlements, focusing on how socio-economic pressures and migration have shaped their development. The second section examines their physical and socio-economic characteristics, highlighting their vulnerabilities. Migration is addressed specifically in the third section, exploring its role in driving informal settlement expansion rather than reviewing all aspects of migration comprehensively. The final section investigates the impacts of climate variability on informal settlements, linking global trends to the South African context and analysing policies and strategies for climate-resilient upgrading. Throughout, the chapter considers the social, economic, and environmental factors contributing to informal settlements' vulnerabilities, as well as the adaptive strategies employed by their residents.

2.2. Informal Settlements in the South African context

Informal settlements have long been a part of South Africa's urban landscape. Harrison (1992) traces their origins to the emancipation of slaves in 1834, when newly freed individuals began establishing informal dwellings on the outskirts of cities like Cape Town. These early settlements were often unregulated, growing spontaneously to accommodate expanding urban populations (Harrison, 1992). Over time, informal settlements evolved in response to political, economic, and social pressures, with limited urban planning and constrained access to formal housing. Fast-forward to the modern era, the factors driving the formation of informal settlements have become increasingly complex. Huchzermeyer (2011) explains that contemporary informal settlements are shaped by inadequate planning and engineering practices, often exacerbated by urban policies that prioritize economic growth over equitable

development. These policies frequently neglect the needs of vulnerable populations, leading to urban environments that fail to support residents living in informal settlements (Huchzermeyer, 2011). As a result, informal settlements today continue to reflect a range of socio-political and economic challenges that extend beyond their physical appearance.

Huchzermeyer (2002) argues that the informal settlements in South African cities highlight the inadequacies of the political and economic system in serving the urban population. This has a long genealogy. The discovery of gold and diamonds in the 19th century triggered a major shift in economic activities towards the interior of the country, resulting in significant regional disparities (ibid). Wealthy, globally connected regions emerged, starkly contrasting with impoverished rural and semi-rural areas. This economic shift was further exacerbated by the 1913 Land Act and the 1923 Natives Act, which entrenched permanent racial separation and prohibited Africans from purchasing or leasing land outside designated reserves (Modise & Mtshiselwa, 2013; Huchzermeyer, 2002). Consequently, the lack of official urban socioeconomic integration, including legal access to land, contributed to enduring inequalities (Huchzermeyer, 2002).

According to Huchzermeyer (2002), the 1970s marked a pivotal period in South Africa, initiating a complex and often unclear process of democratization. Influenced by international trends and progressive South African academics, a more favourable view of informal settlements emerged (Harrison, 1992). By 1979, there was growing recognition that existing policies were inadequate. Between 1979 and 1985, the government transitioned from anti-urban policies to a more liberal approach, promoting self-help housing through site-and-service programmes, such as the Urban Foundation's Inanda Newtown project in 1981 (Harrison, 1992; Abbott, 2002). In 1985, the government lifted the housing freeze, granted Black urban citizens the right to own property, and began upgrading townships (Harrison, 1992). However, these changes did not disrupt the prevailing power dynamics, with the white elite continuing to dominate. Consequently, South Africa remains one of the most unequal countries among middle-income nations (Sulla, Zikhali, Cueva,2022).

In 1990 south Africa entered a new era in its political development as a result urban policy shifted significantly. The President's Council report of 1985 recognized informal settlements can make an important positive contribution to the urbanisation process and potentially beneficial if organized and serviced (Harrison, 1992). It categorized informal settlements as "desirable" when planned and serviced, and "undesirable" when chaotic and risky. Rejecting the effectiveness of squatter demolitions, the report advocated indirect measures such as legalizing certain settlements, upgrading, providing serviced land and setting feasible development standards. The Department of Land Affairs White Paper on Land Policy (1997)

acknowledged the issue of uneven pattern of urban land prices and squatting as a consequence of past discriminatory policies and sought to address it through rapid land designation and servicing. According to Harrison (1992) by the early 1990s, approximately 7 million South Africans were living in informal settlements. A decade later, there was a notable shift toward a more sensitive approach to addressing informal settlements, emphasizing support and upgrading. However, it was only in 2004 that a dedicated funding mechanism for these efforts was established (Huchzermeyer, 2011).

In the post-apartheid era, informal settlements have become highly visible and politicized phenomena (Harrison, 1992; Human rights watch, 2024). South African political leaders at various levels of government frequently blame the rapid increase of informal settlements on undocumented migrants from other countries (Huchzermeyer, 2011; Human Rights watch, 2024). Labelling 'illegal migrants' as the cause serves as a convenient scapegoat, diverting attention from the internal factors that exacerbate domestic inequality and urban disparities (Huchzermeyer, 2011). Limited understanding of migration and urbanization across the African continent exacerbates this narrative. While the substantial burden of the apartheid legacy is acknowledged, South Africa's growing inequalities are largely linked to the country's neoliberal macro-economic policies, which have increasingly exposed South African markets to global competition (ibid). ‘An in-depth anthropological study of an informal settlement in KwaZulu-Natal in South Africa shows how a series of interconnected shifts that include rising unemployment and inequalities, reduced marriage rates, and the greater mobility of women’ contributes to ‘the persistent growth of informal settlements’ (Huchzermeyer, 2011:26).

2.3. Characteristics of informal settlements in urban settings

Informal and unplanned settlements are characterized by their affordability or relative cost-effectiveness. On the other hand, climate change vulnerability has brought informal settlements into the spotlight, highlighting their exposure to environmental risks. Wekesa, Steyn and Otieno (2011) argue that conventional building technologies are often unaffordable for the urban poor due to widespread poverty. Inadequate funding from local and national governments impedes the provision of essential community services and infrastructure. Weak enforcement of by-laws, along with political and economic interests, complicates upgrading programmes for informal settlements, particularly regarding security of tenure. Additionally, high land costs in urban centres significantly contribute to the expansion of informal settlements (ibid). Huchzermeyer (2014a) notes the Marxist argument that low-cost shelter perpetuates informality by supporting wage exploitation, which relies on affordable housing. However, she adds that this low-cost shelter also facilitates inclusion, enabling low-wage or unemployed households to establish themselves in urban areas at minimal cost, thus finding

livelihoods and investing in family life aspects such as education (Huchzermeyer, 2014a). 'It is important to recognise the personal endeavour, ingenuity, intimacy, complexity, human scale, political action, small-scale market activity and cultural and artistic expression in these settlements' (Huchzermeyer, 2011:26). The following sections, which in part draws on literature on informal settlements in and beyond South Africa, will examine these characteristics, focusing on their physical attributes and the socio-economic conditions faced by their inhabitants. Understanding these aspects is essential for developing effective interventions and policies to address the challenges of informal settlements.

2.3.1. Physical characteristics

According to Ghasempour (2015), informal settlements are residential areas where housing units are developed on land without legal ownership or formal permission. These settlements often emerge out of necessity as residents seek affordable housing solutions amid economic and social constraints, leading to communities on land lacking secure tenure. By 2001, approximately 9.1 million people in South Africa resided in informal settlements (Stats SA, as cited in Wekesa et al., 2011). These settlements vary significantly in physical characteristics based on location and residents' income levels. Typically situated in areas of poor environmental quality, such as dumpsites and marshlands, the dwellings are often makeshift, constructed from materials like metal, cardboard, and plastic, and fail to meet exclusionary building regulations. Consequently, they provide minimal protection and are prone to collapse(ibid). Additionally, fire outbreaks frequently impact informal settlements. Although statistics on fires are limited, they reveal that fire incidents have substantial effects (Spinardi, Cooper-Knock, & Rush, 2020). The vulnerability of these communities extends to flooding, presenting a high risk of major disasters (Spinardi, Cooper-Knock, & Rush, 2020). In response to these challenges, some informal settlements in South Africa are consolidating with residents converting makeshift shacks into more durable brick-and-mortar structures (Huchzermeyer, personal communication quoted in Comins, 2023). The case study in this research report is an example of this new trend. This shift towards more stable construction materials addresses the need for greater safety and stability. Basic infrastructure, such as potable water, sewerage and stormwater drainage, is often still absent, posing significant health hazards and exacerbating socio-economic struggles and environmental degradation (Wekesa, Steyn, & Otieno, 2011).

2.3.2. Socio-economic Characteristics

The inhabitants of informal settlements in South African cities are predominantly poor and rely heavily on the informal economy for subsistence (Kekana, Ruhiiga, Ndou, 2023). A significant proportion of informal settlement communities in South Africa face the inability to meet their daily needs (ibid). Unemployment rates are exceptionally high, reaching between 58% and 72% in informal settlements in Buffalo City, Durban and Alexandra in Johannesburg, impacting quality of life, crime rates and housing conditions (Wekesa, Steyn, and Otieno, 2011). Environmental injustice is evident in South African informal settlements. Disparities in access to basic services highlight environmental racism and classism where marginalized communities face unequal environmental quality compared to affluent areas (Kekana, Ruhiiga, Ndou, 2023). For example, during Cape Town's drought in 2019 residents in informal settlements experienced more severe water shortages due to unreliable access compared to wealthier neighbourhoods (ibid). Informal settlements in South Africa are at times located near upmarket wealthy areas. Owners of these upmarket homes argue that the presence of informal settlements has devalued their residential properties(ibid). This reflects a typical environmental justice issue, emphasizing locational advantage that benefits a privileged few. Moreover, there is an implicit racial discrimination at play, as informal settlements are predominantly occupied by Black Africans, while upmarket homes are largely owned by White residents(ibid). Informal settlements often occupy environmentally sensitive areas prone to hazards such as floods and landslides, exacerbating their vulnerability. Air pollution from cooking and heating sources like firewood and paraffin further degrade environmental quality, posing health risks to residents, especially children Nkoane, 2019: Kekana, Ruhiiga, Ndou, 2023. These settlements are characterised by a decline in health and nutrition levels, higher school dropout rates and increased pressure on both the physical and social environments of low-income urban residents (Nkoane, 2019: Kekana, Ruhiiga, Ndou, 2023)

Historically, South Africa's response to informal settlement upgrading shifted from a focus on eradication to recognizing the need for targeted implementation mechanisms. One such mechanism was the National Upgrading Support Programme (NUSP), which was established as a capacity-building entity to support the implementation of the Upgrading of Informal Settlements Programme (UISP), outlined in the National Housing Code (Massey, 2013). NUSP played a crucial role in providing technical assistance to municipalities, facilitating participatory planning processes, and promoting sustainable approaches to informal settlement upgrading.

The first decade after political independence in South Africa in 1994 saw the state as the primary driver of housing delivery, a continuation of the strong, state-led approach taken by the apartheid government (Tissington, 2010). The private sector was tasked with applying for

housing subsidies on behalf of communities, identifying, servicing land and constructing housing where possible. However, this approach faced significant criticism for relying on market-driven solutions, which many argued would reinforce the inequalities of the racist capitalist housing market instead of addressing its systemic flaws(ibid). However, this approach largely excluded active citizen involvement in addressing the housing crisis, as the state heavily relied on private sector developers. This approach saw a notable shift, partly driven by a landmark socio-economic rights case decided by the Constitutional Court in 2000. The ruling compelled housing policymakers to reconsider their strategies, as the court highlighted that, despite having a range of housing delivery mechanisms on paper, the overwhelming focus on long-term projects aimed at mass-producing standardized housing units overlooking the urgent needs of people living in informal settlements or other vulnerable conditions(ibid). As a result, the next decade witnessed the introduction of the Breaking New Ground (BNG) framework which marked a significant shift from merely providing housing to creating integrated human settlements aimed at fostering broader urban development(Parikh, Bisaga, Loggia, Georgiadou, & Ojo-Aromokudu, 2020) A key component of this evolution was the People's Housing Process (PHP), which was later turned into the Enhanced People's Housing Process (ePHP). This approach emphasizes community participation and local economic development in housing initiatives (Parikh et al., 2020). In-Situ Upgrading, introduced through BNG, has emerged as a critical strategy, advocating for incremental improvements within existing settlements to avoid disrupting social networks and economic activities (Massey, 2013). This approach involves participatory processes where communities actively engage in planning and decision-making, ensuring that interventions are contextually relevant and sustainable over the long term (Ibid). This prioritizes infrastructure services through the UISP, which aims for inclusive and holistic upgrading solutions (Brown-Luthango, Reyes, & Gubevu, 2017). The UISP supports incremental upgrading and community involvement being part of the National Housing Code (2009) to promote sustainable development and address environmental vulnerabilities (Brown-Luthango et al., 2017).

Effective upgrading necessitates holistic infrastructure interventions encompassing water, sanitation, waste management and electricity (Brown-Luthango et al., 2017). Integration of these services within projects ensures lasting benefits and improved living conditions, guided by environmental assessments aligned with broader urban management strategies. In 2019, Nkoane posited that the provision of low-income housing would constitute only a small part of the national response to informal settlements due to slow time frames and high costs. According to the Housing development agency (HDA) (2014), the upgrading approach as practiced in South Africa is incremental and infrastructure led. The goal in many municipalities is to prioritize interim services and ensure all informal settlements are included in the

government's service delivery programmes, even if formalization may not be immediately possible. Brown-Luthango et al., (2017) argues that while full upgrades are financially unsustainable, interim services like prefabricated ablution blocks are implemented based on land suitability .The approach that has generally been adopted to operationalise the UISP, namely to categorize informal settlements according to their suitability for upgrading and related to this for specific responses, either Full Upgrading (Category 'A'), Interim Basic Services with upgrading to follow (Category 'B1'), Emergency Basic Services (Category 'B2') with relocation to follow, and urgent relocations (Category 'C'), (ibid).

2.4. Challenges and socio-economic impacts of informal settlements upgrading

The South African state's failure to roll out informal settlement upgrading is primarily attributed to inadequate resource allocation, ineffective cost-recovery strategies, limited funding, and coordination difficulties among multiple funding sources (Sibiya, Aigbavboa, & Didibhuku, 2013). Additionally, low levels of cooperative governance and limited human resource capacity further exacerbate these issues (ibid). Significant challenges facing informal settlement upgrading in Gauteng Province include delays in decision-making and approval processes by the Department of Human Settlements, a scarcity of developable and well-located land for relocation where this is needed, frequent changes in government personnel and processes, and with officials having citing an increasing number of migrants moving to informal settlements as one of the challenges, reflecting broader perceptions that often blame migration and informal settlements for urban challenges. Other challenges include difficulties in development planning and approvals by state organs, legal obstacles, a lack of participation from informal settlement inhabitants.

Informal settlements upgrading projects across different provinces and cities in South Africa often face criticism for not adequately improving residents' quality of life or addressing underlying socio-economic inequalities (Massey, 2013). Residents may find themselves burdened with new financial obligations for services previously inaccessible, exacerbating hardships in contexts of high unemployment and limited alternative livelihoods (Brown-Luthango et al., 2017). Moreover, unintended consequences such as declining community cohesion have been observed post-upgrading, attributed to changes in housing arrangements that affect social dynamics and mutual support networks (Massey, 2013). This occurs when upgrading fails to follow the Upgrading Informal Settlements Programme (UISP), which mandates minimizing disruption to residents daily lives. These complexities underscore the ongoing debates and uncertainties surrounding effective informal settlement upgrading, necessitating a nuanced approach that balances physical interventions with social and economic support. The discourse on informal settlement upgrading in South Africa calls for a

comprehensive (though incremental) approach that not only addresses physical infrastructure but also enhances socio-economic resilience and community well-being. Achieving sustainable outcomes requires continuous adaptation of policies and practices, informed by local contexts and the active participation of residents in shaping their living environments (Brown-Luthango et al., 2017). The implementation of the UISP remains fraught with challenges and unresolved aspects, highlighting the complexity of addressing the needs of informal settlement dwellers while striving for sustainable and inclusive urban development.

2.5. The role of migration in the growth of informal settlements

Urban areas such as those in Gauteng experience rapid growth due to both internal migration from other towns, cities, provinces, and international migration attracted by economic opportunities (Landau & Gindrey, 2008). As the economic hub of South Africa, Gauteng has traditionally drawn migrants seeking employment and better living conditions. However, recent trends indicate shifts in migration patterns, with fewer people moving to Johannesburg compared to other cities. Yet many face significant barriers to accessing formal housing markets due to high costs and regulatory hurdles. Consequently, they settle in informal settlements where housing is more affordable, albeit lacking adequate services and infrastructure (Warner, Afifi, Kalin, Leckie, Ferris, Martin, Wrathall, 2013). In addition to informal settlements, the proliferation of makeshift dwellings, known as 'shacks,' is particularly evident in backyard settings within established townships (Turok & Borel-Saladin, 2016). This form of informal housing reflects the struggle of low-income groups to find suitable accommodation within the formal housing sector constrained by high costs and regulatory complexities. Across low- and middle-income countries, including South Africa, the under-provision of affordable housing exacerbates the challenge of accommodating rapid urban population growth (ibid). Migration's role in contributing to informal settlement growth in South Africa underscores (Turok & Borel-Saladin, 2016) recommendation for the urgent need for holistic urban policies that address housing affordability, infrastructure development and regulatory barriers.

2.6. Climate change as a driver of migration

Climate change serves as a powerful catalyst for migration across the globe, primarily through its profound impacts on environmental conditions essential for human habitation and livelihoods (International Organisation for Migration, 2009). Rising temperatures, altered precipitation patterns, and more frequent and severe weather events such as hurricanes, floods and droughts directly threaten agricultural productivity, water availability, and overall living conditions in vulnerable regions (McLeman & Smit, 2006; Black, Adger, Arnell, Dercon,

Geddes & Thomas, 2011). For instance, prolonged droughts can render farmland barren and unproductive, compelling rural populations to seek alternative livelihoods in urban areas or even migrate across borders in search of more stable environments (McLeman & Smit, 2006). Coastal communities face escalating risks from sea-level rise, intensifying storm surges, and erosion, which threaten their very existence and prompt relocation to safer regions (Warner et al., 2013). Migration, while adaptive in response to environmental stress, can increase vulnerability if it leads to displacement to areas with limited resources or inadequate infrastructure

Moreover, climate change acts synergistically with socio-economic factors such as poverty, inequality, and governance challenges, exacerbating vulnerabilities and limiting adaptive capacities in affected communities (Black et al., 2011). In regions already burdened by socio-economic disparities, the added strain of climate impacts can trigger or intensify migration flows as people seek safer and more sustainable living conditions (McLeman & Smit, 2006). This dynamic interaction underscores the interconnectedness of environmental degradation, social resilience, and human mobility, necessitating holistic approaches to policy and planning that integrate climate adaptation strategies with sustainable development goals (Warner et al., 2013).

Furthermore, the long-term implications of climate change, including anticipated shifts in agricultural zones and the availability of freshwater resources, pose profound challenges to food security and livelihoods in many parts of the world (Black et al., 2011). As communities grapple with these uncertainties, migration emerges as a pragmatic response to ensure survival and adapt to changing environmental conditions. Southern Africa is highly vulnerable to climate change, with warming occurring at nearly twice the global average. South Africa, the continent's largest greenhouse gas emitter and among the top 25 globally, has seen mean annual temperatures increase by 1.4°C, double the global average of 0.7°(Igamba,2023). Climate impacts include intensified weather extremes, changing rainfall patterns, prolonged dry spells, and increased heat waves, leading to declining crop yields, livestock losses, rising food insecurity, and more frequent vector- and waterborne diseases (ibid).

Since 1980, South Africa has faced 86 weather-related disasters, affecting over 22 million people and causing over R113 billion in losses. Events like Cape Town's 2018 water crisis and nationwide floods in 2021 highlight the country's high climate vulnerability(ibid). Rural populations, especially the poor, lack the resources to adapt or recover, exacerbating inequality and deepening poverty. Climate change further threatens agriculture, reducing productivity, disrupting trade, and spiking food prices. Rising temperatures, droughts, and floods force subsistence farmers to abandon their land, contributing to climate-induced

migration. Provinces like Limpopo and Eastern Cape face severe droughts, driving rural populations to urban areas like Johannesburg and Polokwane (ibid). However, cities often lack the resources to integrate migrants, leaving many in informal settlements exposed to environmental hazards and poor living conditions.

By recognizing climate change as a key driver of migration, policymakers and stakeholders can better anticipate and respond to the complex challenges posed by environmental displacement, ensuring that migration is managed in ways that uphold human dignity, rights, and sustainable development goals.

2.7. Climate change and urban vulnerability (Impacts of climate change on urban areas)

Urban areas worldwide face substantial challenges due to climate change, exacerbating vulnerabilities and impacting human well-being (Güneralp, Güneralp and Liu, 2015). Urbanization trends indicate that by 2030, nearly 60% of the world population will reside in cities, significantly increasing exposure to natural hazards like floods and droughts (Güneralp et al., 2015). These water-related disasters are not only occurring more frequently but also among the costliest, causing extensive damage to infrastructure and affecting millions of people globally.

Historically, floods, heavy downpours, hailstorms, heat waves and droughts have accounted for a substantial portion of natural disasters, with profound socio-economic consequences. The impact of climate change on urban areas is multifaceted, affecting infrastructure, built environments and water resources (Hunt & Watkiss, 2011). Between 1900 and 2006, they comprised 38% of all disasters, causing 45% of total casualties and affecting over 84% of people impacted by natural disasters (Güneralp et al., 2015). Economic losses from these hazards have increased by more than 500% since the early 1980s, primarily driven by rapid urbanization in susceptible regions (Güneralp et al., 2015). Urban settlements are particularly vulnerable due to the concentration, location in hazard-prone areas like coastlines, and dependence on climate-sensitive sectors (Hunt & Watkiss, 2011). Severe weather events such as floods, storms and heatwaves pose substantial risks to the built environment, leading to increased costs of insured damage and infrastructure losses (Hunt & Watkiss, 2011). High temperatures as a result of heatwaves drive up energy demand for cooling, placing stress on power grids, which are already strained in countries like South Africa. Power outages disrupt infrastructure systems, including water supply and transport (Igamba,2023). Projections indicate a significant rise in economic vulnerability to coastal and riverine flooding by 2050, driven by climate change's adverse effects on agriculture, infrastructure, health, and

resources, which disrupt livelihoods, escalate costs, and highlight the urgent need for targeted adaptation strategies (Güneralp et al., 2015).

In well-governed cities, effective storm and surface drainage systems are integrated into the urban infrastructure, with additional measures like parks and open spaces to safely accommodate floodwaters from severe storms (Satterthwaite, 2008). There is also potential for land-use management and incremental adjustments to enhance flood-water management capacity. However, in poorly governed cities, these measures are often absent (ibid). Most residential areas lack installed drainage systems and rely on natural drainage channels, which are frequently obstructed by buildings or infrastructure. In many urban centres, a significant portion of the population lacks access to solid-waste collection services (ibid). In areas with poor solid waste management or drainage maintenance, debris and plant growth can clog drains, resulting in localized flooding even with light rainfall (ibid). This inadequate infrastructure not only exacerbates flooding but also impacts water resources in urban areas, influencing demand, availability, and quality (Hunt & Watkiss, 2011).

Higher temperatures accelerate evaporation rates, intensifying water demand, while altered precipitation patterns disrupt water supplies (Hunt & Watkiss, 2011). Semi-arid and arid regions are particularly susceptible, facing heightened risks to freshwater resources that support critical economic sectors such as agriculture, energy, and public health (Hunt & Watkiss, 2011). These impacts underscore the need for integrated water management strategies that enhance resilience to climate variability and change. The impacts of climate change on urban vulnerability are significant and growing, necessitating proactive adaptation measures to safeguard infrastructure, mitigate risks, and enhance urban resilience. Addressing these challenges requires comprehensive strategies that integrate climate considerations into urban planning, infrastructure development, and water management, ensuring sustainable and resilient cities for future generations.

Informal settlements exemplify governance failures and the denial of the universal right to shelter, with many climate-vulnerable communities residing in these areas. Limited access to basic services exacerbates their vulnerability to natural and human-made hazards, including floods, fires, diseases, and industrial accidents. High population density and poor infrastructure amplify the risks posed by climate change (Nokwenama, 2023). In February 2022, heavy rains in Gauteng caused severe flooding, displacing over 180 people in Ivory Park, Tembisa. Similarly, devastating floods in April 2022 led to a National State of Disaster, with KwaZulu-Natal experiencing over 300 mm of rainfall within four days, causing landslides, infrastructure damage and the displacement of thousands, especially in low-lying areas like

eThekwini. These events highlight the disproportionate impact of climate change on informal settlements (ibid).

Climate change excessively impacts informal settlements compared to formal areas due to their precarious locations, often near rivers. These areas face heightened flood risks as rivers frequently become dumping grounds for waste, exacerbating the impact of climate-induced heavy rainfall. In parts of the Ngong River in east Africa, homes are swept away annually during rapid flooding, leaving residents to search for their belongings and missing relatives (Pashayan, 2024). Floodwaters often stagnate near homes, creating breeding grounds for mosquitoes that spread malaria, yellow fever, dengue fever, and other vector-borne diseases. Stagnant water also increases the risk of waterborne illnesses such as cholera, typhoid, dysentery, and hepatitis, further endangering the health of those in informal settlements (ibid).

2.8. Conceptual Framework

Informal settlements often arise from economic exclusion, with residents displaying self-organization and creativity to achieve stability and permanence. Migration, influenced by various socio-economic factors, contributes to the expansion of these settlements. Climate change exacerbates the vulnerabilities of informal settlements through extreme weather events and increased health risks. Recognizing these relationships is crucial for developing integrated policies and strategies to address the challenges faced by urban populations.

2.8.1. Key definitions and theoretical underpinnings

This research adopts the definition of informal settlements by Huchzermeyer, Karam, and Maina (2014), who describe them as unplanned housing developments lacking official approval, characterized by inadequate infrastructure and poor access to services. This definition is similar to the one provided by Wekesa, Steyn, and Otieno (2011) in Section 2, Characteristics of informal settlements in urban settings, which also emphasizes the lack of planning, poor infrastructure, and limited access to services as key features of informal settlement. This perspective emphasizes their self-help nature, aligning with Huchzermeyer's (2014a) assertion that they represent early instances of self-organization in response to economic exclusion. Informal settlements articulate Lefebvre's attributes of the right to the city, displaying high levels of self-organization, self-expression, and creativity, and an attempt to counter spatial domination (Huchzermeyer, 2021). This is particularly relevant in Johannesburg and by case study settlement Stjwetla in particular, as residents increasingly explore brick-and-mortar constructions that reflect aspirations for stability and permanence. The expansion of informal settlements in cities evidences the inadequacies of the political-economic system in serving the urban population. In South African cities, accommodation has

often been overcrowded in migrant worker hostels, dilapidated township housing, and informal settlements (Huchzermeyer, 2021).

Migration, for the purposes of this report, ‘is defined as the movement of persons away from their place of usual residence, whether across an international border or within a State, temporarily or permanently, and for a variety of reasons’ (IOM, 2019:137). This definition encompasses legal categories like migrant workers and smuggled migrants, as well as those whose status or means of movement are not specifically defined under international law.

This report adopts the definition of climate change as outlined by the United Nations Framework Convention on Climate Change (UNFCCC), which describes it as a change directly or indirectly caused by human activity that alters the composition of the global atmosphere, alongside natural climate variability. Climate and weather patterns influence air quality, food security, water availability, and the risk of life-threatening diseases. The increased emission of carbon dioxide and other greenhouse gases traps energy in the atmosphere, causing a “greenhouse effect” that leads to extreme weather patterns, compromised food security, and increased vector-related and climate-related diseases and deaths. Human activities, such as increased urbanization and use of cooling systems, exacerbate risks for vector-borne diseases (WHO, 2015).

2.8.2. Factors contributing to the intersection of Informality, migration and climate change

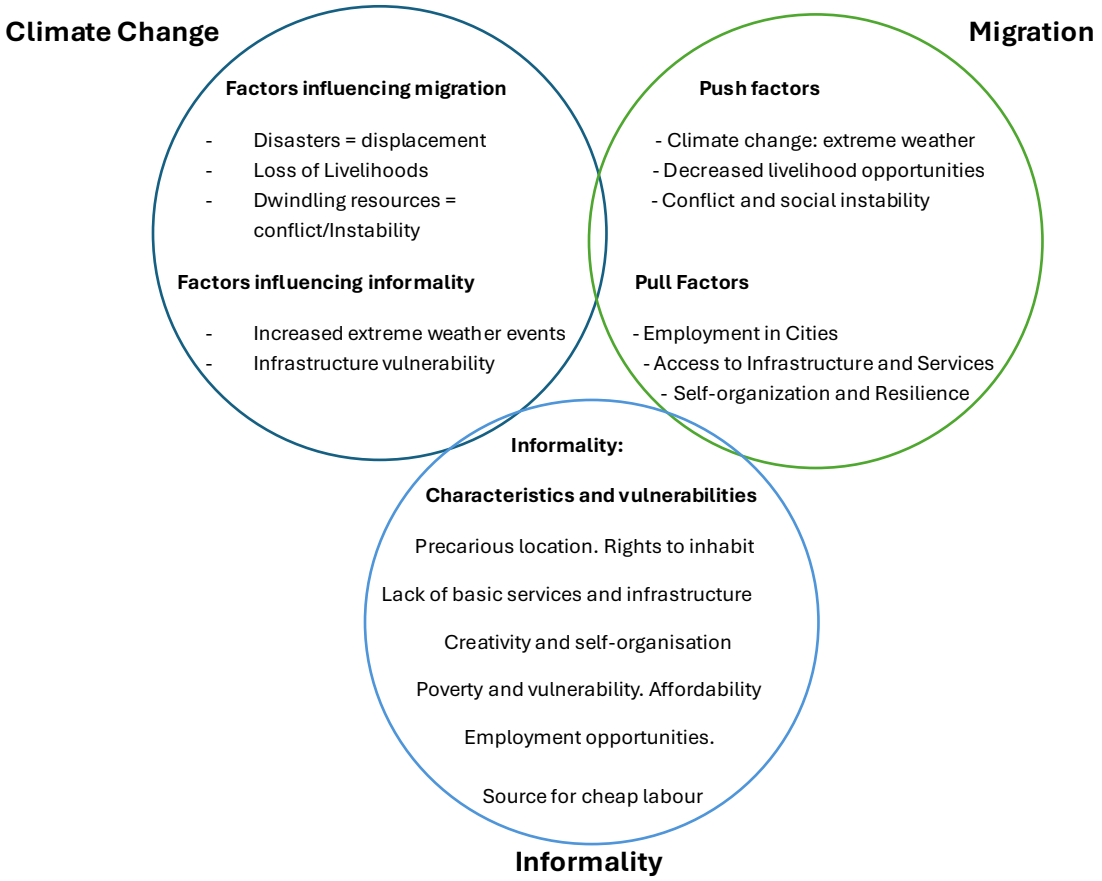


Figure 2. 1: Interconnections between Migration, Climate Change, and Informality, Illustrating the dynamic interplay among these phenomena and their collective impact on urban environments. (Source: authors construct, 2024)

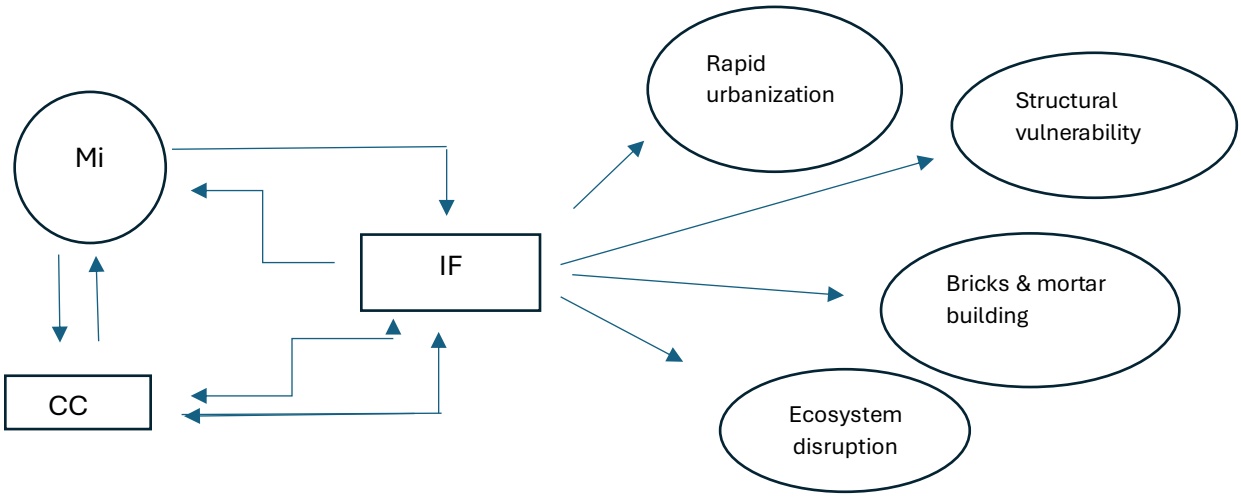


Figure 2. 2 : This diagram illustrates the cyclical and interrelated nature of informality, migration, and climate change, demonstrating how these phenomena influence and rotate around each other over time. (Source: authors construct, 2024)

Figures 2.1 and 2.2 illustrate the factors contributing to the intersection of informality, migration and climate change, emphasizing their cyclical and interrelated nature. These diagrams show how one phenomenon often influences the other. Migration is typically driven by the search for better job opportunities and services in cities. However, the lack of affordable housing and infrastructure often leads to the formation of informal settlements. These settlements are characterized by precarious living conditions, unclear land rights, and limited services, while also demonstrating resilience through self-organization. The intersection highlights how climate-induced displacement and poverty fuel urban migration, resulting in informal housing with limited access to essential resources

This research adopts a multidisciplinary conceptual framework integrating migration theories, urban land market theory and spatial justice. Drawing from de Haas' (2007) integrated approach to migration, I examine how climate change, migration and informality influence urban development, particularly in informal settlements. De Haas' framework allows for an understanding of migration as a response to both environmental pressures and economic opportunities, shaped by broader social processes. Additionally, Kihato's (2006) provides insights into the political economy of urban land markets and how economic and political power structures shape land distribution in cities, particularly the exclusion of low-income groups from valuable urban spaces. This theory helps explain why informal settlements often emerge in marginal areas with inadequate infrastructure, reinforcing social inequalities. Huchzermeyer (2014b) Lefebvre's concept of the "Right to the City" challenges these exclusionary practices, advocating for spatial justice and equal access to urban resources for all residents, including those in informal settlements. Together, these theories guide the analysis of how migration patterns and informal settlements are shaped by both systemic inequalities and the ability of marginalized communities to assert their rights within the city. This framework connects migration, climate change and urban land markets within a broader social transformation process, offering a nuanced understanding of how environmental, economic, and social factors interact to create and sustain informal urban spaces.

2.9. Conclusion

This review has explored the complex interplay between informality, migration, and climate change, with a focus on urban settings in South Africa, while drawing on international literature to broaden the context. Informal settlements, historically driven by socio-economic pressures and exacerbated by migration seeking economic opportunities amidst climate-induced environmental challenges, remain central to urban development in the Global South. These settlements, facing compounded vulnerabilities from climate variability such as extreme weather and environmental degradation, highlight the challenges of inadequate infrastructure

and services. Migration continues to fuel the expansion of informal settlements, with affordability being a key driver despite the lack of services. As policy responses evolve towards more inclusive and community-driven approaches, like the National Upgrading Support Programme, the need for integrated climate adaptation strategies in urban planning becomes increasingly evident. Building on these insights, the following chapter delves into Stjwetla, a case study located along the Jukskei River in Alexandra, Johannesburg. Stjwetla epitomizes the intersection of migration, informality, and climate vulnerability, where socio-economic factors and environmental challenges have shaped its growth. This chapter will examine the settlement's physical context, historical development, and socio-economic drivers, providing a detailed analysis of the factors shaping Stjwetla’s development.

3. Chapter 3: Context chapter

3.1. Introduction

The intersection of informality, migration, and climate change continues to shape the socio-economic and spatial landscapes of cities in the Global South, including Johannesburg, South Africa. Migration driven by economic opportunities, access to services, environmental and political factors has contributed to the rapid growth of informal settlements in urban areas. Stjwetla, located along the Jukskei River in Alexandra, exemplifies the multifaceted challenges that arise at this intersection. Residents face precarious living conditions, which are further exacerbated by environmental vulnerabilities linked to climate change. This chapter provides a detailed examination of Stjwetla as a case study, exploring the settlement's physical context, historical development, and socio-economic drivers. It situates Stjwetla within the broader migration patterns in South Africa, drawing connections between migration and the growth of informal settlements. By addressing both the physical challenges faced by the settlement such as flooding due to its location along the river and the socio-economic drivers that contribute to its expansion, the chapter aims to provide a comprehensive understanding of the factors shaping Stjwetla's development.

3.2. Migration Dynamics in South Africa: Patterns and Drivers of Migration in Gauteng

Migration often driven by environmental disasters, economic exploitation or political tensions is perceived in South Africa as causing problems like environmental degradation, health issues, brain drain and social instability (Kok & Collinson, 2006). Despite these negative associations, migration offers hope for individuals and households (Kok & Collinson, 2006). According to StatsSA (2024), South Africa is a major destination for migrants across Africa, with 2,418,197 international migrants recorded in the 2022 census, accounting for 4% of the total population. Internal migration primarily involves young adults aged 20–39, most of whom move to Gauteng for better job opportunities and living conditions, driven by socio-economic factors to which climate change is expected to increasingly contribute. This highlights the interconnectedness of environmental and socio-economic drivers in shaping migration patterns.

Gauteng, the smallest province by land area in South Africa, is the largest by population with a total population of 15,099,422, and the most urbanized, (StatsSA, 2023). It is home to the country's densest urban centers and is regarded as South Africa's economic heartland and a gateway to Africa due to its strategic position, despite being the only landlocked province without international borders (Naude, 2008; Ngobeni, 2014). Between 2001 and 2011, Gauteng experienced a 30% population growth rate, with 52% of this growth attributed to in-

migration (Ngobeni, 2014). The province's development since the 1880s with the discovery of mineral wealth has been shaped by both internal and cross-border migration (Ngobeni, 2011). As the present-day economic hub of the country, Gauteng hosts robust financial, service, and manufacturing sectors, attracting migrants in search of employment, better income, quality education, and improved services (Ngobeni, 2014). Within the province, the City of Johannesburg holds the largest population, with 4,803,262 residents, 89.8% of whom live in formal dwellings and 9.7% informal settlements (StatsSA, 2023).

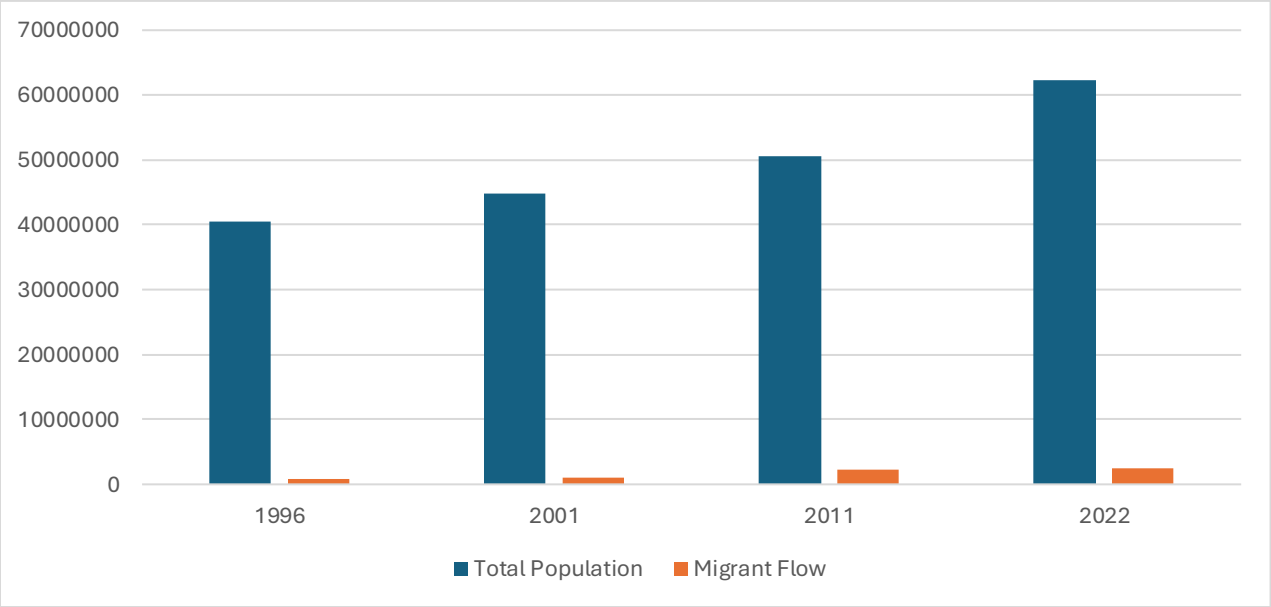


Figure 3.1: illustrates the Distribution and Percentage of Population Born Outside South Africa Relative to the Total Population (1996–2022). (Source: Authors construct based StatsSA,2024)

Between the 2001 and 2011 censuses, Gauteng attracted the most in-migrants, with Gauteng's immigrant population rising from 46.5% in 2001 to 51.5% in 2022 (StatsSA, 2024). The main reasons for migration include seeking paid work and being closer to spouses(ibid). Employment is a key pull factor, with higher employment levels attracting more migrants(ibid). Both (Ngobeni, 2014; StatsSA, 2024) argue that migrants from other provinces and foreign countries are more likely to be employed than native Gauteng residents. During apartheid and in the transition to democracy, poor rural people, trapped by apartheid homeland policies, struggled to escape their situation, leading to minimal changes in South Africa's migration levels between 1975-80 and 1992-96 (Kok & Collinson, 2006). Since then Labour migration has played a critical role in households surviving the legacy of the homeland system(ibid). While migration impacts South Africa in various ways, it also poses challenges, such as straining ecosystems and increasing the occupation of unsuitable land, particularly in the context of climate change.

3.3. Migrant flows in Johannesburg: Migration flows to inform development planning

Migration flows are key considerations for effective development planning. When managed well, migration can serve as a powerful catalyst for socio-economic development. However, if mismanaged, migration can burden a struggling society and economy and at times can raise concerns about national security. This emphasizes the importance of understanding migrant numbers and trends to inform infrastructure, service delivery and housing strategies.

It is widely acknowledged that rapid population growth, particularly urban growth, poses a significant challenge to development in many countries (United Nations department of economic and social affairs, 2022). This challenge is especially pressing in developing nations, where most of the population growth over the next 15 years will be concentrated in urban areas (UNDESA, 2014). According to Sibiya, Aigavboa, and Thwala (2013) population increase in cities is putting significant pressure on existing infrastructure and services. Recent data highlights the scale of migration in Johannesburg, the country's economic hub, which has consistently experienced high inflows of both internal and international migrants. According to an StatsSA (2023), the City of Johannesburg emerges as the municipality with the highest migrant population, hosting 510,809 migrants. This accounts for an 8.42% of the city's population. Migrants, regardless of their occupation or income level, must be integrated into the provision of services, infrastructure, and the housing market. Furthermore, census data from the 2022 survey revealed 149,845 recorded in-migrants, 198,213 out-migrants, and 4,215,539 non-movers within Johannesburg, highlighting the dynamic nature of population movements in the city (StatsSA (2023). This indicates a net outmigration of approximately 50,000 people, challenging the narrative that Johannesburg is burdened by in-migration(ibid). According to the 2022 census statistics, the city has experienced more out-migration than in-migration, necessitating a shift in the understanding of population trends(ibid).

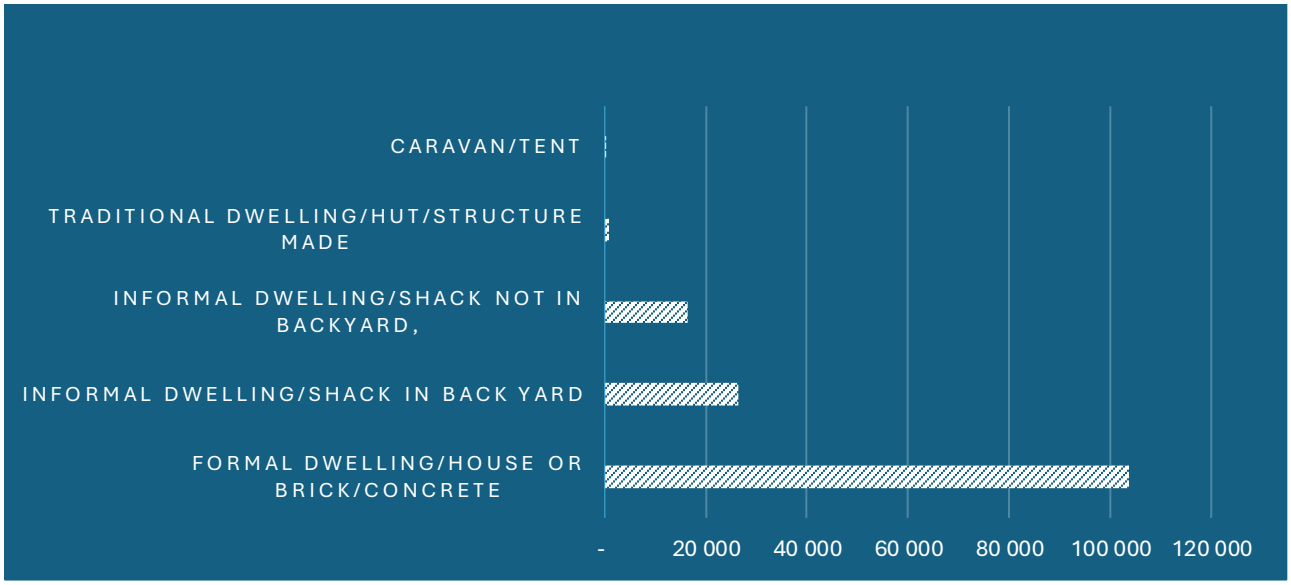


Figure 3. 2: illustrates the different housing typologies occupied by immigrants in the city of Johannesburg. (Source: authors constructure based on StatsSA, 2023 unreleased census data)

The City of Johannesburg accounts for the highest proportion of immigrant-headed households in Gauteng, with 245,362 households led by immigrant heads. This represents 44.1% of all immigrant-headed households in the province, reflecting Johannesburg's status as the largest and most populous city in the region. While these figures highlight the significant presence of immigrant-headed households, they align with expectations given Johannesburg's size and diversity. This statistic also underscores the role of immigrants in shaping the housing landscape and contributing to household responsibilities. Immigrant households form a notable part of the city's population, yet the data indicates that only a small proportion live in informal settlements or precarious housing typologies. This highlights the importance of grounding discussions in evidence to counter prevailing narratives that often misrepresent immigrants' living conditions and needs. Such narratives, frequently employed by officials, politicians, and movements like Dudula, frame immigrants as burdens or even illegal, overlooking their actual contributions and vulnerabilities. This supports the rationale for their inclusion in this study and underscores the importance of exploring the intersection of informality, migration, and climate change to better understand the unique challenges they face.

Census data reveals that the number of immigrants in Johannesburg is lower than often perceived, with most immigrants residing in formal housing rather than informal settlements. Contrary to dominant narratives, immigrants are not the majority among shack dwellers, and the city has experienced a net out-migration. These findings challenge common anti-foreigner sentiments and highlight the importance of accurate, evidence-based perspectives. Understanding these dynamics is crucial for contextualizing the intersection of informality,

migration and climate change, ensuring that discussions are grounded in fact rather than rhetoric.

3.4. Infrastructural Interventions in Johannesburg's Informal Settlements

In Johannesburg's informal settlements, state-led infrastructural interventions typically fall under the categories of interim services or ‘formalisation. According to Huchezermeyer, the upgrading programme (UISP) includes stormwater and drainage systems, especially for settlements located in vulnerable areas (Huchzermeyer, 2006a: p. 50, as cited by Adegun, 2014). Despite South Africa still facing informal settlements across the country, which have existed for a long period, this innovation is still a work in progress as it has not been fully realised.

3.5. Stormwater drainage: Infrastructural inadequacy in informal settlements

As urban populations grow, human impacts on land surfaces and drainage systems intensify. Consequently, even moderate storms can result in significant river flows due to surface runoff from hard surfaces and drains. According to Douglas, Alam, Maghenda, McDonnell, McLean, and Campbell (2008), it is common in the global south for a significant portion of the low-income population to reside in flood-prone areas, making them particularly vulnerable to the impacts of climate change, especially flooding. Parts of stjwetla in Alexandra such is indicative of this trend (Douglas et al., 2008). Morgan (2019) highlights stormwater management is generally excluded from the basic conditions outlined in the Upgrading Informal Settlements Programme (UISP), as set out in Chapter 13 of the National Housing Code (2004). This issue has not yet been adequately addressed in the policy. Water-related infrastructure in low-income communities is often affected by power dynamics at the municipal level, where providing services to the poor is given low priority (Morgan, 2019). High-density settlements such a Stjwetla, with no stormwater management, contribute to polluted stormwater runoff, which degrades rivers like the Jukskei. As a result, river morphology changes which has shifted the river channel as evident in Figure 3.3. The City of Johannesburg Municipality has faced serious water quality issues due to contaminated drainage from informal settlements contributing to contaminants in the Jukskei River (ibid). The river is heavily polluted by sewage leaks as well as direct sewerage discharge, solid waste, and contaminated runoff from impermeable surfaces, with informal settlements like Stjwetla being major contributors. This pollution has a broader impact as the Jukskei flows into Hartbeespoort Dam, a key drinking water source for the eastern part of the Northwest province. As Morgan (2019) argues If measures were taken to reduce contaminants entering the system, it would ease the strain on the infrastructure responsible for cleaning water for consumption. Morgan’s (2019) study found that due to undersupply and a high demand from the growing population, communal taps in

Stjwetla have low water pressure during peak times. The overloaded (and under-supplied) infrastructure, coupled with the dense and unplanned nature of the settlement, makes maintenance difficult. Water often ponds around the communal taps as there is no proper drainage system to remove excess water, further complicating the situation (ibid).



Figure 3.3 : Jukskei River morphology changes due to illegal dumping which have shifted the river channel (Source: Morgan, 2019:19)

3.6. Challenges and Strategies for Stormwater Management in Informal Settlements: The Case of Johannesburg

Adegun (2014, 2015) highlights the importance of stormwater management in urban environments, particularly in rapidly urbanizing cities like Johannesburg. Informal settlements in South Africa face significant challenges due to inadequate drainage systems and poor infrastructure, which exacerbate flooding risks, especially in high-risk zones (Membele, Naidu, Mutanga, 2022). Climate change further intensifies these issues by increasing the frequency of extreme weather events. While municipalities often discourage self-help infrastructure initiatives, community-led efforts are already improving stormwater management in some areas.

The City of Johannesburg's Climate Change Adaptation Plan calls for a catchment-scale approach to stormwater management, integrating sustainable urban drainage systems (SUDS) and green infrastructure. Despite legal frameworks like the National Water Act and the National Disaster Management Act, challenges persist in effectively addressing stormwater management in informal settlements. The lack of integration with the broader urban water cycle, insufficient awareness among developers, and reluctance to invest in informal areas undermine the effectiveness of these policies. These issues emphasize the need for more inclusive stormwater management strategies that address the unique challenges posed by informal settlements in the context of migration and climate change.

3.7. City of Johannesburg's Climate Change Adaptation Plan

CoJ (2021) The City of Johannesburg's (CoJ) commitment to climate action goes far beyond reducing greenhouse gas (GHG) emissions and mitigating climate risks. The City of Johannesburg's Climate Action Plan (CAP) is a comprehensive strategy designed to achieve net-zero emissions and climate resilience by 2050 (CoJ, 2021a). This plan emphasizes pro-poor, inclusive, and equitable climate initiatives and incorporates several key elements: promoting renewable energy, enhancing energy efficiency in buildings, developing green transport systems, improving waste management practices, and optimizing water and wastewater treatment. By 2030, a comprehensive review of energy use, potential energy savings, and energy generation opportunities in the water and wastewater systems will be undertaken, leading to the development of a Net-Zero-Energy program. The goal is to reach net-zero emissions across all water and wastewater systems by 2050, encompassing water treatment, conveyance, supply, as well as wastewater treatment and disposal. The CAP sets ambitious emissions reduction targets, aiming for a 25% reduction by 2030, a 75% reduction by 2040, and achieving net-zero emissions by 2050, all based on 2016 levels (CoJ, 2021a).

With more direct relevance to the situation in informal settlements, adaptation measures are a crucial part of the CAP, focusing on enhancing water security, creating resilient settlements, managing floods and droughts, developing resilient infrastructure, and improving community health. In City of Johannesburg, governance structures such as the Climate Action Forum have been established to coordinate efforts and ensure effective implementation (CoJ (2021). The plan highlights the importance of stakeholder engagement and partnerships, involving youth, civil society, academia, businesses, and residents. Grounded in climate risk assessments and emissions inventories, the CAP aims to create jobs, improve air quality, increase access to services, and ensure the equitable distribution of benefits (ibid.).

The City's strategy for tackling climate change as a matter of social justice is deeply intertwined with the efforts to eradicate poverty and foster inclusivity. According to CoJ (2021a), the Climate Action Plan (CAP) aims for all households to have access to safe, resilient, and affordable basic services by 2030, and for 100% of the population to live in affordable, resilient, and low-carbon housing by 2050. Additionally, all residents will have access to safe and sustainable open spaces, with tree cover exceeding 30%. In terms of managing floods and droughts, by 2030, flood management practices will be improved and integrated across all sectors to minimize the social, economic, and environmental impacts of flooding. Moreover, comprehensive early warning systems for floods, droughts, fires, and storms will be established, with updated response plans. By 2050, no homes, offices, industries, or critical infrastructure will be located in high-flood-risk areas, and water supply and food systems will be drought-resistant (CoJ, 2021a).

To transform Johannesburg into a Water Sensitive City, by 2030, all existing backlogs in urban stormwater infrastructure upgrades will be addressed, and new stormwater guidelines will be developed (Ibid). By 2050, Water Sensitive Urban Design (WSUD) principles will be integrated into all aspects of urban planning, with the city achieving 30% green cover, including green roofs, to aid in city and passive building cooling.

The concern is that while the CAP sets ambitious targets, its actual implementation may be hindered by resource constraints, slow infrastructure delivery, and challenges in ensuring that informal settlements like Stjwetla are fully integrated into the plan. Additionally, the CAP’s effectiveness in addressing these areas depends on whether it can bridge the gap between formal and informal areas, particularly given the city's history of uneven development and the lack of sufficient funding for informal settlement upgrades. So, while these issues are acknowledged, there may be practical challenges that could prevent full realization of the plan's objectives for informal settlements.

3.8. The city of Johannesburg flood risk management

The City of Johannesburg's Flood Risk Management plan includes several key elements aimed at reducing flood vulnerability and enhancing resilience (CoJ, 2021b). A central component is establishing early warning systems to disseminate timely hazard warnings to at-risk communities, including those in remote areas. The City of Johannesburg's Disaster Management Plan addresses flooding in multiple ways, identifying it as one of the top hazards in the city's risk profile. The plan indicates that flooding presents a severe annual risk that requires attention.

Seasonal flood risks are highlighted, with flooding posing a high probability and high-impact threat during summer months. The hazard calendar shows flooding as a high severity risk (H5) from October to March. (CoJ, 2021b). The plan calls for implementing preparedness actions for seasonal threats like heavy rainfall and flooding. This includes establishing clear evacuation procedures, routes, and sites in advance for areas exposed to flash floods. Early warning systems are emphasized to alert at-risk communities of impending flood threats, with particular attention to disseminating warnings to remote and isolated communities. Overall, the plan aims to reduce flood vulnerability through prevention, mitigation, preparedness, rapid response, and post-disaster recovery measures. This comprehensive approach focuses on protecting vulnerable informal settlements and poor communities in flood-prone areas. Key actions include developing evacuation procedures, routes, and sites in advance for areas exposed to flash floods, implementing seasonal preparedness actions for heavy rainfall and flooding threats, and conducting disaster risk assessments to identify flood-prone areas and vulnerable communities.

The plan integrates flood risk reduction measures into development planning, protects critical infrastructure from flood damage, and establishes rapid response and relief systems. By focusing on reducing vulnerability and building resilience in flood-prone informal settlements, it aims to manage flood risks through prevention, mitigation, preparedness, response, and recovery (CoJ, 2021b).

However, the plan’s success in areas like Stjwetla will depend on addressing the unique challenges of informal settlements. These communities often lack proper infrastructure, suffer from poor drainage, overcrowding, and limited access to emergency services. Informal housing structures may block evacuation routes or complicate the establishment of clear evacuation sites. Additionally, the plan’s reliance on formal development planning may overlook community-driven adaptive strategies, such as self-help drainage solutions already employed by residents.

3.9. Compounded vulnerability in Stjwetla (flooding)

The most vulnerable industries, settlements, and communities are often those situated in coastal areas and river floodplains, where economies heavily depend on climate-sensitive resources (Satterthwaite, Huq, Pelling, Reid, & Romero Lankao, 2007). These regions, particularly those experiencing rapid urbanization, are also more susceptible to extreme weather events(ibid). Anwana and Owojori (2023) In the coming years, flooding is anticipated to become increasingly prevalent due to climate change and various human activities. According to Anwana and Owojori (2023), urban human settlements have grown more susceptible to flooding and other natural disasters due to shifting land use patterns, unplanned growth, and the impacts of climate change. Therefore, flooding is recognized not only as a physical hazard but also as a social issue. Addressing this challenge requires immediate and sustainable action from developers, city planners, government officials, and community members to mitigate or prevent its effects on marginalized and vulnerable groups. By 2050, the risk of flooding is expected to increase due to population growth and the expansion of properties in flood-prone areas (ibid.). Ziervogel et al. (2014) highlight that everyday stressors are intensified when these settlements are situated in areas at risk from environmental hazards such as flooding, poor water quality, and inadequate waste management.

In November 2016, flash floods in the Stjwetla informal settlement, adjacent to Alexandra township in northern Johannesburg, washed away several dozen houses within minutes, leaving many residents destitute (Danielak, 2022; Morgan, 2019). The government's response prioritized emergency relief and preventing new constructions near the riverbank. However, with persistent annual flood risk the settlement has grown, with ongoing construction on unstable landfill and illegal dumping in the Jukskei River catchment increasing the likelihood of future flash floods. The dense, makeshift constructions, some under electricity pylons, also heighten fire risks, as evidenced by the March 2019 fire affecting over 100 households (Danielak, 2022).

Natural hazards in South Africa are embedded in their historical and political context. The country’s disaster management framework is comprehensive but challenged by the legacy of apartheid, rapid urbanization and unregulated urban growth, which exacerbate disaster vulnerability(ibid). Recurring urban disasters reveal persistent flaws in disaster governance and risk reduction. Factors such as informality, poverty, exclusion, and haphazard building practices increase both physical and social vulnerabilities, unevenly affecting different socioeconomic and ethnic groups, and reducing communities' ability to mitigate harm.

South African city dwellers have faced a rapidly changing urban environment, chronic violence and increasing climatic variability, causing droughts and excessive rainfall, which can trigger

infrastructural failures(ibid). These hazards combined with the specific vulnerabilities of Stjwetla residents, test City of Johannesburg's urban governance, particularly its ability to prepare for and respond to disasters and support long-term recovery from socioeconomic impacts. The industrial-scale illegal dumping narrows the riverbed, increasing flood risks. Makeshift shacks and brick houses are built on uncompacted landfill, which is particularly prone to landslides along the riverbank.

The severe rainfall from November 9-10, 2016, was declared a national disaster (Davies, 2016), inundating roads and the international airport, causing fatalities. Flash floods from the Jukskei River washed away parts of Stjwetla, resulting in one child's death and displacing around 200 families. Johannesburg's Disaster Management Centre documented nearly 900 affected individuals, whom less than 30 were South Africans. Immediate rescue operations and humanitarian aid were coordinated by the city's Emergency Management Services, followed by temporary accommodation and other assistance from municipal departments (Danielak, 2022).

3.10. Stjwetla as a case study

Stjwetla is an informal settlement situated on the northern boundary of Alexandra Township, Johannesburg, along what was once the Jukskei River floodplain. Established in the late 1980s, partly on a municipal waste dump, Stjwetla covers approximately 13 hectares, bordered by the Jukskei River and the Alexandra West Bank cemetery (Morgan, 2019). Alexandra, commonly known as 'Alex,' was founded around 1912 when a wealthy farmer subdivided the land and sold plots to black families. Known for its affordable housing, Alexandra became a hub for poor migrants seeking employment in nearby areas (Gary, 2019). Despite its proximity to urban centers, Stjwetla is one of South Africa's neglected informal settlements, with the Jukskei River heavily impacted by surrounding human activity (Morgan, 2019). In 2005, authorities sought to relocate the Stjwetla informal settlement after discovering it was situated on a landfill (Ngobeni, 2020).



Figure 3.4 : Visual Representation of Stjwetla informal settlement(Source : Google earth, 2024)

3.11. Profiling Stjwetla

The most recent detailed census data for Stjwetla is not fully available yet, as StatsSA is releasing the 2022 census results in stages. The 2011 census data remain the most recent complete dataset, estimating Stjwetla's population at 5,130 (StatsSA, 2012). Most of its residents speak Xitsonga (55.5%) and Sepedi (20.5%). The settlement lacks essential infrastructure. Additionally, the settlement had no local policing and (Morgan, 2019) did not find evidence of NGO presence at the time of his research, contributing to a low sense of security.

Stjwetla is not connected to a formal sewerage system, relying instead on chemical toilets provided by the municipality. A private company is responsible for maintaining these 236 toilets, averaging about one toilet per 25 residents (Morgan, 2019). Most toilets in Stjwetla are located on the settlement's periphery, with some residents as far as 150 meters from the nearest facility. Many are now embedded within the settlement, with desludging trucks entering on narrow roads. To cope with limited access, residents have devised strategies such as privatizing toilets with padlocks or constructing their own pit or bucket latrines. In some cases,

residents resort to defecating in plastic bags or directly in the nearby Jukskei River, contributing to environmental hazards (Morgan, 2019).

Parts of the area is prone to flooding due to various factors, including rapid urbanization, reduced catchment buffer capacity, and the illegal dumping of construction materials near the river (Morgan, 2019; Ngove, 2020). In 2012, the construction of a new road and bridge further exacerbated the situation by encroaching on the riverbed and accelerating bank erosion(ibid). Flooding has become a frequent occurrence, with homes destroyed by storms in 2008 and 2013 and 2016. Despite government promises for relocation, progress has been slow. The community remains wary of relocation due to past forced removals, where informal settlements were demolished with brutal methods (Huchzermeyer & Karam, 2006). This history has led residents to view relocation with suspicion, associating it with oppression rather than opportunity.

3.12. Conclusion

The case of Stjwetla, located along the vulnerable banks of the Jukskei River in Johannesburg, offers a localised lens through which to examine the intersection of informality, migration, and climate change. Informal settlements such as Stjwetla, shaped by both internal and regional migration patterns, reflect broader socio-economic inequalities and spatial challenges within South Africa's urban fabric. Despite policy interventions like the Upgrading of Informal Settlements Programme (UISP) and climate adaptation strategies implemented by the City of Johannesburg, the compounded vulnerabilities posed by rapid urbanization, environmental degradation and inadequate infrastructure persist. The lack of effective stormwater management, exacerbated by illegal dumping and a lack of enforcement, continues to threaten the physical and social resilience of Stjwetla's residents. Moving forward, addressing these intersecting challenges will require more comprehensive and inclusive urban planning policies that integrate climate resilience, infrastructure development, and sustainable migration management. This chapter demonstrates that enhancing the adaptive capacity of informal settlements like Stjwetla is essential for building a more equitable and resilient urban future in the face of climate change.

4. Chapter 4: presentation and discussion of key findings

4.1. Introduction

This chapter presents the empirical research findings, organised around the main research question and sub-questions, each addressing a distinct theme. Focusing on the intersection of informality, migration, and climate change within Stjwetla, the chapter examines migration experiences and residents' coping strategies in response to climate impacts such as flooding, environmental risks, and socio-economic challenges intensified by informal living conditions. While these findings provide an initial analysis of the complex interactions between climate vulnerability, migration patterns, and the informal urban landscape, they do not seek to offer exhaustive insights. Instead, they highlight key areas that merit further investigation, acknowledging that the study's scope is primarily to raise critical issues for future research and policy development.

4.2. The intersection of informality, migration, and climate change manifests in the case of Stjwetla informal settlement

Migration has long been a survival strategy, particularly in Southern Africa, where labour migration shapes the region's economic history. Even after apartheid, remnants of the migrant labour system persist, with migrants drawn to cities in search of better economic opportunities (Vosloo, 2020). Areas like Alexandra in Johannesburg attract a steady influx of migrants due to the availability of low-skilled jobs in factories, domestic work, and gardening in surrounding areas. The driving force for migration is the perception or the aspiration of a better life (Bosh & Farre, 2013), with many forced to migrate and work predominantly in the informal sector (Stats SA, 2022). Family connections often facilitate the ease of integration into informal settlements, making the transition smoother for new migrants. Those interviewed, typically aged 25 to 40, are individuals motivated primarily by the search for work. As one resident explained, "I came here looking for work. There's only one thing that brings you here: work, nothing else" (Interview with a Community Resident 7, 4 October 2024). The intersection of informality, migration, and climate change in Stjwetla reveals complex challenges and adaptations. To illustrate the connection of these aspects, this section of the study will perform a detailed analysis of each element to improve understanding of the complexity and adaptations in Stjwetla.

4.2.1. Informality

Stjwetla exemplifies all aspects of informality, and its informal status presents opportunities and vulnerabilities for its residents. On the one hand, the informal infrastructures provide low-cost housing close to employment centres. Still, on the other hand, they expose the residents to heightened environmental risks due to drainage and flood barriers and social risks due to a lack of unregulated land use and insecure land tenure.

During heavy rains, some residents are left exposed to climate-induced flooding, as some of the settlement's informal infrastructures are close to the Jukskei River. Despite these risk factors, informal settlements like Stjwetla offer affordable housing for people migrating to the city who cannot afford formal rent, allowing many to remain close to work areas like Sandton and Limbro Park. As (interview with community Resident 1, 20 September 2024) mentioned, "The rent here is manageable."

While conducting interviews at Stjwetla, one notable observation beyond the informal infrastructure was the visibly inadequate installation of electricity power lines. While some areas of the settlement have electricity, illegal connections persist, posing serious risks, especially during floods when water can conduct electricity and cause electrocution. Although informality provides affordable housing and land access, it traps migrants in poverty and disrupts land use patterns

4.2.2. Migration

The migration patterns in Stjwetla reflect various factors, including economic opportunities and environmental instability, as highlighted in interviews with residents. These factors often serve as temporary solutions for individuals navigating the city's economic hardships. Economic pressures draw migrants into informal settlements, with Stjwetla becoming a refuge for both internal and international migrants seeking affordable housing near potential jobs. In an interview conducted with Community Resident 2 (interview, 20 September 2024) originally from zimbabwe, he explained his decision to move to Stjwetla: 'I came in search of work and employment opportunities, despite knowing the risks of flooding and the lack of infrastructure.' Stjwetla has emerged as an informal hub for migrants, whose reasons for settling there echo universal migration motivations

The unstable living conditions, particularly due to flooding, often lead to a transient population in Stjwetla. New migrants frequently struggle to stay in the area for extended periods. As noted in an interview with (Community Resident 7, 4 October 2024), many newcomers "don't last... they come here, and once they get hit by floods, they permanently leave." This statement

highlights how climate instability disrupts residency in the community. Extreme weather events such as floods force individuals to leave their homes and informal settlements like Stjwetla; residents face heightened vulnerability to flooding and other climate-related diseases, leading to increased internal displacement as people seek safe living conditions.

4.2.3. Climate Change

The relationship between climate change and migration is increasingly recognised as a significant global concern (IOM,2008). As environmental conditions continue to deteriorate, many individuals and families are compelled to relocate for safer living conditions and better opportunities. In the context of Stjwetla, this relationship is particularly poignant. Climate change has intensified the vulnerabilities inherent in informal settlements, making Stjwetla a microcosm of how urban poverty, inadequate infrastructure, and environmental instability intersect. As noted in the Interview with (Community Resident 5 Interview, 27 September 2024) attested, “Every year, we face floods, especially in January,” highlighting the seasonal pattern of flooding that strains resources and their resilience in these challenges.

It is important to note that the respondents did not represent the entire settlement of Stjwetla. The minority of those interviewed reported increased frequency and severity of floods in recent years. Most of the respondents rely solely on their own innovative ideas to develop coping mechanisms during flood disasters. In response to these challenges, they have had to rely on self-help coping mechanisms, such as building elevated structures (Ngove, 2020) or taking preventive measures to safeguard essential items. Despite these efforts, residents still lack the resources to create lasting solutions, making these strategies only partially effective. A typical example, as noted by community resident 5 (interview, 27 September 2024), “currently, there are no specific strategies that we, as a community or individuals, have adopted to cope with the flooding. When the water levels rise, we simply have to leave our homes and stay under the bridge until the situation improves.”

Heavy local rains are not the sole cause of flooding in Stjwetla. The residents I interviewed were aware of this issue, which has prompted them to prepare for potential floods during the rainy seasons. A resident explained that if it rains heavily in any of the areas through which the river flows, it often leads to rising water levels in Stjwetla. They noted, "Sometimes it doesn’t even rain here, but the river fills up because it’s raining somewhere else" (Interview with Community Resident 1, 20 September 2024).

Another aspect contributing to worsening the flooding is human activities like illegal dumping, particularly by construction firms. During the interviews, one resident highlighted that, “The

problem of flooding wasn't as severe until construction firms began dumping rubble in the river. Now, the water can't flow properly, and when it rains heavily, the area floods uncontrollably" (Interview with Community Resident 1, 20 September 2024). Another resident emphasized the need to, “clean the Juskei River” (Interview with Community Resident 3, 20 September 2024). Resident 1, being a long-time resident, has observed shifts in the population over time and remarked, "Once they get hit by floods, they leave; no one stays or can cope with this for long." (Interview with Community Resident 1, 20 September 2024).

Amidst the above-mentioned challenges, the residents I interviewed strongly desired infrastructure improvements, including relocation assistance, to reduce their exposure to flood risks. Amongst those interviewed, those residing in the flood line see relocation as a viable solution given the settlement’s proximity to the river and lack of infrastructure, even though relocation poses logistical and financial challenges. A resident voiced out that, “if they do move us, it would be a burden on our finances” and further voiced out that “the worsening climate impacts make it difficult to consider staying in Stjwetla long-term” (Interview with Community Resident 4, 20 September 2024).

Residents of Stjwetla show resilience, with many engaging in informal economic activities. I observed that street vending and small-scale businesses thrive, especially among international migrants who exhibit entrepreneurial skills. To support this observation, one of the community resident leaders said, “I realized that’s it mostly immigrants that are selling” (Interview with community leader 4, 20 September 2024). The residents in Stjwetla, despite the above-discussed vulnerabilities that they have to battle with, are resilient and positive and choose to make the most of what outside observers may view as a dire situation. These sentiments are brought to life by the interview held with the resident community patroller (Interview with Community Patroller 1, 20 September 2024), who said, “The beauty of this place, and safety. Like right now plenty of people are coming to Stjwetla. Also, look now, this place is active. Tomorrow, there will be many cars parked here from Soweto, etc. This place is booming. There are also economic activities; you can sell here; you can’t sleep without eating here, people always make a plan.”

4.3. The impact climate variability has had on the residents of Stjwetla and how they have responded to it

Climate change is a major issue for informal settlements in South Africa, such as Stjwetla, which is exposed to flooding from the Jukskei River and is at risk of disaster in times of heavy rainfall and river overflow (Mere, 2011). Frequent flooding causes extensive damage to fragile homes, as well as the abandonment of structures due to flood damage and the loss of belongings. “Floods destroy everything. Our clothes, food, even our cupboards,” one resident

shared, highlighting the constant financial strain (Interview with a Community Resident 5, 27 September 2024). This, therefore, traps residents in a cycle of poverty. Residents face a heavy financial toll, repeatedly repairing their homes and replacing lost essentials like food and clothing. Those with sturdier structures avoid the dual burden of rebuilding and replacing.

Floodwater often brings contamination and waste into the area, impacting health and sanitation. Efforts to revive the Jukskei River through cleanup campaigns by groups like Water Warriors are undermined by persistent sewage spills. Blocked sewers, often diverted into the river due to a lack of maintenance plans, exacerbate pollution (Bega, 2024). As the water rises, this waste is washed into the flooded areas. There are also sewerage pipes discharging into the riverbank, which mixes with flood water to create contamination. Residents living closer to the Jukskei River are especially vulnerable to these effects, as rising water levels carry pollutants, including debris and harmful substances into homes. One resident noted that this leads to heightened risks of illness. This contamination can increase the spread of diseases, particularly in areas with limited access to clean water and sanitation.

Poor sanitation and waste management worsen health risks, particularly during floods. Upgrading strategies should prioritise accessible, safe, affordable sanitation with community-specific waste management systems. Community-led waste management initiatives and enhanced waste collection services could prevent unsanitary buildup and contamination. Currently, some residents use the nearby cemetery due to inadequate facilities, as one community leader shared “People currently are building next to the cemetery; some now use the cemetery to relieve themselves because the bucket toilets are unusable in the summer heat” (Interview with Community Leader 5, 4 October September 2024).

Illegal electrical connections using uninsulated wiring, combined with wet conditions, create severe hazards. A resident highlighted the serious dangers of these unsafe practices, emphasizing the need for safer solutions. “When the extension cord gets overloaded, it heats up, melts, and if it touches other wires, it sparks and shocks people” (interview with Community Resident 4, 20 September 2024). This issue becomes more severe during the rainy season when water infiltration increases the risk of electrocution. In response to ongoing flooding and unpredictable weather, residents have developed various strategies to adapt, which depend on their resources and social connections within the community. Some residents who have managed to save enough money or receive help have elevated their homes with brick foundations to prevent water from entering. One explained, “I built with bricks, and I have never experienced flooding before. Even if they decide to remove us, where will they relocate us?” (Interview with Community Resident 3, 20 September 2024). This indicates a proactive

but costly response to environmental challenges, reflecting resilience and frustration over uncertain relocation plans.

Efforts to adapt, such as elevating homes or using bricks for sturdier structures, have proven insufficient. One resident explained," Although residents living on the flood line who opt for brick construction are still affected, most of their homes do not get easily washed away like the unsubstantiated structures do when floodwaters infiltrate them. Therefore, these measures are effective to a certain extent though not always entirely proof against severe flooding" (Interview with Community Resident 3, 20 September 2024). Despite their resilience, some of their strategies fail to fully mitigate the risks, temporarily displacing them during floods.

Flooding, however, presents a significant challenge, particularly for residents who lack the resources to build flood-resistant structures. One participant noted that flooding was "not an issue at that time," but it worsened as construction waste in the river raised water levels. Long-term stability in Stjwetla remains uncertain, as residents face threats of removal without viable relocation options, and some expressed frustration that promises of alternative housing "have not materialised." One interviewee (Interview with Resident 7, 4 October 2024) mentioned moving to "higher ground until the situation improves" and waiting out the floods, even if this means enduring hours without shelter. Although the community has no formal emergency response system, residents share basic preparedness knowledge and occasionally help each other. For example, during heavy rains, neighbours often warn each other to move belongings or vacate low-lying areas temporarily. Patrollers remain vigilant, especially when they detect changes in weather or signs of heavy rainfall. However, tribal tensions sometimes limit cooperation, as some residents note a division in how assistance is offered across different groups. For those living in shacks, solutions like evacuating are common. However, this coping strategy is unreliable, as some residents report losses despite their efforts as they fail to move everything. In extreme flooding, residents lose their shacks along the riverbanks, which forces them to rebuild once the flooding has subsided.

Of note is that some residents look to community organisations and parties like the EFF for support. Resident 7 (interview, 4 October 2024) noted that the EFF has "attempted to help residents along the river line relocate," although the assistance remains sporadic. While some political parties and organisations occasionally visit, their involvement is perceived as inconsistent and primarily limited to emergency supplies. This frustration highlights the need for sustained and meaningful intervention rather than temporary relief measures. There is a consensus among the residents I interviewed that the government should invest in enclosing the flood-prone parts of the Jukskei River or improving its drainage to reduce flood risk.

Furthermore, another factor that worsens the resident's vulnerability is the alleged corruption related to the settlement. As mentioned in Chapter 3, companies and individuals have illegally dumped construction rubble and waste along the Jukskei River, worsening flooding and health risks. Even when authorities (Johannesburg Metro Police Department) intervene, the same offenders return, with allegations by some of my respondents that bribery facilitates their actions. Interview with community leader 5(interview, 4 October) “We tried engaging with the community and they stopped. The situation now is better and we were aware. We don’t know who they were, we reported to JMPD and take time to respond. Sometimes they arrest the people and tomorrow we would see the very same people dumping again.” As already mentioned, residents are reluctant to relocate despite the precarious conditions they face. This reluctance stems from broken promises made by the government, such as providing container homes or access to RDP housing, which have not been fulfilled. Additionally, many residents fear that relocation would place them far from their work, forcing them into unaffordable rental situations. These concerns highlight the complexity of the relocation issue, which requires addressing both the unmet promises and the fear of economic displacement to ensure any relocation efforts are effective and trusted. "If they move us, we will be thrown into Soweto, and it will cost us transport and rent, but here, we don’t have that problem," said one resident, reflecting on their difficult trade-offs. (Interview with a community resident 3, 20 September 2024). Despite this, some acknowledge that staying in Stjwetla may no longer be viable, with one resident stating, “We have no choice, but we can’t keep dealing with Jukskei.” (Interview with a community resident 7, 27 October 2024).

This section reveals that while some residents adopt proactive measures like elevating homes, these adaptations are unevenly effective and depend heavily on individual resources. The role of external factors, such as illegal dumping and sewage contamination, further complicates the situation, making residents more susceptible to health risks and financial loss. The findings also shed light on the community’s reliance on informal networks for coping, the role of political parties in sporadic assistance, and the deep mistrust in government relocation plans. These insights emphasize the complexity of addressing climate-related challenges in informal settlements and the resilience of the residents despite systemic shortcomings.".

4.4. Migration dynamics in Stjwetla as shaped by individual histories, reasons for movement, and migration experiences

Residents of Stjwetla have diverse migration backgrounds influenced by economic, familial, and housing pressures. Many interviewees cited employment needs, affordable housing, and displacement from prior locations as key factors in their move to Stjwetla. Limited job opportunities in migrants’ places of origin and high rental costs elsewhere also contribute to Stjwetla’s appeal. A Zimbabwean resident shared his experience of moving to Johannesburg

due to starvation and a lack of job opportunities in his hometown. He noted that tribal discrimination in the local job market also played a significant role in his decision to migrate. However, he faced high living costs and a challenging search for housing, ultimately making Stjwetla the only viable option. "The reasons for people coming here haven't changed; it's still about hunger and desperation they have no choice but to settle here." (Interview with a Community Leader 5, 4 October 2024)

Proximity to work sites is another factor, especially for those in low-wage or informal employment sectors. As one resident noted, "My workplace is close to Stjwetla; for others, their workplaces are farther from here." (Interview with Community Resident 2, 20 September 2024). Migrants often face precarious labour conditions as employers exploit their vulnerability by offering low wages. This job competition can strain relationships with local South Africans, who feel economically sidelined. "The challenge is that many companies hire international migrants due to cheap labour, which leaves South Africans unemployed. This creates serious challenges in the community and affects our relationships." (Interview with a Community Leader 5, 04 October 2024). Migrants, often undocumented, may accept lower wages, which sometimes pushes local residents out of job opportunities and heightens economic tensions.

In addition to job competition, social divisions are reinforced by tribalism, which sometimes affects collaborative efforts within the settlement. While some coexistence exists in Stjwetla, I was told that tensions can arise, especially between South Africans and foreign nationals like Shangaans from Mozambique. One resident shared, "Relationships between South Africans and foreign nationals, especially Shangaans, are not good because they isolate themselves. We are not necessarily divided, but there is a certain division level along tribal lines." (Interview with a community resident 5, 27 Septemeber 2024).

For many, searching for affordable housing with adequate space also shaped their migration decisions. One interviewee noted that he moved to Stjwetla because "The place where I was staying before wasn't big enough" (Interview with community resident 1, 20 September 2024), indicating a need for more room to accommodate his family. Despite the difficult living conditions, Stjwetla continues to draw people seeking affordable rent and nearby job opportunities. Its limited regulations and low-cost housing offer a temporary solution for many facing financial instability. However, based on the interviews held with a minority of the residents, this transient population and job competition seem to deepen social divides and foster mistrust. Interviews with residents highlight how economic survival, social networks, and tribalism intersect to shape the migration experience in Stjwetla, complicating migrant integration and straining relationships with local South Africans.

4.5. Different aspects of informality that facilitate and limit residents' ability to cope with and adapt to climate change-related challenges in the presence of migration dynamics

Informal settlements like Stjwetla provide affordable shelter for migrants who cannot afford formal housing, therefore meeting immediate survival needs in Johannesburg. However, their rapid expansion, often lacking resilient infrastructure, leaves residents vulnerable to climate impacts. While migrants are drawn to Stjwetla due to its affordability and proximity to economic opportunities, these factors also constrain residents' capacity to address climate challenges. Due to the prevailing informality in Stjwetla, residents build and adapt temporary shelters like shacks using available or recycled materials. However, unplanned growth has led to overcrowding, which subsequently affects not only the ability of new migrants to find building space but also stresses the local infrastructure and increases exposure to hazards. Some residents even occupy dangerous locations, such as under electricity cables, which adds to risks like illegal electrical connections and flooding. Although these settlements meet urgent housing needs, without the necessary state intervention, they often lack long-term viability.

Some of Stjwetla's residents' reliance on somewhat affordable material, which, however, runs the risk of failing the durability test, results in structures that are vulnerable to extreme weather, leaving residents with weak structures at risk. Due to the lack of effective regulation regarding land occupation, residents are increasingly settling in flood-prone areas under pressure for accommodation, heightening their vulnerability to climate hazards. As mentioned, basic services like proper electrical connections, water, and waste management are often lacking or accessed informally, leading to hazards like unsafe electrical installations and practices that lead to electrocution, electric fires, and health risks, especially during floods.

Though Stjwetla's informality poses various challenges, as discussed above, it also offers significant advantages that can contribute to the livelihoods and resilience of the migrants. Residents sharing resources during crises build community support networks where they share similar experiences and backgrounds. They have access to affordable housing, likely proximity to employment opportunities, flexibility and easy adaptability with no strict regulations, and entrepreneurial opportunities, with residents starting small businesses.

Economic opportunities within informal settlements are crucial for residents, particularly migrants, who engage in small-scale businesses to survive despite precarious conditions. Nevertheless, issues such as the perception that they are selling expired goods or not employing locals in foreign-owned businesses exacerbate tensions.

4.6. Implications for Informal Settlement Upgrading Strategies

As part of my research, interviews included questions about possible improvements to Stjwetla and its longer-term future. This was relevant in exploring the intersection of informality, migration, and climate change, particularly given the settlement's vulnerability to these issues.

This response, from a resident whose house is located at the riverbank, reflects the significant challenges they face. It's important to note that responses from other residents may vary, particularly those whose homes are not located in flood-prone areas or those who have invested more in enhancing their units. "Even with our efforts to build with bricks, I don't believe there will be any significant change here. The government must construct a new settlement for us, far away from this location. Even when we build with bricks, water still seeps in, making it feel like we haven't improved our situation. No services can enhance the living conditions here" (Interview with a Community Resident 6, 27 September 2024). "Even with our efforts to build with bricks, I don't believe there will be any significant change here. The government must construct a new settlement for us, far away from this location. Even when we build with bricks, water still seeps in, making it feel like we haven't improved our situation. No services can enhance the living conditions here" (Interview with Community Resident 6, 27 September 2024, riverbank location). This highlights the urgent need for government support and robust infrastructure improvements.

Flood mitigation strategies should prioritise flood-resistant infrastructure to reduce recurring flood risks that endanger residents' safety and livelihoods. Potential interventions include raised foundations, drainage systems, and water retention strategies, similar to successful flood management initiatives along the Nile River, though at a different scale, which include embankments, floodgates, and pumping stations (United Nations Environment Program, undated; World Bank, 2022). Some residents suggest relocating high-risk areas near the river to create a protective buffer zone; as one patroller noted, "Firstly, we need to relocate the people living in flooding areas or near the riverbank and restructure that whole area. It should then act as a buffer zone" (Interview with Community Patroller 3, 20 September 2024).

In light of the improvements that need to be initiated in Stjwetla, it is paramount to note that formalised measures in the guise of physical infrastructure are not the only need. The residents also need responsive initiatives that speak to the social and economic situation surrounding Stjwetla. The residents have consequently taken it upon themselves to initiate community-driven projects, such as patrol units, to combat high crime rates, demonstrating local capacities in addressing immediate issues. Engaging Political local leaders and enhancing these community structures could foster a collaborative approach to upgrading, especially when paired with capacity-building programs. High unemployment and limited

constructive activities perpetuate cycles of early parenthood and alcohol use (Popovici & French, 2013). Structured programs could engage residents, provide employment, and strengthen the community's resilience. One patroller explained, “Most people are unemployed; others, as you see, recycle materials like glass and plastic bottles to survive” (Interview with a Patroller 2, 20 September 2024).

Given Stjwetla’s position as a dense informal settlement within Johannesburg, any formal upgrading must consider the migration dynamics that shape the area. Many residents fear relocation due to financial concerns, such as the increased transportation costs of moving to locations like Soweto. “If they do move us, they’ll likely relocate us to Soweto, which would burden our finances. It would cost us more for transportation to work, and we might have to start paying rent, which we don’t do here” (Interview with a Community Resident 1, 20 September 2024). Relocation should, therefore, be a last resort, with barricades placed in vacated areas to prevent further resettlement and perpetuation of informality.

As a community leader explained, corruption in housing allocation is assumed to remain a serious challenge: “Yes, they tried to build houses, but even now there is a case with over 200 people who were supposed to be allocated houses, which were then sold. The case is still pending in the high court” (Interview with community leader 4, 20 September 2024). Addressing this issue requires active engagement, oversight mechanisms, and community representation to ensure transparent and fair housing allocation especially for those who cannot be incorporated into an in situ upgrading programme.

While illegal electricity connections are common, they present serious risks. Upgrading must include safe, affordable electricity to prevent electrocution in flood-prone areas. As mentioned in this study, wires must be elevated to avoid exposure to illegal electrical connections and potential contact with water, which may cause electrocution. Addressing these needs would significantly improve residents' safety and quality of life. As stated earlier in this study, divisions within Stjwetla, often along ethnic lines, challenge social cohesion. Upgrading strategies should incorporate programs fostering unity, such as shared facilities and communal spaces like community centres, clinics, and creches. As a resident noted, “We require creches that cater to all children living here, ensuring no child is left behind, regardless of tribal affiliation” (Interview with a Community Resident 3, 20 September 2024). Stjwetla’s migration dynamics necessitate structured support systems to meet the needs of migrants. These people are integral to the community’s socio-economic fabric but often face legal and social barriers.

4.7. Conclusion

This chapter has examined the intricate dynamics of migration, informality, and climate vulnerability in Stjwetla. It provides initial insights into how these factors interact to shape the lived experiences of residents based on an analysis of a small sample of qualitative interviews. Key findings on issues like flooding, socio-economic pressures, and informal infrastructure highlight the community's resilience and adaptability while underscoring the limitations faced due to systemic gaps in support and resources. These insights suggest the need for a more balanced and effective implementation of existing policies, such as the Upgrading of Informal Settlements Programme (UISP), to address the unique challenges faced by high-risk informal settlements. The findings emerging from this discussion will be presented in the concluding chapter, ensuring alignment with the lived realities of communities like Stjwetla. Ultimately, the findings emphasize the importance of refining current approaches to upgrading informal settlements, focusing on reducing immediate risks while advancing long-term urban integration

5. Chapter 5: conclusion and recommendation chapter

5.1. Introduction and synopsis to the study

This research investigates the intersection of informality, migration, and climate change using Stjwetla, an informal settlement in Johannesburg, as a case study. It aims to understand how these phenomena intersect and influence each other, shaping the lives and resilience strategies of residents. With Africa's urban population projected to double by 2050, cities like Johannesburg attract migrants seeking better opportunities, often leading to informal settlements characterized by poverty and inequality (Vosloo,2020). The study highlights how climate change exacerbates these challenges, prompting migration and increasing the vulnerability of residents to disasters like flooding. By employing a qualitative approach, the study draws on semi-structured interviews and secondary data, to examine migration dynamics, climate impacts, and the role of informality in urban resilience.

This chapter dedicates much of its focus to recommendations, as they are directly informed by the insights derived from addressing the five central research questions. These recommendations aim to bridge the systemic gaps identified in the study, particularly in urban policies, migration dynamics, and climate change impacts. The focus on recommendations is crucial, as they seek to address the vulnerabilities highlighted in Stjwetla. By responding to these five questions, the recommendations aim to contribute to more balanced and context-specific policies for upgrading informal settlements like Stjwetla

5.2. The central research questions were:

a) How does the intersection of informality, migration, and climate change manifest in Stjwetla?

b) How does climate variability impact Stjwetla residents, and how have they responded?

c) What migration dynamics shape Stjwetla in terms of individual histories and experiences?

d) How does informality both facilitate and limit residents' capacity to cope with climate change challenges?

e) What are the implications for informal settlement upgrading strategies?

The research adopted a multidisciplinary conceptual framework that integrates migration theories, urban land market theory, and spatial and environmental justice. Drawing from de Haas (2007) and Kihato (2006), the framework emphasized systemic inequalities and the adaptive resilience of marginalized urban communities. Stjwetla, situated along the flood-prone Jukskei River, exemplifies the compounded vulnerabilities of informal settlements. Established in 1995, it has grown rapidly due to economic migration. The settlement's precarious location and lack of infrastructure (Danielak, 2022) make it particularly vulnerable to climate-related risks, such as flooding, and socio-economic challenges, including inadequate housing and service provision.

Key findings reveal that Stjwetla's residents face heightened vulnerability to climate risks, such as frequent flooding, compounded by socio-economic challenges and limited infrastructure. Migration to the settlement is driven by economic opportunities and unaffordable formal housing. Informality serves as both a survival mechanism and a barrier, fostering resilience through self-organization but restricting access to formal resources and services. The research highlights the inadequacy of current government upgrading programs, lack of involvement in community engagement and calls for more inclusive, climate-resilient urban planning.

5.3. Significance of the study

By focusing on Stjwetla, the research illustrates the compounded vulnerabilities faced by informal settlement residents in rapidly urbanizing cities. It challenges dominant narratives blaming migrants for urban challenges, instead emphasizing the structural factors driving informality and climate risk**.** Furthermore, the study highlights gaps in current urban policies, particularly the limited integration of climate adaptation measures in informal settlement upgrades. It underscores the need for multi-sectoral approaches that address systemic inequalities, enhance resilience, and promote equitable service delivery. The findings aid to the discourse on urban resilience by providing a nuanced understanding of the intersection between migration, informality, and climate change. They affirm existing theories, such as Lefebvre's Right to the City, and contribute new insights into the adaptive strategies employed in informal settlements

5.4. Recommendations

In Stjwetla, practical and sustainable flood management requires a combination of community-led initiatives and infrastructure upgrades. Residents should actively participate in elevating homes, improving drainage, and identifying flood-prone areas to reduce vulnerabilities. Collaborative efforts must also focus on disaster preparedness, enhancing water and sanitation systems, and implementing flood mitigation measures such as temporary barriers and stormwater drainage. To sustain these initiatives, funding mechanisms, including stipends for volunteer programs like Water Warriors, can support ongoing river clean-up efforts, reduce contamination, and foster environmental stewardship. This integrated approach addresses immediate flood risks while building long-term resilience and community empowerment.

The impacts of climate variability, particularly flooding, demand a holistic flood risk management plan in Stjwetla. Combining robust infrastructure improvements such as flood barriers and water retention zones with community participation ensures more adaptive and effective solutions. Accurate, localized data is essential to identify vulnerabilities, tailor interventions, and address anti-migrant narratives by demonstrating the socio-economic contributions of migrants. Regular area-specific surveys, along with inclusive urban planning, can strengthen social cohesion, enhance climate resilience, and safeguard livelihoods for both long-term residents and migrants.

Migration dynamics in Stjwetla are shaped by economic necessity and the availability of affordable housing. To support new arrivals, local authorities should provide flexible housing solutions like temporary shelters and shared spaces, alongside programs that facilitate social integration. Initiatives such as language support, skills training, and access to healthcare and jobs are vital for fostering inclusivity. Empowering residents through micro-business development, supported by small grants and training, can enhance livelihoods and promote economic diversification. Climate-resilient practices, such as recycling and sustainable production methods, can further align economic empowerment with environmental sustainability.

Achieving long-term resilience in Stjwetla requires integrating informal settlements into climate-resilient urban planning while addressing immediate challenges. Key priorities include improving drainage systems, securing safe electrical connections, and enhancing flood barriers, complemented by early warning systems and disaster response programs. Partnerships with environmental organizations, government, and local actors are critical for river rehabilitation and sustainable flood mitigation. Relocation should be considered only as a last resort for those in extreme danger, with transparent planning to ensure access to

affordable housing and essential services. Regular consultations with residents will align policies with local needs, fostering trust, inclusivity, and sustainable development.

5.5. Directions for Future Research

Future research is essential to explore further solutions that address the complex needs of informal settlements in high-risk areas. Studies focusing on climate-resilient infrastructure within informal urban settings would provide valuable insights into affordable and adaptable solutions for settlements like Stjwetla. Such research could examine cost-effective flood mitigation strategies that consider residents limited financial resources and the unregulated nature of informal housing.

Another promising area for research lies in the socio-economic integration of migrant communities within urban environments. Investigating successful programs that support economic integration and social cohesion, such as small business development initiatives or vocational training programs, could provide a foundation for future support structures that benefit residents and migrants. Finally, research into urban policy frameworks that have successfully included informal settlements within broader city planning could serve as models for sustainable development in Johannesburg and similar cities facing rapid urbanisation.

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7. Appendices

7.1. Appendix A: University Ethical Clearance Letter

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG | SCHOOL OF ARCHITECTURE PLANNING

6 August 2024

Maseko, Thithi

2380459

TO WHOM IT MAY CONCERN

RESEARCH ETHICS APPROVAL

The intersection of informality, migration and climate change: the case of Stjwetla informal settlement in Johannesburg.

This letter serves to confirm that the Ethics application for the above titled study has been approved. The researcher has been granted clearance to proceed with the research study or project.

Protocol/clearance number is: **SOAP057/05/2024**

Yours sincerely

Motsei Choabi
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7.2. Appendix B: Participant information sheet (Community leaders)

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG | SCHOOL OF ARCHITECTURE PLANNING

Participant Information Sheet – Community Leaders

14 May 2024
Dear Sir / Madam

My name is Thithi Maseko, and I am a Masters student at the School of Architecture and Planning at the University of the Witwatersrand, Johannesburg. My supervisor is Prof. Marie Huchzermeyer. I am conducting a research study on how the phenomena of informality, migration, and climate change interact and influence each other in an informal setting, focusing on the case of Stjwetla informal settlement in Johannesburg. The title of the study is "The Intersection of Informality, Migration, and Climate Change: The Case of Stjwetla Informal Settlement in Johannesburg."

I am inviting you to participate in an interview where I will ask questions and seek your insights based on your observations and experiences. This will be a once-off interview lasting approximately 45 minutes, with a maximum duration of one hour if needed. The interview will be conducted in Stjwetla, either at your residence or at the Gift of the Givers TRA, during work hours.

With your permission, I would like to audio-record the interview. All data collected, including audio recordings and photographs, will be stored in an encrypted cloud drive for a period of 5 years, after which it will be deleted. I will be the sole person with access to this data.

The interview will be confidential and anonymous. When I share the results of the research study, I will not include your name or anything else that could identify you.

If you decide to take part in the research study, it should be because you want to volunteer. You do not have to take part. You can stop being in the study at any time. You do not have to answer any questions if you do not want to. You will not get any direct benefits if you choose to join the research study. You will not lose any services, benefits or rights you would normally have if you decide not to join. Taking part in the research study will not cost you anything. You will not be paid for being in this research study.

The risks for this research study are no more than what happens in everyday life.

This research study will be written up as a research report. The report will be available on the university library website. If you would like to receive a summary of this report, I will be happy to send it to you.

If you have any questions during or afterwards about this research study, feel free to contact me or my supervisor on the details listed below. If you have any concerns or complaints about the ethical procedures of this research study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email hrecnon-medical@wits.ac.za.

Yours sincerely,
Thithi Maseko
14 May 2024



Researcher:
Thithi Maseko, 2380459@students.wits.ac.za

Supervisor:
Prof Marie Huchzermeyer, Marie.Huchzermeyer@wits.ac.za, 011-7177688

7.3. Appendix C : Participants information sheet (Community résidents)

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG | SCHOOL OF ARCHITECTURE PLANNING

Participant Information Sheet – Community Member

14 May 2024
Dear Sir / Madam

My name is Thithi Maseko, and I am a Masters student at the School of Architecture and Planning at the University of the Witwatersrand, Johannesburg. My supervisor is Prof. Marie Huchzermeyer. I am conducting a research study on how the phenomena of informality, migration, and climate change interact and influence each other in an informal setting, focusing on the case of Stjwetla informal settlement in Johannesburg. The title of the study is "The Intersection of Informality, Migration, and Climate Change: The Case of Stjwetla Informal Settlement in Johannesburg."

I am inviting you to participate in an interview where I will ask questions and seek your insights based on your observations and experiences. This will be a once-off interview lasting approximately 45 minutes, with a maximum duration of one hour if needed. The interview will be conducted in Stjwetla, either at your residence or at the Gift of the Givers TRA, during work hours.

With your permission, I would like to audio-record the interview. All data collected, including audio recordings and photographs, will be stored in an encrypted cloud drive for a period of 5 years, after which it will be deleted. I will be the sole person with access to this data.

The interview will be confidential and anonymous. When I share the results of the research study, I will not include your name or anything else that could identify you.

If you decide to take part in the research study, it should be because you want to volunteer. You do not have to take part. You can stop being in the study at any time. You do not have to answer any questions if you do not want to. You will not get any direct benefits if you choose to join the research study. You will not lose any services, benefits or rights you would normally have if you decide not to join. Taking part in the research study will not cost you anything. You will not be paid for being in this research study.

The risks for this research study are no more than what happens in everyday life.

This research study will be written up as a research report. The report will be available on the university library website. If you would like to receive a summary of this report, I will be happy to send it to you.

If you have any questions during or afterwards about this research study, feel free to contact me or my supervisor on the details listed below. If you have any concerns or complaints about the ethical procedures of this research study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email hrecnon-medical@wits.ac.za.

Yours sincerely,
Thithi Maseko
14 May 2024



Researcher:
Thithi Maseko, 2380459@students.wits.ac.za

Supervisor:
Prof Marie Huchzermeyer, Marie.Huchzermeyer@wits.ac.za, 011-7177688

7.4. Appendix D: Consent form (Community leaders)



Consent form: Community Leaders.

Title of project: The intersection of informality, migration and climate change: the case of Stjwetla informal settlement in Johannesburg.

Name of researcher: Thithi Maseko

I, ……., agree to participate in this research project.

I agree to the following:

(Please circle the relevant options below)

The research study was explained to me. I understand what this study is about.	YES	NO
I understand that I am volunteering to take part in the study.	YES	NO
I agree that the interview may be audio recorded.	YES	NO
I agree that direct quotations from my interview may be used by the researcher in their research report.	YES	NO
I agree that my participation will remain anonymous (my name or Portfolio held in the Leadership Committee will not be used by the researcher in their research report).	YES	NO
I'm aware that due to my insights and views as community leader, people who know Stjwetla well may be able to identify me in the research report or publication, even if my name is not used.	YES	NO
I'm aware that due to my insights, position and views as a community leader, anonymity cannot be guaranteed in the research reports or publications.	YES	NO

…… (signature)
…… (name of participant)
…… (date)

7.5. Appendix E: Consent form (Community residents)



Consent form: Community Members.

Title of project: The intersection of informality, migration and climate change: the case of Stjwetla informal settlement in Johannesburg.

Name of researcher: Thithi Maseko

I, ……., agree to participate in this research project.

I agree to the following:

(Please circle the relevant options below)

The research study was explained to me. I understand what this study is about.	YES	NO
I understand that I am volunteering to take part in the study.	YES	NO
I agree that the interview may be audio recorded.	YES	NO
I agree that direct quotations from my interview may be used by the researcher in their research report.	YES	NO
I agree that my participation will remain anonymous (my name or other identifying data will not be used by the researcher in their research report).	YES	NO
I am aware that anonymity cannot be guaranteed throughout the data collection process because the research will be conducted within the community, and it may be visible to others who is participating in the interviews.	YES	NO

…… (signature)
…… (name of participant)
…… (date)

7.6. Appendix E: Interview question guide (Community leaders)

Introduction:

1. How long have you been serving as a community leader in Stjwetla, and what motivated you to take on this role?
2. What portfolio do you currently hold in the leadership committee?
3. Can you provide insights into the main challenges faced by the Stjwetla community from your perspective as a leader?

Climate-Related Changes and Responses:

1. From your position, what changes have you observed over the years in Stjwetla regarding rainfall, wind, hail, heat, and cold patterns?
2. In your experience, how have the occurrences of rainfall, wind patterns, cold spells and hailstorms evolved in Stjwetla?
3. Are there any noticeable trends or shifts in these climate events or their impacts that you've observed over time?
4. How has the community responded to these climate challenges, and what role has the community leadership played in facilitating these responses?
5. Are there organized groups such social support networks, and migrant support groups and how do they collaborate or interact to address challenges and provide assistance within Stjwetla?

Migration Patterns and Dynamics:

1. In your experience, what factors or circumstances typically inform migrants' decisions to relocate to Stjwetla?
2. How have the demographics, settlement locations, and integration experiences of international migrants within Stjwetla changed over time?
3. How have the demographics, settlement locations, and integration experiences of internal migrants within Stjwetla changed over time?
4. How have the reasons that international migrants come to Stjwetla changed over time?
5. How have the reasons that internal migrants come to Stjwetla changed over time?
6. How do these migration decisions affect various aspects of the community, such as its population size, social cohesion and access to services?
7. What specific factors, such as economic opportunities, social networks, environmental conditions, or instability, do you believe influence residents' decisions to migrate out of the settlement of Stjwetla?

Informality and Coping Strategies:

1. As a community leader, how do you perceive the role of structures, such as community networks, traditional knowledge, and grassroots initiatives, in shaping residents' ability to cope with change of weather patterns.
2. How do the residents of stjwetla cope with flooding due to heavy rains and what informs their actions?
3. Specifically, how do these mechanisms contribute to resilience-building efforts, adaptation strategies, and the overall capacity of the community to mitigate the impacts of climate change?
4. Can you provide examples of coping mechanisms or strategies developed by the community that rely on the unregulated nature of construction?

Adapting to Climate Change and Upgrading Strategies:

1. What improvements or changes do you think could enhance living conditions in Stjwetla, considering the challenges posed by climate change?
2. How do you envision formal upgrading strategies being integrated or adapted to address the community's needs and challenges?

Facilitation of Migration by Informality:

1. From your perspective, how does informality help people move from one place to another?
2. Are there any structures or networks that support migrants within the settlement?
3. How do you believe these interactions impact the unity and strength of the community, as well as its ability to overcome challenges and bounce back?

Thank you very much for sharing and contributing to my research in this way. Please feel free to call me any time if you have questions about this interview or would like to add anything else you think I should know.

7.7. Appendix F: Interview guide (Community members)

7.Biographic information

1. Gender [note to myself]
2. Would you mind telling me your age or broad age category?
3. Would you be comfortable telling me your nationality?
4. Could you kindly provide information regarding your place of origin or and languages you can speak?

Introduction

1. How long have you lived in Stjwetla, and what initially brought you here?
2. Can you tell me about your experiences living in Stjwetla informal settlement?
3. Can you describe any climate-related changes or events you've observed in Stjwetla?
4. How have these climate changes impacted your daily life and the community as a whole?
5. Can you share any specific strategies or actions you and your community have taken in response to these climate challenges?
6. What informed those specific strategies or actions?

Migration Dynamics

1. What factors influenced your decision to migrate to Stjwetla, and can you share your migration experience?
2. From your own observations how have migration patterns changed over time within Stjwetla?
3. In your view, how do the migration experiences of newcomers to Stjwetla differ from those who have been residing there for an extended period?

Informality and Coping Strategies

1. How does the lack of regulations on land occupation and construction in Stjwetla affect how residents deal with challenges brought by climate change?
2. How does the location of Stjwetla influence and impact the residents' ability to cope with climate change-related challenges?
3. Could you discuss any informal coping mechanisms or strategies you and your neighbours have developed?

4. What challenges do you encounter in adjusting to, recovering from, and preparing for weather-related changes, such as floods or extreme heat, in the informal settlement?

Implications for Upgrading Strategies:

1. From your perspective, what improvements or changes could be made to enhance living conditions in Stjwetla considering climate change, migration and informality?
2. What services would you like to see provided in the area to address challenges faced by residents?
3. How do you think services brought into the area to improve living standards can be introduced in the future in a way that aligns with your preferences and the desires of the community?

Facilitation of Migration by Informality:

1. Informal settlements like Stjwetla are important for people moving into the city for jobs or a better life. How do you think settlements like Stjwetla help people move into the city?
2. Can you provide examples of how informal structures or networks support migrants within the settlement?