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# Geospatial method for mapping urban decay: Structural components in the Thohoyandou Central Business District, South Africa

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Research article

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## Abstract

Evidence of urban decay in small towns across South Africa has become increasingly visible. Typically linked to neglect and ageing, urban decay encompasses social, economic, environmental, and physical decline. This article investigates the dynamics of urban decay in the Central Business District (CBD) of Thohoyandou, a rural town in Limpopo province, where the built environment continues to deteriorate despite the Thulamela Urban Development and Revitalisation Strategy. The study aims to characterise urban decay in Thohoyandou CBD through mapping, with emphasis on its implications for structural elements of the built environment. A mixed-methods design was employed, using observations and questionnaires as primary data sources. Convenience sampling selected 374 CBD users. Observation data were systematically recorded and categorised to identify decay features, while questionnaire responses were analysed using mean scores and ranked by affected areas and causes. Fifty-one features of urban decay were identified. Spatial analysis revealed clustering along everyday movement networks and key activity nodes. The three main contributing factors are poor urban management, infrastructure deterioration, and building-related issues, reflecting weaknesses in institutional capacity and policy implementation. Integrating geospatial data with structural analysis offers municipalities a diagnostic tool for monitoring progress. Findings suggest resource-constrained towns require targeted, spatially prioritised, phased regeneration strategies to effectively address urban decay.

**Keywords:** geospatial mapping, GIS, urban decay, structuring elements, urban management, small towns

## GEORUIMTELIKE METODE VIR DIE KARTERING VAN STEDELIKE AGTERUITGANG: STRUKTURELE KOMPONENTE IN DIE THOHOYANDOU SENTRALE SAKEGEBIED, SUID-AFRIKA

Bewyse van stedelike verval in klein dorpies regoor Suid-Afrika neem toe. Dit word dikwels verbind met die agteruitgang van stedelike ruimtes weens verwaarlosing en veroudering, wat sosiale, ekonomiese, omgewings- en fisiese dimensies insluit. Hierdie artikel ondersoek stedelike verval in die Sentrale Sakekern (SSK) van Thohoyandou, ’n landelike dorp in Limpopo, waar die beboude omgewing steeds agteruitgaan ten spyte van die Thulamela Stedelike Ontwikkelings- en Herlewingsstrategie. Die studie beoog om verval in die Thohoyandou SSK te karakteriseer deur kartering, met fokus op die implikasies vir strukturele elemente van die beboude omgewing. ’n Gemengde navorsingsontwerp is toegepas, met waarnemings en vraelyste as primêre databronne. Gerieflikheidssteekproefneming het 374 SSK-gebruikers ingesluit. Waarnemingsdata is sistematies aangeteken en gekategoriseer om vervalkenmerke te identifiseer, terwyl vraelysantwoorde deur gemiddelde tellings ontleed en volgens geraakte gebiede en oorsake gerangskik is. Altesaam 51 kenmerke van verval is geïdentifiseer. Ruimtelike analise toon dat verval gekonsentreer is langs daaglikse bewegingsnetwerke en sleutelaktiwiteitsnodusse. Die drie hoofbydraende faktore is swak stedelike bestuur, infrastruktuur-agteruitgang en gebouverwante probleme, wat institusionele en beleidsmatige tekortkominge weerspieël. Die integrasie van georuimtelike data met strukturele analise bied munisipaliteite ’n diagnostiese instrument om vordering te monitor. Bevindinge dui daarop dat hulpbronbeperkte dorpe geteikende, ruimtelikgeprioritiseerde en gefaseerde herlewingsbenaderings benodig om verval doeltreffend aan te spreek.

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**MOKHOA OA JEOSPATIAL OA HO BONTŠA HO SENYEHA HA LITOROPO, THOHOYANDOU**

Ho bolo ha metse metseng e menyenyane Afrika Boroa ho ntse ho bonahala haholoanyane, ho ama sechaba, moruo, tikoloho le tikoloho e hahiloeng. Thohoyandou CBD, toropo ea mahaeng profenseng ea Limpopo, e sebelisitsoe e le mohlala ho hlahloba ho senyeha ha tikoloho e hahiloeng le hoja ho bile le Leano la Tsosoloso ea Metse la Thulamela. Phuputso e sebelisitse moralo oa mekhoa e tsoakaneng, ka lipuisano le lipotso e le mehloli ea data. Batho ba 374 ba sebelisang CBD ba ile ba khethoa ka mokhoa o bonolo. Lintlha tsa tlhokomelo li ile tsa bokelloa ka hlophiso, tsa aroloa ka lihlopha ho bontša likarolo tsa ho bola, ha likarabo tsa lipotso li hlahlojoa ka lintlha tse mahareng le ho hokahanngoa le libaka le lisosa tse amanang. Ho ile ha khetholloa likarolo tse 51 tsa ho bola ha metse. Tlhahlobo ea sebaka e bontšitse hore ho bola ho bokellana haufi le marang-rang a metsamao ea letsatsi le letsatsi le li-node tsa bohlokoa tsa mesebetsi. Mabaka a ka sehloohong ke tsamaiso e mpe ea litoropo, ho senyeha ha meralo ea motheo le litaba tsa meaho, tse bontšang bofokoli bokhoning ba setheo le ts'ebetsong ea leano. Ho kopanya data ea jeospatial le tlhahlobo ea sebopeho ho fa bomasepala sesebelisoa sa ho beha leihlo tsoelo-pele. Liphuputso li bontša hore litoropo tse nang le mehloli e fokolang li hloka maano a reretsoeng, a behiloeng pele sebakeng le a arotsoeng ka mekhahlelo ho sebetsana ka katleho le ho bola ha metse.

## 1. INTRODUCTION

The prevalence of urban decay in small rural towns worldwide is on the increase, and is closely linked to poor development, failure to adapt to shocks, deindustrialisation, loss of service functions, and the prevalence of obsolete buildings (Fertner *et al*., 2015). In Europe, the decay of small and medium-sized towns is commonly characterised by vacant properties, demolished buildings, and escalating unemployment (Cudny, 2012; Weaver *et al*., 2017; Mayer & Lazzeroni, 2022). Evidence of urban decay in small towns across South Africa is increasingly becoming evident. The Department of Cooperative Governance and Traditional Affairs in South Africa (COGTA, 2021) admitted that small towns are subject to urban decay. Generally, urban decay is associated with the degeneration of urban spaces, due to neglect and ageing, including social, economic, environmental, and physical deterioration.

This article focuses on the dynamics of urban decay in the Central Business District (CBD) of Thohoyandou, a small rural town in a former homeland area located in Limpopo province of South Africa, where urban decay is an interplay of several factors, including but not limited to apartheid spatial configuration, capital flight, decentralisation, poor urban governance, continued financial mismanagement, poor enforcement of planning law, poor service delivery, and ineffective land-use management systems (COGTA, 2021; Govender & Reddy, 2020; Kotze & De Vries, 2019; Swanepoel & Smallwood, 2019; Conradie, 2020; Goldberg & Jansen van Rensburg, 2020). These factors, when combined, pose a threat to the long-term sustainability, vitality, and functioning of urban centres. These factors were insufficiently examined in the context of small rural towns, in contrast to the focus on metropolitan areas.

The built environment of CBDs in South Africa's small towns continues to deteriorate, despite deliberate urban-regeneration efforts and the presence of multiple planning and policy frameworks. There are numerous local, provincial, national, and international policy and legal instruments, including the Sustainable Development Goals, the Constitution of the Republic of South Africa, the National Development Plan, and local planning tools such as the Integrated Development Plan, Spatial Development Framework, and Land Use Management Scheme. Yet Thohoyandou Town still experiences persistent urban decay. This disconnect between policy intentions and actual implementation outcomes raises significant concern. This gap underscores the need for a diagnostic approach that can spatially capture and explain the dynamics of decline in small towns' centres.

Although Thohoyandou aims to achieve city status by 2030, its built environment, particularly the CBD, continues to decline in both image and urban form. The built environment in this instance refers to all man-made structures such as, for example, buildings, roads, infrastructure, and public spaces that provide setting for human interaction. The structural elements, including districts, edges, paths, nodes, and landmarks (Lynch, 1960), form the spatial framework of towns and cities, and each of them can be differently affected by processes of urban decay. The built environment, therefore, is critical to defining city image and form, as well as shaping how CBD users work, live, interact, and experience life within these surroundings.

The study aims to characterise urban decay in the Thohoyandou Town CBD through geospatial mapping to reveal its implications for the built environment. By integrating GIS geospatial data with Lynch's (1960) structural elements, the research develops a spatially informed diagnostic tool to assess and monitor urban decline. The central research question guiding this study is: How can geospatial mapping integrated with Lynch's structural elements reveal the spatial dynamics and drivers of urban decay in Thohoyandou Town CBD, and provide a framework for informing regeneration strategies? The results from the study are intended to guide the Thulamela Local Municipality (and other local municipalities), especially in resource-constrained small towns, to adopt targeted, spatially informed and phased oriented urban-regeneration strategies. The study's value lies in offering empirical evidence to support effective implementation of regeneration initiatives in small towns.

## 2. LITERATURE REVIEW

### 2.1 Small towns in the South African context

Small towns are defined differently across contexts, evolving over time and space. Tripathi, Mitra and Mujumdar (2025: 26) describe small towns as "relatively small

urban settlements with a moderate population size, intermediate between rural villages and larger cities, that serve as local centres for economic, social, and administrative activities within the region as they may have relatively better basic urban infrastructure, commercial establishments, educational institutions, healthcare facilities, and governance structures".

In South Africa, small towns vary significantly in population size and geographic extent. According to COGTA (2021), these settlements are relatively 'tiny' in functional capacity compared to large cities, yet they remain diverse in form and role, with some classified as rural, others as mining towns, and others as tourist destinations. This diversity makes defining small towns in the South African context particularly complex.

Internationally, definitions also differ. For instance, France has no nationally endorsed definition of a small town (Jousseaume & Talandier, 2016). However, literature commonly categorises small towns according to size, spatial characteristics, functional roles, and economic structure (COGTA, 2021). Steinfuhrer, Vaishar and Zapletalová (2016) argue that definitions of small towns should be flexible and based on multiple criteria. In general, small towns exist below intermediate cities in the settlement hierarchy, act as local nodes, often operate with limited governance capacity, rely on natural resources for their functions, and display varying levels of service and infrastructure provision (COGTA, 2021). White, Sepe and Masconale (2004) also highlight their importance as critical building blocks in regional development.

Despite their strategic role in regional social and economic development, small towns frequently face neglect and decline (Wagner & Growe, 2021), especially when situated in rural areas (Tripathi *et al*., 2025). In many sub-Saharan African countries, these challenges are compounded by weak public service functions (Wang, Ran & Li, 2022). Contemporary conditions further intensify these vulnerabilities, as small towns are increasingly exposed to climate-induced natural hazards such as floods and droughts, as well as global disruptions such as the COVID-19 pandemic. For example, Thohoyandou Town experiences recurrent flooding during the February-March rainy season each year. Such cumulative stressors contribute to declining liveability and vitality of small towns, often resulting in urban decay.

## 2.2 Urban decay

Urban decay became a widely used idea in the 19th century, after the Industrial Revolution, when rapid industrial growth led to overcrowded cities in the United Kingdom and elsewhere (Fainstein, 2025). It refers to parts of a town or city that have become run-down, with dirt, neglected buildings, poor facilities, and a deteriorating built environment (Enoma & Idehen, 2018). Alade, Ogunkan and Alade (2021) describe urban decay as the deterioration of buildings and older neighbourhoods caused by neglect, crime, and limited financial support. Akabuilo and Okeke (2018) explain urban decay as a gradual process, in which an area that once worked well slowly falls into disrepair and neglect. Urban decay is often driven by a mix of economic, social, and physical factors that, if not addressed, can leave an area in poor condition (Ndlebe, 2017). White *et al*. (2014) also link urban decay to lawlessness.

Mutisya (2016) describes urban decay as ongoing neglect in parts of an urban area. Rapid urbanisation has also been linked to urban decay (Govender & Reddy, 2020). Several factors can contribute to urban decay, including fast urban growth, overpopulation, weak urban governance, failing infrastructure, poor construction materials, and derelict buildings (Ndlebe, 2017; Conradie, 2020). Ndlebe (2017) adds that overcrowding in urban centres can worsen these conditions. Conradie (2020) notes that poor management and poor maintenance of infrastructure in cities, towns, and small towns can accelerate decline. In some instances, failed or poorly built infrastructure projects in small towns also contribute to urban decay (COGTA, 2021). Together, these problems can gradually damage the urban environment in terms of image and form (Mutisya, 2016; Ndlebe, 2017).

Decaying urban areas often have many empty buildings. Akabuilo and Okeke (2018) argue that these vacant properties can create social risks because they may attract criminals and other illegal activities. Urban decay can also drive businesses and investors away, reduce jobs, shrink the local tax base, and slow economic growth (Owens III, Esteban & Sarte, 2020). This often happens when small businesses, industries, and manufacturers relocate or close (Acioly, 1999). As a result, urban decay reduces an area's appeal for investment and lowers the quality of life of people who live and work there (Ndlebe, 2017). Enoma and Idehen (2018) note that the effects of urban decay include poverty, disinvestment, economic decline, rising unemployment, higher levels of crime, and social disorder, and, in physical terms, grime, unsafe structures, poor amenities, and a deteriorating urban environment.

## 2.3 Policy and legislative context

A range of international, national, provincial, and local policy and legislative frameworks guide efforts to improve city imaging and address urban decay.

### 2.3.1 Sustainable Development Goals 2030 (SDGs)

This study engages directly with SDG 11, which advocates for inclusive, safe, resilient, and sustainable urban settlements (UN-DESA, 2024). The SDGs rest on three core pillars, namely social, economic, and environmental sustainability, that collectively emphasise the creation of liveable urban and rural spaces. As a signatory to the SDGs, South Africa is committed to this global agenda. Target 11.3 highlights the role of integrated and participatory planning in curbing urban decline. Achieving this target remains particularly challenging for small rural towns where urban decay is prominent. According to UN-DESA

(2024), the world is currently off-track in meeting the SDGs by 2030. This underscores the need for context-specific interventions, especially those requiring sustained financial investment in projects aligned to SDG 11.

#### 2.3.2 The Constitution of the Republic of South Africa Act 108 of 1996

Section 24 of the Constitution guarantees all citizens the right to an environment that is not harmful to health and well-being, and one that is protected for present and future generations. These constitutional imperatives are echoed in the National Development Plan (NDP), which emphasises the creation of liveable, equitable, sustainable, resilient, and efficient spaces that support both social cohesion and economic opportunity (NPC, 2012). Urban decay undermines these constitutional provisions, by negatively affecting citizens' safety, health, and environmental quality, issues that disproportionately impact the urban poor. It is, therefore, essential for local authorities to develop holistic and responsive strategies that address the root causes of urban decay in small towns, ensuring alignment with constitutional expectations concerning health, safety, and environmental protection.

#### 2.3.3 Spatial Planning and Land-Use Management Act (SPLUMA) 16 of 2013

SPLUMA provides a comprehensive and uniform framework for spatial planning and land-use management across South Africa. The Act seeks to redress apartheid-era spatial injustices, while promoting the sustainable use and development of land and strengthening intergovernmental cooperation (RSA, 2013). SPLUMA sets out development principles, norms, and standards that guide all spatial planning processes. Local-level planning instruments such as precinct plans must, therefore, align with SPLUMA's principles, including spatial justice, spatial sustainability, efficiency, spatial resilience, and good administration. Efforts to reverse urban decline in small towns must be grounded in these guiding principles to ensure coherent and legally compliant planning outcomes.

#### 2.3.4 The Municipal Systems Act 32 of 2000 (MSA)

The MSA regulates the legislative and executive functions of municipalities and enables them to fulfil their constitutional obligations, including the provision of basic services. Section 25 of the Act mandates municipalities to develop and adopt five-year Integrated Development Plans (IDPs) that coordinate and integrate all municipal sectoral plans within the limits of available resources and capacity (RSA, 2000). The MSA thus provides key mechanisms aimed at promoting social and economic development, while ensuring equitable access to services. Urban decay hampers these functions, by undermining economic growth and disrupting planning efforts. Addressing decay requires the effective implementation of local plans such as the Spatial Development Frameworks (SDFs), IDPs, and Land Use Management Schemes (LUMSs). In Thulamela Local Municipality, the IDP vision states: "We, the people of Thulamela would like our Municipality to achieve a city status by 2030, to promote urban regeneration and comprehensive rural development whilst encouraging local economic development to improve the quality of lives of our people" (Thulamela Local Municipality, 2017).

This vision is reinforced in the municipality's SDF and LUMS, which promote efficient land development, a safe and healthy environment, economic growth, and environmental protection. The LUMS also ensures adherence to the South African National Building Standards (SANBS) and other land-use regulations. Despite the clarity of Vision 2030, significant urban decay persists. The Municipality is currently revising its local-level plans to ensure alignment with its long-term development objectives and to address the persistent challenges undermining urban regeneration.

### 2.4 Structural elements

Lynch's (1960) structural elements provide the preferred mode of analysis for this study, because they offer a perceptually grounded framework that links the physical deterioration of urban form to its legibility and usability. Unlike purely technical assessments of material decay, Lynch's theory enables researchers to diagnose deterioration, by tracing how it undermines the clarity, coherence, and navigability of the city image. This makes it particularly valuable for understanding urban decay in town centres, where deterioration is a matter not only of material failure, but also of declining perceptual quality and user experience.

Lynch (1960) believes that individuals construct a series of mental images of their surroundings, and can read, interpret urban features, and process them into vivid mental maps referred to as conceptual or perceptual maps to navigate the city spaces with ease. These perceptual maps are a composition of five broad elements, namely districts, edges, paths, nodes, and landmarks. Because these elements are directly tied to observable physical features, they provide a structured way to diagnose how deterioration manifests spatially and experientially.

Paths encompass streets, passages, and walkways, with the primary purpose of facilitating movement within an urban area (Lynch, 1960). Edges refer to linear elements that form boundaries and break continuity between areas (Lynch, 1960). Districts are sections of an urban area that share common characteristics and can be mentally grouped by observers (Lynch, 1960). Al-Kodmany (2013) acknowledges that traits such as building function or form, architecture, and land-use activities can be employed to define districts. Nodes are strategic focal points used by observers as intensive foci, often occurring at the convergence or intersection of routes (Lynch, 1960). Landmarks are external reference points that help users orient themselves and build a clear image of a place

(Lynch, 1960). To some extent, districts can be understood as inclusive of nodes, edges, paths, and landmarks (Mireku, Abubakari & Martinez, 2021). This denotes that Lynch's elements are not abstract constructs, but diagnostic categories that relate directly to the physical features which make up the built environment of the city.

Clearly, urban decay can be read as a decline in the quality and legibility of these structural elements, negatively affecting both urban form and user experience. Lynch's (1960) structuring elements are, therefore, central and valuable to this study as a diagnostic framework for investigating, tracing, recording, and documenting observable change in the built environment. A perceptual or cognitive map serves not only as a navigational tool, but also as a diagnostic lens to study and document urban decay based on observable occurrences within or around paths, edges, districts, nodes, and landmarks (Lynch, 1960).

In this article, the structural elements serve as the foundational framework for diagnosing urban decay, because they uniquely connect material deterioration to perceptual decline. This enables planners, researchers, and policymakers to trace how physical deterioration is understood and spatially spread from the perceptual image and experiences of users, and to identify areas that require urban management interventions in the CBD. By translating material decline into perceptual legibility, Lynch's framework assists the local municipality in making informed choices and planning decisions on targeted urban management interventions.

## 3. STUDY AREA

Thohoyandou Town CBD was established in the early 1970s and was formally declared the capital of the Republic of Venda (Statistics South Africa, 2011). After the Homelands Policy was rescinded in 1994, Thohoyandou Town was incorporated into the Republic of South Africa (Statistics South Africa, 2011). From the outset, the CBD was planned as an administrative centre to accommodate government buildings of the Republic of Venda (Anyumba, 2019). At present, Thohoyandou Town functions as a political, administrative, and commercial hub for Vhembe District Municipality, with key nodes such as Thulamela Local Municipality Offices, Thohoyandou Post Office, Thohoyandou Police Station, Thohoyandou Magistrate Court, Venda Plaza, Mvusuludzo Shopping Mall, and Game Store Complex. The CBD of Thohoyandou Town also supports both informal and formal trading. As a result, Thohoyandou Town serves as an important economic hub and development node within Thulamela Local Municipality and Vhembe District Municipality. Notably, the CBD has experienced large, uncontrolled, and uncoordinated development in recent years.

At provincial and regional level, the study area is served by the R524 (P98/1), which provides access from both the west and the east. The R524 connects the study area to Louis Trichardt to the south-west and to Punda Maria and Kruger National Park to the south-east. It also links directly to the N1 Road, connecting Thohoyandou to Polokwane and Musina. Because of these locational advantages, commercial and community facilities and related services are concentrated along the R524 corridor (Thulamela Local Municipality, 2010). Maintaining a positive image of Thohoyandou Town as an urban centre is thus important. Figure 1 illustrates the location of the study area with the national, provincial, and local scales.

Local access to the study area is provided via the R523 (P277/1) and the ring road. The R523 (P277/1) also links the CBD to Sibasa and Makonde, small rural towns in the north-east of Thulamela Local Municipality. The CBD is closely connected to the University of Venda (less than 4 km away) via the Casino Boulevard, which provides direct access between the campus and the town centre. Within the CBD itself, movement is constrained by an irregular street layout with limited interchanges, as well as several unnamed internal streets (Anyumba, 2019; Tsoriyo *et al*., 2021). Even so, Thohoyandou Town CBD

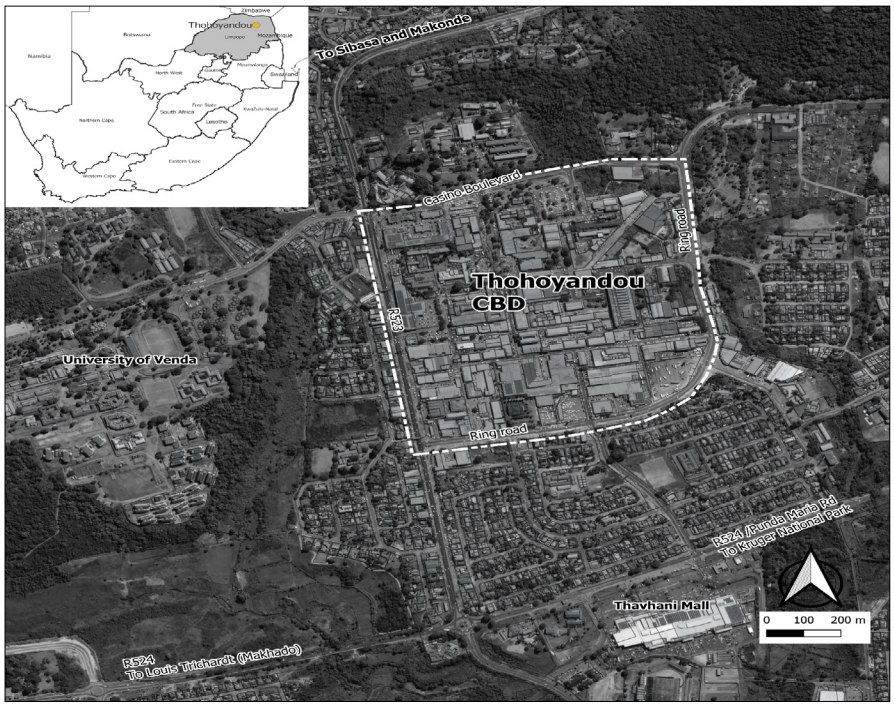


Figure 1: Location of the study area
Source: Authors

remains accessible at regional and local scales, reflecting its national, regional, and local significance.

In terms of the built environment form, Thohoyandou Town CBD mainly comprises one- to two-storey buildings, and has limited open and green space (Anyumba, 2019). In recent years, the CBD has expanded through large-scale land-development projects which leapfrogged into areas adjacent to, but outside, the business district (Thulamela Local Municipality, 2020). This pattern of growth reduces the availability of well-located land for new development within the CBD and shapes how the town centre can expand over time (Thulamela Local Municipality, 2020).

## 4. METHODS

### 4.1 Research design

A convergent mixed-methods research approach, as highlighted by Cresswell and Creswell (2023) was adopted to collect data in Thohoyandou Town CBD. A case study research design was used to evaluate the dynamics of urban decay in Thohoyandou Town CBD through the parallel collection and merging of both quantitative and qualitative data, providing a comprehensive analysis of urban decay in the study area (Creswell & Creswell, 2023). Data was collected from the CBD users by means of questionnaires. Observations were used to capture urban decay in real time, using an observation checklist. Quantitative data were gathered through a structured questionnaire focusing on the built-environment areas most affected by urban decay and the perceived causes. Qualitative data were captured in real time through observation. The design further enables descriptive, spatial, content, and thematic analyses (Braun & Clarke, 2012). Descriptive ranking was used to identify the areas most affected by urban decay and the leading causes. Content analysis was used to group the observed features of urban decay, while thematic analysis categorised these features into three main contributing factors. Spatial analysis transformed geospatial data into Kernel Density maps and integrated Lynch's (1960) cognitive map with geospatial data from the study area to depict the features, attributes, and situations of urban decay affecting each structural element (*e.g.* districts, nodes, landmarks, paths, edges), thereby determining the least and most affected structural elements. Using both observation and questionnaire data was necessary, because it provides both statistical and contextual insight into CBD user experiences (Creswell & Plano Clark, 2018). The combination of quantitative and qualitative methods also allows for triangulation of findings and strengthens the validity of conclusions regarding the deteriorating urban environment in Thohoyandou Town CBD (Creswell & Creswell, 2023). The integration of Lynch's (1960) structural elements provided an interpretation of urban decay not only as the physical decline of buildings, but also as a disruption of the city's image, thereby informing a practical understanding and geospatial approach for improving the implementation of urban-regeneration strategies in small towns.

### 4.2 Population, sample, and response

Statistics South Africa (2011) estimated Thohoyandou Town's population at 69,000 people. Given the fluid and varied nature of CBD users, the study applied non-probability sampling and surveyed 374 participants (5% margin of error; 95% confidence level), as recommended by the Raosoft online sample size calculator (Raosoft, 2004). From the 374 CBD users, 202 valid responses were received, resulting in an overall response rate of 54.4% which was adequate for analysis of the research results (Morten *et al*., 2012). This was considered ideal, because the role of Thohoyandou Town CBD as an administrative centre and economic hub in the district attracts diverse users and groups of people. This allowed sufficient presentation of varying patterns, opinions, and perceptions from people who directly interact with the physical built environment in Thohoyandou Town. The CBD is ever buzzing, due to incessant movement of vehicle and people. This was considered ideal to demonstrate the relevance of the diagnostic tool useful to deal with urban decline, which may not be accurately represented by the broader town.

### 4.3 Data collection

#### 4.3.1 Quantitative

Quantitative data were collected from 374 CBD users between mid-2022 and early 2023, using a structured questionnaire. Recruitment combined online distribution (Google Forms shared via community WhatsApp groups, university mailing lists, and local business associations) with in-person outreach at key CBD sites. Respondents were approached at taxi ranks, shopping centres, informal trading areas, and municipal offices during both peak hours (07h00-09h00; 16h00-18h00) and offpeak times (10h00-15h00) to capture diverse activity cycles. Stratified sampling ensured representation of traders, shoppers, commuters, workers, students, informal traders, taxi users, and municipal officials.

Participants under the age of 18 years were excluded, and individuals unwilling to provide informed consent were not enrolled. Ethical clearance was obtained (No. FSEA/22/URP/08/1707), and informed consent was secured from all participants either digitally (via Google Forms consent tick box) or in writing for in-person respondents.

The questionnaire comprised three sections focusing on activities and experiences impacted by urban decay. Section 1 captured respondents' socio-demographic characteristics, including gender, age, length of CBD use, and frequency of visits. Section 2 included statements on the built-environment areas most affected by urban decay (*e.g.* buildings, public facilities, streets, and pedestrian paths). Section 3 included nine statements on perceived causes of urban decay (*e.g.* maintenance and management). Participants indicated their level of

agreement or assessment for each item, using a 7-point Likert scale (1 = strongly disagree/very poor/extremely unlikely; 7 = strongly agree/very good/extremely likely). Likert-scale measures are commonly used to assess perceptions and human experiences (Koo & Yang, 2025).

#### 4.3.2 Qualitative

a. Observations

The SW mobile application was used to capture photographs, record and document features, attributes, and situations associated with urban decay throughout the study area (Kabir, *et al*., 2018). The SW mobile application is a free mobile phone geographic information system application used to collect (text and photographs), present, and share geospatial data across phones and computers in different formats, including keyhole markup language files (KMZ) and shapefile layers (SHP) (Softwel, 2016). Shapefiles contained information or attributes that described geospatial features (ESRI, 1998).

The SW mobile application functioned as an observation checklist, automatically assigning ID numbers, recording GPS coordinates, descriptive narratives, and images for each instance of decay. With the SW mobile app, 371 individual points representing features of urban decay were recorded. These points were converted into geospatial data shapefiles to show the location of instances of urban decay. The features were not predefined from literature but emerged from repeated patterns in the geospatial and photographic dataset. Observations were conducted by the researcher; inter-observer reliability was not assessed, but photographs were taken for every recorded point, ensuring visual corroboration of textual descriptions. These 371 georeferenced points were then grouped into 51 categories, which formed the basis for subsequent content and thematic analysis.

b. Mapping

To illustrate the extent of urban decay, mapping was used to first transform geospatial data into Kernal Density maps and integrated Lynch's (1960) structural elements with geospatial data from the study area to depict features, attributes, and situations of urban decay affecting the built environment (*e.g.* districts, nodes, landmarks, paths, edges).

### 4.4 Data analysis

#### 4.4.1 Quantitative

The Statistical Package for the Social Sciences (SPSS) was used to analyse the respondent profile and questionnaire data relating to the two constructs, namely the areas most affected by urban decay, and the causes of urban decay. Percentages were calculated from the 1-7 rating scale. For reporting purposes, responses were aggregated and only the combined percentage for scale points 5-7 was presented for each item within each construct and for ranking analysis. Construct reliability was assessed using Cronbach's *alpha*, with values of 0.70 or higher regarded as acceptable (Gliem & Gliem, 2003).

#### 4.4.2 Qualitative

An inductive approach was adopted, and the pattern of the 51 urban decay features emerged as evidence-driven from the geospatial data and photographs collected. Unique urban decay features were identified, by reading through descriptive texts and examining the photos, and these were systematically grouped into categories (see Table 1). Content analysis was used to interpret the observational data (qualitative indicators) such as abandoned and derelict properties, building conditions, the quality of public services, the condition of social and public facilities, and the state of the built environment and infrastructure. Observed indicators associated with decay were systematically recorded and grouped, with their frequency of occurrence used to describe patterns of prevalence across the dataset (Nowell *et al*., 2017). These patterns informed the subsequent thematic analysis and the identification of the main contributing factors (Braun & Clarke, 2012; Guest, MacQueen & Namey, 2012). The main themes included poor urban management, infrastructure deterioration, and building-related factors.

Spatial analysis of urban decay in Thohoyandou Town CBD was conducted to provide an in-depth understanding of geographical and spatial spread, coverage and concentration of features and attributes which defined urban decay. The SW Maps mobile application data was converted into Geographic Information System (GIS) shapefiles and analysed through ArcMap (ArcGIS software). Through spatial analysis, pockets and parts of the CBD where urban decay was concentrated were identified using ArcMap. The outcome of the spatial analysis is a heat map (Kernel Density Heat Map) depicting pockets or parts of Thohoyandou Town CBD where decay is most and least intense. The input data for analysis were 371 independent geospatial points representing urban decay features in Thohoyandou Town CBD. Kernel density, as a point pattern analysis method, was employed to generate hotspot maps of urban decay, following the steps outlined by Krisp *et al*. (2009). The normal distribution function, commonly used (Krisp *et al*., 2009), was adopted for the analysis, and the results were presented as high, moderate, and low concentrations. The geospatial data points for the urban decay feature points were in the WGS 1984 geographic coordinate system. In running the Kernel Density analysis, the search radius was left at the default, yielding a computed radius of 0.00090067070475360704 degrees, and the cell size was 3.39298548881288E-05. The classification method used for the heatmap was the planar method. Given that this was not an advanced analysis, default parameters were used, and the following were not set: no weighting, no severity, and no sensitivity testing. The computed heatmap and potential clusters were visually interpreted.

## 5. RESULTS AND DISCUSSIONS

### 5.1 The features of urban decay in Thohoyandou Town CBD

#### 5.1.1 Occurrence frequency

Based on the observation data analysis, 371 urban decay instances were recorded in the Thohoyandou Town CBD, representing 51 distinct features (Table 1). Table 2 summarises the most prevalent features, evidencing what the literature refers to as a state of disrepair, run-down, deterioration, and neglect (Alade *et al*., 2021; Akabuilo & Okeke, 2018). Potholes were the dominant feature, accounting for 22.91% (n = 85) of all recorded instances, indicating that road deterioration is the most prevalent and highly frequent and notable physical problem in the CBD. This was followed by damaged paving (7.55%; n = 28), gravel islands (7.28%; n = 27), and gravel frontage zones/walkways (7.01%; n = 26), pointing to widespread deficiencies in road and pedestrian infrastructure. Degraded walkways (6.47%; n = 24) further reinforce the declining condition of pedestrian facilities. Moderately occurring features include water leaks (4.58%; n = 17), waste accumulation (4.31%; n = 16), and damaged drainage catch basins (3.77%; n = 14), suggesting persistent maintenance and service-delivery challenges. Blocked drainage systems and construction waste accumulation also contribute to the overall deterioration. Although other urban decay features are less frequent, issues such as illegal dumping, damaged waste bins, old and dilapidated buildings, and open manholes remain important, because they signal environmental neglect and create safety hazards. The high prevalence of potholes directly undermines mobility, safety, and the smooth flow of people and vehicles, thereby disrupting business operations in the CBD and underscoring the urgent need for targeted interventions.

#### 5.1.2 Impact severity

The widespread presence and visibility of urban decay features across the study area indicate that Thohoyandou Town CBD is affected by multiple, interconnected drivers of decline. These include contextual and historical factors, as the CBD is located in a former homeland area. Former homeland areas experienced rapid urbanisation, while remaining largely under-serviced, with significant public service and infrastructure backlogs. This is reflected in Thohoyandou Town CBD, where public infrastructure is particularly affected by urban decay. Dominant features such as potholes, gravel frontage zones, and degraded

Table 1: Features of urban decay in Thohoyandou Town CBD

| No. | Urban decay feature | Total recorded | % | No. | Urban decay feature | Total recorded | % |
|---|---|---|---|---|---|---|---|
| 1 | Abandoned building | 1 | 0.27 | 27 | Gravel access street | 4 | 1.08 |
| 2 | Abandoned bulk infrastructure | 2 | 0.54 | 28 | Gravel frontage zone/ walkway | 26 | 7.01 |
| 3 | Abandoned project | 1 | 0.27 | 29 | Gravel island | 27 | 7.28 |
| 4 | Blocked drainage catch basin | 13 | 3.50 | 30 | Gravel parking area | 1 | 0.27 |
| 5 | Blocked rainwater drain inlet | 4 | 1.08 | 31 | Gravel transport waiting area | 1 | 0.27 |
| 6 | Blocked roadside water gutter | 2 | 0.54 | 32 | Illegal dumping spot | 9 | 2.43 |
| 7 | Collapsed retaining wall | 2 | 0.54 | 33 | Illegal waste burning spot | 3 | 0.81 |
| 8 | Collapsing retaining wall | 1 | 0.27 | 34 | Invisible road marking | 3 | 0.81 |
| 9 | Construction waste accumulation | 11 | 2.96 | 35 | Narrow walkway | 1 | 0.27 |
| 10 | Damage electricity box and illegal urinating spot | 7 | 1.89 | 36 | Old building (dilapidated buildings) | 5 | 1.35 |
| 11 | Damaged and blocked drainage catch basin | 4 | 1.08 | 37 | Open manhole | 5 | 1.35 |
| 12 | Damaged and rusty gutters at taxi rank | 1 | 0.27 | 38 | Open rainwater drain inlet | 2 | 0.54 |
| 13 | Damaged drainage catch basin | 14 | 3.77 | 39 | Plant invaded frontage zone | 1 | 0.27 |
| 14 | Damaged frontage zone/ walkway | 1 | 0.27 | 40 | Poorly constructed building | 1 | 0.27 |
| 15 | Damaged island | 2 | 0.54 | 41 | Pothole | 85 | 22.91 |
| 16 | Damaged manhole | 3 | 0.81 | 42 | Public ablution facility in bad condition | 3 | 0.81 |
| 17 | Damaged paving | 28 | 7.55 | 43 | Sand- and grass-invaded frontage zone | 2 | 0.54 |
| 18 | Damaged road sign | 1 | 0.27 | 44 | Sand- and stone-invaded area | 2 | 0.54 |
| 19 | Damaged street crossing | 3 | 0.81 | 45 | Sand-invaded parking bay | 1 | 0.27 |
| 20 | Damaged waste bin | 6 | 1.62 | 46 | Sewer leak | 3 | 0.81 |
| 21 | Degraded access walkway | 1 | 0.27 | 47 | Soil- and grass-invaded walkway | 4 | 1.08 |
| 22 | Degraded parking lot | 1 | 0.27 | 48 | Unusable transport waiting area | 7 | 1.89 |
| 23 | Degraded walkway | 24 | 6.47 | 49 | Waste accumulation | 16 | 4.31 |
| 24 | Exposed wastewater pipe | 2 | 0.54 | 50 | Wastewater spillage | 2 | 0.54 |
| 25 | Grass and plants invaded ops | 2 | 0.54 | 51 | Water leak | 17 | 4.58 |
| 26 | Grass and soil invaded walkway | 3 | 0.81 | | Total | 371 | 100 |

Table 2: Dominant urban decay features

| Feature | % (n=85) | Rank |
|---|---|---|
| Potholes | 22.91 | 1 |
| Damaged paving | 7.55 | 2 |
| Gravel islands | 7.28 | 3 |
| Gravel frontage zones/walkways | 7.01 | 4 |
| Degraded walkways | 6.47 | 5 |
| Water leaks | 4.58 | 6 |
| Waste accumulation | 4.31 | 7 |
| Damaged drainage catch basins | 3.77 | 8 |

walkways reduce the ability of these assets to perform their intended functions. For example, when roads and walkways fail to support safe vehicular and pedestrian movement, traffic circulation across the CBD is disrupted and this hinders safe movement of users. Potholes are commonly associated with poor road design, excessive surface run-off, limited maintenance, and the use of poor-quality construction materials (Naveen, Yadav & Kumar, 2018). During emergencies, potholes can slow down emergency vehicles and reduce response effectiveness, increasing the risk of damage, injury, or loss of life (Anyumba, 2019). More generally, persistent potholes can damage vehicles, contribute to congestion, and increase the likelihood of accidents and fatalities (Naveen *et al*., 2018). This underscores the urgent need for government interventions to rehabilitate urban infrastructure and prioritise historically disadvantaged rural and small towns, thereby supporting safer urban environments, reducing user risks, and enhancing the overall quality of the built environment.

### 5.1.3 User risk

Many users of the Thohoyandou Town CBD reported that roads, streets, bus and taxi ranks, public parking areas, frontage zones, walkways, and passages often become unsafe and unusable during periods of heavy rainfall. This highlights the vulnerability of the CBD's infrastructure to increasingly intense rain events, resulting in hazardous and inaccessible public spaces. The prevalence of damaged and blocked drainage catch basins points to stormwater and drainage systems that are poorly maintained and lack sufficient capacity to cope with intense rain events, leaving the wider CBD built environment vulnerable to flooding. Such system failures pose risks and can damage public and private property and infrastructure and trigger other disaster-related impacts (Nurashikin, Rodger & Rumaizah, 2019). For small towns, these repair and recovery costs place additional pressure on already financially constrained municipalities. More broadly, urban decay affecting buildings, infrastructure, walkways, and streets creates negative financial consequences, including disinvestment. As Porter (1999) notes, the availability of reliable, well-functioning infrastructure is one of the conditions that attracts investment and strengthens the competitiveness of urban centres (Choe & Roberts, 2011). The implications for urban planning point to an urgent need for infrastructure upgrades that can prevent flooding and enhance reliability. Prioritising such improvements has the potential to attract investment, strengthen resilience, ensure safer environments, and mitigate the negative impacts of urban decay.

## 5.2 Spatial concentrations of urban decay in Thohoyandou Town CBD

Figure 2 maps the spatial distribution of urban decay features in the CBD. These points were then used to analyse spatial concentrations of urban decay in the Thohoyandou Town CBD through Kernel Density geoprocessing analysis function in ArcMap. Kernel Density generates density surfaces from point-location data (Krisp *et al*., 2009; Elson *et al*., 2021), allowing this study to produce heat maps that highlight the pockets where decay is most intense. Identifying these clusters through Kernel Density analysis helps determine which areas of the CBD are most affected and which decay features are most prevalent, providing useful insight for targeted resource allocation, prioritising future improvement and urgent urban management interventions. The resultant heat map (Figure 3) highlights three distinct clusters within the CBD, each reflecting different land-use pressures and management conditions. This uneven spatial concentration and clustering of urban decay reflect a selective approach to urban management in the CBD, with certain areas neglected by the local authority. These patterns indicate that urban decay is not random but rather a manifestation of poor policy implementation, neglect, and unequal governance, underscoring the need for targeted strategies to revitalise the identified clusters within Thohoyandou Town CBD.

Cluster 1 (north-eastern pocket) is located in the north-eastern part of the CBD. This area is dominated by light industrial- and retail-related land

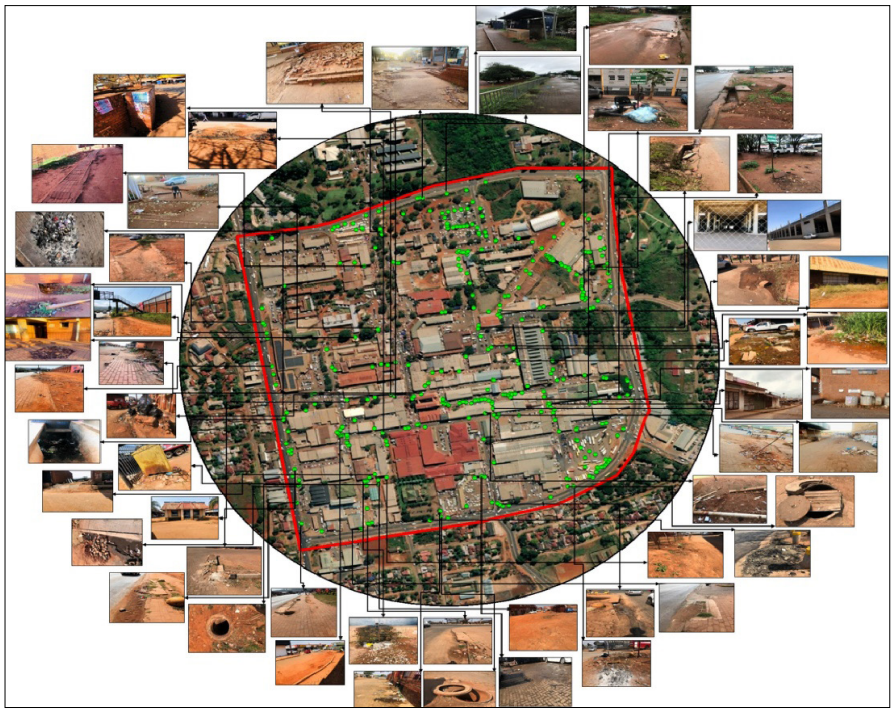

Figure 2: Mapping urban decay in Thohoyandou Town CBD
Source: Authors, 2023

uses, including vehicle-parts retailers, building-material suppliers, and wholesale shops. The concentration of these activities draws heavy vehicles and a high volume of traffic, accelerating the deterioration of surrounding streets and pedestrian paths. This is reflected in the prominence of potholes and degraded pavements, particularly near building-material suppliers and wholesale outlets. The combination of high traffic intensity and inadequate maintenance has made this cluster one of the most visibly deteriorated sections of the CBD. The findings highlight the urgent need to repair potholes and upgrade pavements to improve street quality and pedestrian safety. The concentration of traffic-intensive activities in this cluster underscores the importance of a zoning review to better balance land use, manage traffic flows, encourage alternative routes, and promote sustainable transport modes.

Cluster 2 (central south-eastern pocket) extends from the central CBD towards the south-eastern areas and comprises commercial land-use activities such as the shopping mall, fast-food outlets, offices, wholesale shops, and public transport facilities (taxi and bus ranks). These functions attract high pedestrian and vehicular volumes, resulting in heavy utilisation of the built environment. Due to sustained neglect and a lack of systematic maintenance, the infrastructure in this cluster shows extensive wear, including damaged walkways, deteriorated road surfaces, and overloaded public spaces. The high concentration of activity in this cluster amplifies the visibility and disruption caused by urban decay, undermining the town's image and diminishing the quality of experiences for Thohoyandou Town CBD users. These findings highlight the urgent need for government-led infrastructure rehabilitation, public space enhancement, and urban revitalisation strategies to restore both the aesthetics and functionality of the built environment.

Cluster 3 (south-western pocket) is positioned along the R523, a route which channels substantial traffic through the CBD. The locational advantage of this corridor has attracted land uses such as filling stations and small-scale motor-repair workshops. Many of these workshops operate informally, with repair activities spilling and often extending onto public spaces, including pavements, parking areas, and walkways, thereby accelerating physical deterioration. Despite these pressures, the south-western cluster's boundary shows fewer decay features. Respondents attributed this to the presence of privately managed complexes (Venda Plaza and Game Complex), whose management bodies reportedly respond more quickly and efficiently to maintenance issues than the local municipality. The implications are that governments should promote community engagement and build partnerships with private businesses to leverage their sense of ownership, efficiency in maintenance, and continued investment in the CBD. In addition, urban design and planning must prioritise clear separation between pedestrian areas and informal small-scale businesses to enhance safety and improve the aesthetic quality of the CBD.

### 5.3 The causes of urban decay in Thohoyandou Town CBD

Table 3 presents the demographic profile of respondents from the Thohoyandou Town CBD (n = 202). The vast majority of the respondents (55%) have been visiting the CBD for over 10 years, reflecting a largely experienced user base, while smaller proportions reported 4-6 years (20%), 1-3 years (17%), and 7-10 years (8%). In terms of visit frequency, the vast majority of the respondents visit 2-3 days per week (38%) or once a week (32%). A notable 22% visit daily, while only 8% reported 4-6 visits per week. Respondents are long-term, regular users whose lived experiences

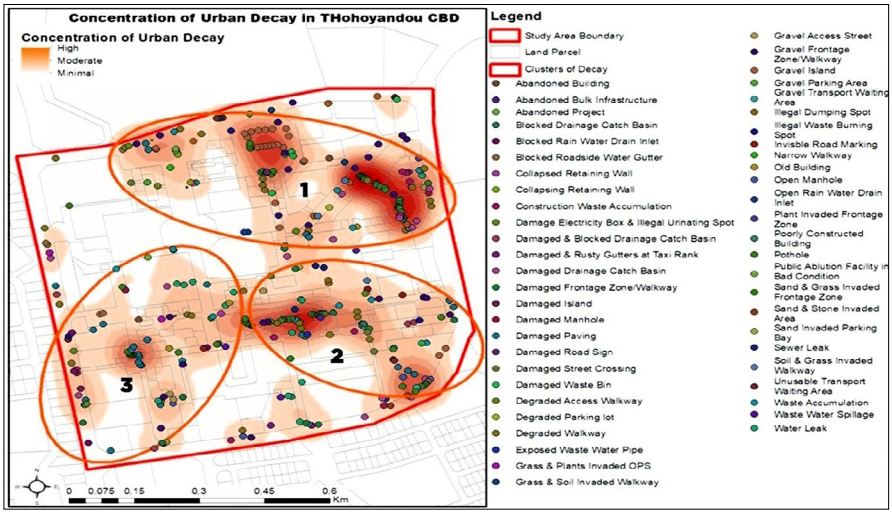


Figure 3: Concentration and spatial coverage of urban decay features in Thohoyandou Town CBD

Source: Authors, 2023

Table 3: CDB respondents' profile

| Demographic | Category | % (n=202) |
|---|---|---|
| Using or visiting the CBD (years) | 1-3 | 17 |
| | 4-6 | 20 |
| | 7-10 | 8 |
| | >10 | 55 |
| Frequency of visits (days per week) | 1 | 32 |
| | 2-3 | 38 |
| | 4-6 | 8 |
| | 7 | 22 |

provide informed perspectives on the CBD's conditions and image over time. Their insights underscore the value of citizen engagement, offering a foundation for planners to prioritise interventions that align with community expectations and address urban decay.

Table 4 presents respondents' perceptions of the overall causes of urban decay in the Thohoyandou Town CBD (n = 202). The high Cronbach's *alpha* value (0.92) indicates strong internal consistency among the variables. The results show that poor governance is perceived as the leading cause of urban decay (89%), followed closely by poor service delivery and lack of maintenance (both 88%). Factors related to planning and construction, namely poor planning, poor construction, and inferior building materials, also ranked highly at 86%. In contrast, abandoned buildings (65%) and unoccupied buildings (47%) are considered to be moderate contributors, while natural disasters (38%) are perceived as the least impactful cause. Drawing from these insights, strengthening governance and enhancing service delivery are essential to reversing urban decay in the CBD. Priority should be given to improving construction standards, rehabilitating abandoned buildings, and enforcing accountability for poor maintenance.

Table 5 presents a cross-tabulation and ranking of the respondents' perceptions on causes of urban decay and the built-environment areas most affected in the Thohoyandou Town CBD (n = 202). The Cronbach's *alpha* values (0.813-0.867) indicate good internal reliability across the assessed built-environment categories. Lack of maintenance emerged as the most significant contributing factor to urban decay (mean = 85.25%), followed by poor construction (84.75%) and inferior building materials (83.25%). Other notable contributing factors include weak stormwater systems (57.75%), vandalism (53.25%), and natural disasters (38.75%). Element-specific challenges were also identified, with littering (88%) mainly affecting public facilities, while weak stormwater systems (84%) and weak sewer systems (58%) predominantly affected roads and streets. In terms of the built-environment areas most affected, public facilities recorded the highest overall mean score (65.13%), followed by roads and streets (55.38%) and pedestrian walkways (54.00%), whereas buildings were comparatively less affected (45.25%). These findings are consistent with cross-cutting factors associated with urban decay in urban centres globally (Ndlebe, 2017; Conradie, 2020). The results further suggest that poor service delivery, inadequate planning, and disasters remain key contributors to urban decay within the built environment of small towns.

### 5.3.1 Institutional accountability

Across observation data, respondent perceptions, and built-environment analysis, three overarching causes

Table 4: Ranking overall causes of urban decay

| Statement/Cause<br>Cronbach's *alpha* = 0.92 | %<br>(n = 202) | Rank |
|---|---|---|
| Poor governance | 89 | 1 |
| Poor service delivery | 88 | 2 |
| Lack of maintenance | 88 | 2 |
| Poor planning | 86 | 3 |
| Poor construction | 86 | 3 |
| Inferior building materials | 86 | 3 |
| Abandoned buildings | 65 | 4 |
| Unoccupied buildings | 47 | 5 |
| Natural disasters | 38 | 6 |

Table 5: Cross-tabulation and ranking of urban decay causes and affected built-environment areas in Thohoyandou Town CBD

| Statement/Cause | Built-environment areas % (n = 202) | | | | Total mean % | Rank |
|---|---|---|---|---|---|---|
| | Buildings | Public facilities | Roads and streets | Pedestrian walkways | | |
| *Cronbach's alpha value* | 0.813 | 0.823 | 0.867 | 0.842 | | |
| Lack of maintenance | 88 | 89 | 84 | 80 | 85.25 | 1 |
| Poor construction | 86 | 85 | 85 | 83 | 84.75 | 2 |
| Inferior building materials | 82 | 83 | 85 | 83 | 83.25 | 3 |
| Vandalism | 71 | 73 | 0 | 69 | 53.25 | 5 |
| Natural disasters | 35 | 30 | 47 | 43 | 38.75 | 6 |
| Littering | 0 | 88 | 0 | 0 | 22.00 | 7 |
| Weak storm-water systems | 0 | 73 | 84 | 74 | 57.75 | 4 |
| Weak sewer systems | 0 | 0 | 58 | 0 | 14.50 | 8 |
| Total mean % | 45.25 | 65.13 | 55.38 | 54.00 | | |

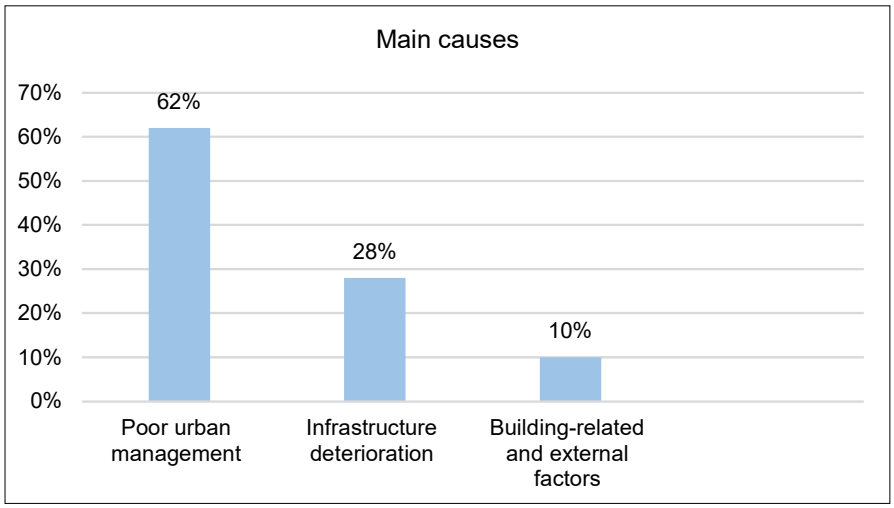


Figure 4: Main causes of urban decay in Thohoyandou Town CBD
Source: Authors

of urban decay in the Thohoyandou Town CBD emerge, all linked to institutional accountability. Figure 4 highlights these findings: poor urban management is the dominant contributor (62%), encompassing poor governance, inadequate service delivery, and lack of maintenance. Infrastructure deterioration follows (28%), including road damage, degraded walkways, and failing storm-water and sewer systems. Building-related and external factors (10%) such as abandoned buildings and natural disasters contribute the least. These results align with Conradie (2020) and COGTA (2021), who emphasise that weak institutional accountability drives urban decline in small towns. Addressing this requires stronger governance, consistent maintenance, targeted infrastructure investment, active engagement with communities and businesses, and strict policy enforcement to curb urban decay in the area.

### 5.3.2 Poor urban management

Poor urban management is the dominant cause (62%|) of urban decay in Thohoyandou Town CBD, contributing to a variety of issues such as construction waste accumulation, sand- and grass-invasion in open spaces, invisible road markings, potholes, damaged signage, sand-invaded parking areas, sewerage leaks, water leaks, wastewater spillages, unusable transport waiting facilities, illegal dumping areas, and blocked roadside gutters, rainwater drain inlets, and drainage catch basins. These challenges highlight poor institutional accountability, a failure in the management and maintenance of urban infrastructure and services, which signals governance failure and ineffective urban management (Acioly, 1999). The absence of functional urban management is identified as the primary cause of urban decay in the CBD. The lack of visible street and pedestrian markings in the CBD was also observed. Road markings and signage are essential for directing traffic and ensuring pedestrian safety. Absence of road markings and signage leads to confusion and potentially dangerous situations for both pedestrians and drivers. Uncollected waste is another critical issue observed in the CBD, which points to inefficiencies in the waste collection, disposal, and management system. Improper waste disposal is detrimental to the city's image and can block drains, contaminating surface water during rainy seasons. Furthermore, burning waste contributes to air pollution (Omang *et al*., 2021). Many respondents highlighted that the municipality's response to maintenance and repair of sewer and storm-water infrastructure is poor. A well-functioning urban sewer system is vital for public health, safety, and flood prevention (Ducci *et al*., 2023). Dysfunctional sewer systems, therefore, expose residents to environmental and health risks. An urgent call for government intervention to redress urban decay is needed.

### 5.3.3 Infrastructure deterioration

Poor institutional accountability leading to infrastructure deterioration was the second most significant cause of urban decay in Thohoyandou Town CBD, contributing to roughly 28% of the observed urban decay factors. This includes collapsing infrastructure, abandoned projects, and failing systems like roads, drainage, and stormwater management. Issues such as damaged drainage catch basins, exposed waste-water pipes, faulty electricity boxes, manholes, and waste bins contribute significantly to the decaying infrastructure. Properly functioning infrastructure is crucial for improving living conditions and supporting economic growth (Gaal & Afrah, 2017). One of the most visible aspects of infrastructure deterioration is the failure of the rainwater drainage system. This system's inability to redirect surface water properly causes flooding and impedes pedestrian movement, especially during heavy rainfall. As a result, pavement and road conditions worsen, leading to premature failure of the road network (Abhijit & Patil, 2011; Naveen *et al*., 2018). In some instances, the surface run-off flows into nearby shops, further exacerbating the problem. Abandoned projects such as the incomplete taxi rank in the CBD are also a major contributor to urban decay. While the structure appears to be relatively new, the incomplete taxi rank remains unoccupied and non-operational, illustrating the failure of infrastructure projects. The presence of abandoned infrastructure projects is a common issue in small towns, contributing significantly to urban decline (COGTA, 2021). In addition, public ablution facilities in the CBD are in poor condition, forcing people to relieve themselves in undesignated areas. Despite this, some functional and maintained toilets are available for a small fee of R2.00 to R3.00. These findings highlight the need for municipalities to prioritise maintenance of infrastructure, completion of abandoned projects, improved drainage systems, and sourcing of finances from alternative funding sources and other government structures to redress urban decay.

### 5.3.4 Building-related factors

Derelict and abandoned buildings account for roughly 10% of the factors contributing to urban decay in Thohoyandou Town CBD. The decline of buildings in various districts, including poorly constructed and old buildings, reflects a significant aspect of the decaying built environment. Poor institutional accountability is also noted in that many of these buildings do not meet South African Building Regulations and Standards (SANBS), particularly in terms of construction quality and safety, yet they are still in use. Some buildings are made with corrugated iron, contributing to a slum-like atmosphere. In the CBD, dilapidated buildings are characterised by broken windows, grass invading the front areas, and general neglect. In one instance, a group of men was observed sitting outside one of these derelict buildings, smoking cigarettes. This highlights the social risks associated with degenerated urban spaces, which can attract illegal activities and unsafe behaviour (Akabuilo & Okeke, 2018). This signals that a multifaceted approach is required to redress urban decay focused on renovation of abandoned

buildings, regular inspections, crime prevention-centred design strategies and zoning relaxation to promote mixed-use development.

### 5.4 Structuring elements showing urban decay in Thohoyandou Town CBD

This section analyses urban decay features within the Thohoyandou Town CBD, using Lynch's (1960) structuring elements (nodes, paths, edges, districts, and landmarks) in combination with geospatial mapping. This approach allows for a systematic and evidence-based understanding of the deteriorating urban environment. Based on observation analysis, the CBD of Thohoyandou Town is characterised by several key structuring elements thst define its layout and functionality. These elements include:

- Movement corridors: Major streets and roads such as Parliament Street and the Ring Road facilitate movement.
- Activity concentrations: Locations of high urban activity, including the Magistrate's Court, taxi ranks, Mvusuludzo Mall, the government complex, plazas, the inner-city square, and the police station.
- Landmarks: Widely recognised reference points such as the City Hall, the Magistrate's Court, the Game Complex, and a distinctive cultural artifact in the middle of the traffic circle along R524 (depicting a large pot balanced on elephant heads), symbolising the VhaVenda culture.

The CBD is defined as a commercial district, aligning with the concept that land-use and building functions are integral to district identity (Al-Kodmany, 2001; Mireku *et al.*, 2021).

Urban decay in Thohoyandou Town CBD manifests through three main categories of deterioration, namely poor urban management, infrastructure deterioration, and building-related factors. These factors contribute to the physical and functional decline of key urban elements, as indicated by geospatial data linked to the structuring elements. The black arrows in Figure 5 link each urban decay feature with

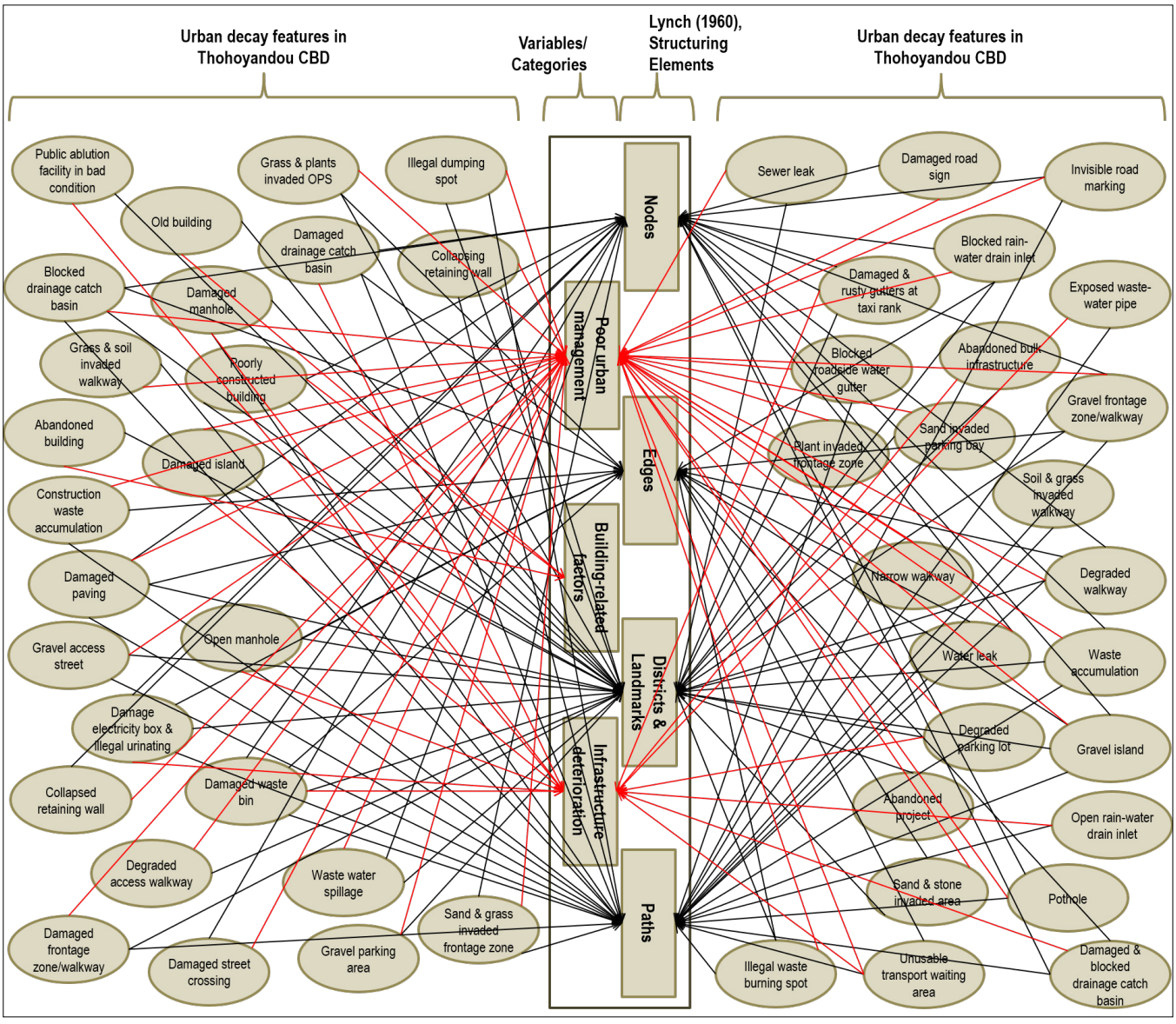


Figure 5: Integration of Lynch's (1960) structuring elements into urban decay features

Source: Authors, 2023

one or more structuring elements where the feature occurred and was recorded in Thohoyandou Town CBD. Urban decay is not isolated or confined to any single structural element. Instead, it impacts multiple components of the urban fabric. For example, blocked drainage systems were recorded in nodes, paths, districts, and edges, reflecting widespread infrastructure failures. This highlights systemic weaknesses in municipal planning effort, as well as the need for coordinated interventions crucial to redress urban decay in the CBD.

Geospatial mapping facilitated the integration of urban decay features with the structural layout of the CBD, making it possible to trace and document deterioration patterns across various elements. Data on urban decay features, collected using the SW Maps mobile application, were exported as shapefile layers and analysed in ArcMap. The shapefile layers were overlaid on maps of Thohoyandou Town CBD to create a unified spatial visualisation of urban decay. This integration allowed for a detailed assessment of where decay was most concentrated. Figure 6 illustrates the spatial distribution of urban decay across the CBD, highlighting the structuring elements most and least affected by deterioration. This diagnostic approach is essential, as it provides a clear spatial understanding and representation of urban decay features within the area and points to most affected areas requiring urgent interventions. These findings have implications for planning, challenging that interventions and resource allocations must be evidence driven to promote redress of urban decay.

Considering the analysis of the features in Table 1 and Lynch's (1960) grouping in Figure 5, Figure 7 provides a summary of the most and least affected structuring elements by urban decay within Thohoyandou Town CBD. The analysis revealed that paths were the most affected by urban decay, comprising 54% of the total recorded features. Nodes followed with 21%, while edges and districts accounted for 13% and 12%, respectively. Landmarks were the least affected by urban decay because these receive regular maintenance by the local municipality. These findings suggest that targeted interventions must focus on enhancing pathways as they significantly impact on user mobility and accessibility of Thohoyandou CBD. Nodal areas should be viewed as opportunities for revitalisation to promote user interactions and enhanced services in the area while redressing urban decay. Thus, user-centred nodal, edge and district design can promote social activities and vibrant hubs in the CBD.

Paths, including streets, roads, and walkways, with an estimated 54% of the total recorded features were most impacted by decay. Common issues included damaged paving, gravel roads, blocked drainage, and unkempt walkways. These features severely hindered both pedestrian and vehicular movement. Poor road maintenance and construction were attributed to these issues, with local officials acknowledging that "the local municipality has not paid

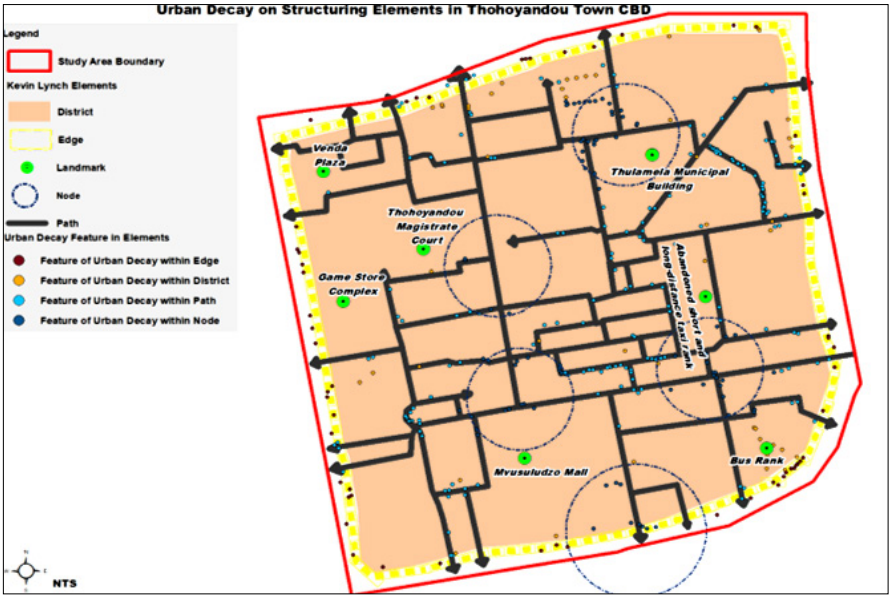


Figure 6: Location of Lynch's (1960) structuring elements and urban decay features in Thohoyandou Town CBD

Source: Authors, 2023

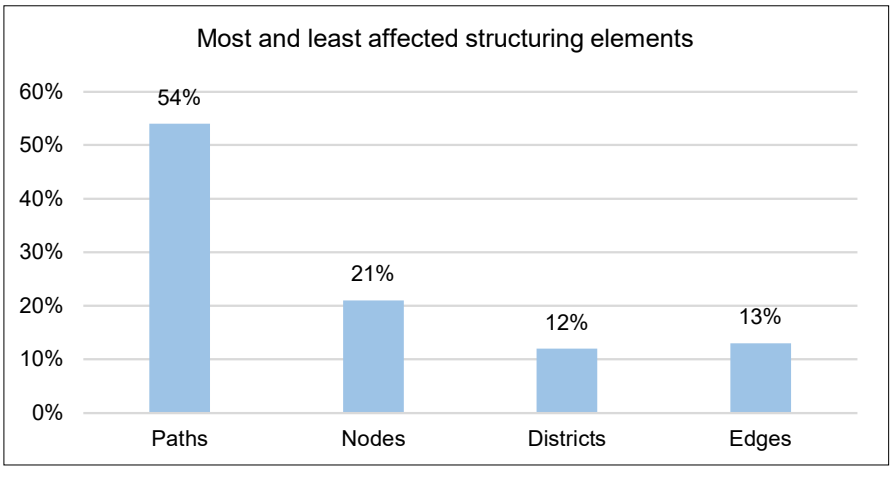


Figure 7: The most and least structuring elements affected by urban decay in Thohoyandou Town CBD

attention to road maintenance as a key urban management task". The lack of proper infrastructure led to increased safety risks, higher vehicle operating costs, and a generally unpleasant urban experience (Burningham & Stankevich, 2005).

Approximately 21% of the total documented features of urban decay were recorded on nodes. Nodes are central hubs of activity and often the first places where neglect is visible. In Thohoyandou, nodes were marked by abandoned buildings, illegal dumping sites, and dilapidated public facilities. These decay features significantly disrupt the functionality and image of the CBD, contributing to social risks and attracting further decay, as described by Ndlebe (2017). Notable decay features in nodes included abandoned buildings (0.27%), illegal dumping (2.43%), and water leaks (4.58%). These nodal centres require targeted revitalisation interventions to address urban decay and enhance urban vitality. There is a need for continuous monitoring and evaluation of maintenance activities. A GIS dashboard on urban decay would be an essential tool for the municipality to track the spatial spread of decline as well as to schedule the needed maintenance in each case.

Edges (13%) and districts (12%) are least affected by urban decay. This could be largely because of their location from where most of the activities and movement of people and vehicles are concentrated. Edges marking the boundaries between different parts of the CBD were characterised by deteriorating infrastructure. Collapsed retaining walls, accumulated construction waste, and illegal waste-burning spots were common features, signalling decay along these transition areas. These deteriorating edges further fragmented the CBD, reinforcing divisions between well-maintained and neglected areas. Districts, larger urban areas associated with specific land uses, were also affected by urban decay, primarily due to infrastructure breakdowns. Blocked drainage systems, sewer leaks, and waste accumulation were common problems in districts, reducing the liveability of these areas. Features such as blocked drainage catch basins (3.50%) and sand invasion in frontage zones (0.54%) exacerbated the deterioration of these urban zones. These findings reveal that edges and districts are perceived as not heavily impacted by urban decay features than other structural components of the CBD built environment. However, they still face similar infrastructure and poor waste management challenges. This implies that there must be prioritisation of holistic planning interventions and infrastructure development to curb and prevent further urban decay in these parts of the built environment.

These findings underscore that urban decay in Thohoyandou is concentrated in specific areas of the CBD, with paths being the most heavily impacted. The decay of nodes and edges also contributes to a fragmented and dysfunctional urban environment. The results suggest that prioritising maintenance and improvement efforts in paths, nodes, and edges would be critical in mitigating urban decay and enhancing the overall quality of life in the CBD. This is essential to achieving policy directions set out in the international and local policy frameworks.

## 6. CONCLUSIONS AND RECOMMENDATIONS

The study sought to characterise and spatially interrogate urban decay patterns using Lynch's (1960) structural elements in Thohoyandou Town CBD, a small rural town in a former homeland area in South Africa. This is critical to broaden understanding of urban decay, by offering insights useful for shaping research, policy, planning, and the implementation of relevant and suitable urban-regeneration strategies. The findings revealed that urban decay in Thohoyandou Town CBD is extensive (51 distinct features), spatially concentrated in Cluster 1 (north-eastern pocket), Cluster 2 (central south-eastern pocket), and Cluster 3 (south-western pocket), and follows a structural pattern (activity concentration centres and major routes) that is not random. Privately managed precincts exhibit fewer urban decay features. The diagnostic analysis adopted corroborates the finding that, despite numerous policy and legislative frameworks, urban decay persists. The most affected structural elements identified in the findings are the paths and nodes, indicating that everyday mobility and activity spaces bear the evidence of urban decay in Thohoyandou Town CBD. This directly affects users' perceptions of the functional and perceptual legibility of Thohoyandou Town CBD through the lens of Lynch's (1960) structural elements, as well as the town's readiness to achieve the development trajectory of becoming a city by 2030. The findings reveal that urban decay in the study area is further attributed to poor urban management, infrastructure deterioration, and building-related factors. This suggests that urban decay in Thohoyandou Town CBD is not only an isolated issue of physical infrastructure degradation, but also a reflection of structural and institutional weaknesses, as well as weak policy implementation by local municipalities, particularly in resource-constrained small rural towns such as Thohoyandou Town.

The implications for policy, planning, and implementation, from the study's findings, are that the municipality must prioritise and strengthen spatially informed, proactive routine maintenance of key pathways and hotspot nodes identified. Hotspot mapping allows the municipality to develop a phased approach to planning, aligning with the IDP, budget cycles, and the implementation of maintenance programmes. In line with this, the study recommends that the municipality adopt geospatial technologies such as GIS Dashboard for municipal urban decay as an institutional tool to support planning and make spatially informed prioritisation of

urban management interventions. There must be incorporation of hotspot maps into IDP and SDFs evaluation processes. This ensures that the limited resources are targeted at the concentrated urban decay zones. It is recommended that such a tool triggers the need for improved coordination and enforcement of policies across various units in the municipality. The idea is that strengthening enforcement of by-laws would curb further deterioration, particularly by improving waste management and building maintenance. Learning from the findings that private precincts exhibit fewer features of urban decay, it is recommended that municipalities explore and promote public-private collaborations. Actively engaging private owners, investors, businesses, and developers to establish partnerships, as well as providing incentives that support improved urban management can help enhance the citys image and legibility in addressing urban decay.

This study was limited to a single CBD of a small rural town, Thohoyandou, in South Africa. Since results from case studies are often difficult to generalise beyond the bounds of the study scope, it is, however, possible to generate lessons applicable to other small towns in the South African context. The findings from the case of Thohoyandou Town CBD extend empirical knowledge on urban decay from a small rural town perspective. Critically, the methodological and analytical frameworks employed are replicable, and offer insights that other municipalities and researchers can adopt to generate empirical evidence comparable across small towns in South Africa and beyond. Future research across small towns of similar scale and diagnostic nature has the potential to generate comparable empirical evidence to gauge policy intentions and the extent of urban decay in small towns. This is crucial to inform targeted policy interventions and urban regeneration aimed at addressing urban decay in small towns. These interventions are urgently needed.

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