

UNIVERSITY OF KWAZULU-NATAL



Assessing the Sustainable Urban Development-Urban Liveability- Inclusive Physical Development Nexus in Selected Cities in North- Central Nigeria

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ABSTRACT

The continuous increase in the urban population worldwide has exacerbated the intensity of urban land use conversion and spatial consumption. This motivation for a better urban space led to the evolution of sustainable urban development, urban liveability, environmental awareness, inclusivity, and urban governance. Therefore, this research aimed to establish the intricate links between sustainable urban development, urban liveability, and inclusive physical development in selected cities in North-Central Nigeria. The theories examined were Citizen Participation, Dependency, Modernisation, and Infrastructure. The selected cities were Lokoja, Lafia, and Minna, all incidentally equidistant to Abuja, the Federal Capital City of Nigeria. This research employed a mixed-methods approach by collecting both qualitative and quantitative data. These data sets ranged from satellite imageries used for the spatio-temporal analysis and urban growth simulation through ArcGIS, Q-GIS, and the Artificial Neural Network. The extent of infrastructure provision and their methods were appraised using the instrumentality of the nearest neighbour analysis and the partial least square analysis using the SmartPLS. The research also appraised the stakeholders' perceptions and methods of infrastructure provision through a word cloud analysis using NVivo analytics. In analysing the provision and condition of the infrastructure in North-Central Nigeria, educational infrastructure was found to be inadequate and poorly maintained; inadequate budgetary allocations exacerbated the problem of urban infrastructure overuse; illegal developments often overtook sites reserved for infrastructure; and funding, vandalism, and project continuity were cited as critical factors. The infrastructure that suffered the highest maintenance neglect was the urban water supply, education infrastructure, and the health care facilities. Political motivation and the population played the most significant roles in the region's urban infrastructure or project development. The triad of consumption, access, and equity was used to evaluate *Hangwurian* City Development's (HCD) proposed sustainable urban infrastructure development plan. Convergent validity was strong in the region, where the AVE was significant at 0.56 or more. A compact development model was found to be a valuable indicator for qualifying the cities. It was found that the challenge of planning regulation and siting of infrastructure could be addressed effectively, however, the public and private sector promoters of projects had to stick to their parts of the bargain. Cities across North-Central Nigeria had to undertake citizen-focused infrastructure planning and development. Therefore, the researcher concluded that city development and urban growth could be moderated through the instrumentality of adequate infrastructure provision and planning to prioritise the needs and desires of residents. This is achievable by adopting the *Hangwurian* City Development Model, which helps to promote cities without ills.

Keywords: Urban development, Nigeria, North-Central Nigeria, Urban development Modelling, *Hangwurian* Model of Urban Development, Participatory planning, Infrastructure, Modernisation, Dependency

DECLARATION STATEMENT

I declare that all the information in this thesis has been collected and presented according to the ethical rules and academic conduct of the University of KwaZulu-Natal. I, at this moment, declare that this thesis signifies my own work that has not been submitted, either in part or whole, for the award of any degree, diploma, or other qualifications at any other institution. Where other researchers' work and sources of information have been used, due acknowledgement has been made in the thesis.

Signed... 

Medayese, Samuel

(220110996)

DEDICATION

This thesis is dedicated to my wonderful nuclear family: Omowumi, Oluwataramisore, Olufela, and my ever-amazing mum, Oyinkansola Medayese. May God continue to bless you all for me.

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Ngiyabonga	kakhulu	Nkulunkulu	wami
waseKuphakameni!!			

PUBLICATIONS ARISING FROM THE THESIS

Journals

Journals

1. **Medayese, S., & Chipingu, H. M.,** (2021). Mediation function of desired quality of life between place-making and liveable communities in African cities. *Forum Geografi*, 35(2).

Conferences

2. **Medayese, S.,** Magidimisha-Chipingu, H., & Chipingu, L. (2021). Conceptual nexus of urban liveability and sustainability. *IOP Conference Series: Earth and Environmental Science*, 654(1), 012027). IOP Publishing.
3. **Medayese, S.,** Magidimisha-Chipingu, H., Popoola, A., & Chipingu, L., (2021). Analytical nexus of urban liveability, liveable communities, and place-making in African cities – *WABER 2021 CONFERENCE*.
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Book Chapters

5. **Medayese, S.,** Magidimisha-Chipingu, H. H., Chipingu, L., & Popoola, A. A. (2021). Situating citizens' participation in inclusive infrastructure development. Magidimisha & Chipingu Eds In *Urban inclusivity in Southern Africa*. (pp. 395-416). Springer.
6. **Medayese, S.,** Magidimisha-Chipingu, H. H., Popoola, A. A., Chipingu, L., & Adeleye, B. M. (2021). Thematic review of trends in inclusive urban development studies (2000-2020). In *Handbook of research on institution development for sustainable and inclusive economic growth in Africa*. (pp. 362-372). IGI Global.
7. Popoola, A. A., Blamah, N. V., Mosima, C., Nkosi, M., **Medayese, S.,** Chipingu, L., & Magidimisha-Chipingu, H. H. (2021). The language of struggle and radical activism as an inclusive city tool among the neglected urban poor of South Africa. In Magidimisha & Chipingu Eds *Urban inclusivity in Southern Africa*. (pp. 417-445). Springer.
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Blog Articles

10. **Medayese, S.**, & Magidimisha-Chipungu, H. (2022, April 18) Does sustainable development guarantee liveability and inclusivity: a comment on the African cities? *Inclusive Cities*. <https://inclusivecities.ukzn.ac.za/>.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

A country's ability to raise its citizens' standard of life by providing better access to health care, education, transportation, and other social services, and by improving the competitiveness of its labour market is directly tied to its infrastructure and service provision (Bocarejo & Oviedo, 2012; Prus & Sikora, 2021). As a result of the importance of infrastructure, rural areas are increasingly linked to regional and international networks and developing urban-rural ties to bring about inclusive and long-term changes in the production, institutional, and social spheres. The United Nations' 2030 Agenda for Sustainable Development recognises that infrastructure is an essential tool that may improve people's living conditions, stabilise social stability, and build a more resilient urban environment (Connor et al., 2017).

These sustainable development goals project that all people should have access to safe, clean water and sanitation; access to reliable, modern energy sources; live in healthy cities; that cities should be inclusive; and that people should live in sustainable settlements. All these projections are tied to infrastructures. A country's progress toward systemic change will be hindered by inadequate, unsustainable, and inefficient infrastructure service delivery; a significant reason for the drive towards infrastructure transformation across the nations of the world (Canton, 2021). However, the drive for infrastructure transformation is yet to receive the same impetus across all nations.

The situation of infrastructure demand and supply in the developing countries of the world, especially in Africa, however, confounds urban managers as there exists a widening difference in infrastructure across the urban space, mainly when one transits from small to medium to large urban spaces in Africa in general and in Nigeria in particular (Gore & Gopakumar, 2015). Many challenges remain before infrastructure can be developed at the pace that fits demand, especially when considering the cost of providing universal access to essential services and the infrastructure required for the economy based on the country's expected GDP growth and population projections, as well as the 5-007 parameter (representing the value of the 5-007

metric), which is used to estimate the cost of providing universal access to essential services (sensitive to asset prices) (Fay et al., 2011).

Furthermore, changes in human-world connections will occur over time and space, with more factors contributing to biodiversity loss and depletion of the planet's resources to ensure adequate provision of infrastructure and services. As cities grow, they affect the environment, with burgeoning urbanisation threatening the balance of climate resilience. However, these have increased the demand for a shift in consumption patterns in resource uptake from non-renewable to renewable natural resources and other ecological necessities with the continuous rise in population (Mahalik et al., 2021). Global resource use and consumption patterns have evolved due to the human population's growth (Meadows & Randers, 2012). The world's poorer countries, which struggle to make their cities more liveable, are the worst hit by this exploitation and overconsumption (Hamm, 2021). The situation in Nigeria in terms of resource over-exploitation and consumption shocks is invariably not different in shape and form across its urban spaces (Nilsson, 2017). In the North-Central Region, in particular, this has had a significant impact on the country's life and existence, necessitating research into the methods of analysis of the intricate links within sustainability, urban liveability, and infrastructure inclusivity, focusing on the use of the environment to ensure effective, efficient, and productive resource consumption (Angelopulo, 2017; Folli, 2018).

1.2 Problem Statement

A lack of infrastructure has plagued sub-Saharan Africa's cities for a long time. In many cities there is no urban infrastructure, and in those with it, it is insufficient to meet the needs of a rapidly expanding population (Hove et al., 2013). Housing for low-income families is scarce, roads are in a state of disrepair, and health care infrastructure is broken down, among the other inherent urban infrastructure challenges. This has compelled residents to build shelters that lack essential utilities such as running water, sanitation, and power without compliance with urban development regulations as a result of their poor access to affordable housing (World Health Organisation [WHO], 2010).

Another issue stemming from unchecked urbanisation is the rapid population growth. Housing, sanitation, and other infrastructure requirements are particularly critical in the rapidly expanding cities of North-Central Nigeria, such as the capital Abuja and its surrounding areas,

including Lafia, Minna, and Lokoja (Bah et al., 2018). Cities in sub-Saharan Africa and South-East Asia have been found to have additional weaknesses, such as natural disasters, in their (UN's) comprehension of these regions. Forty per cent of Africa's one billion people live in cities, with more than half of them residing in slums with insufficient access to clean water and sanitary facilities (UN, 2013). Sub-Saharan Africa's urban population is expected to treble by 2030, reaching 600 million people (Desa, 2012; Thelwall, 2021; Satterthwaite, 2007).

Several conflicts in sustainable development necessitate an immediate response (Watson et al., 2010). The economy and growth must be juggled and rethought to sustain social order, natural resource economics must be pursued further, and power use must be improved (Leach et al., 2010). Our environment faces a range of challenges that include climate change, food, and energy exploitation, waste generation, health concerns for the general population, poverty, social segregation, resource management, and the depletion of the ecosystem (Flint, 2013).

The increasing population, the world's limited bio-capacity, and social inequity all pose significant hurdles to sustainable development (Gough, 2017). Especially given the fact that the global population is projected to reach about 10 billion by the year 2100, the global natural resources are finite (Jones & Warner, 2016). This has resulted in a massive rise in human resource utilisation. People's lifestyles and resource use contribute to global warming by releasing greenhouse gases (Carley & Christie, 2017). The flood of people into the rapidly expanding region of North-Central Nigeria necessitates allocating additional resources (Ibrahim et al., 2009). As a result, the overconsumption of agricultural land for urban development is an issue (Zhou et al., 2015). All possible outcomes result in inadequacies and disruptions with specific natural sequences, namely water scarcity, poverty, deterioration of agricultural land, deforestation, and a condensed loss of ecosystems (Bodley, 2012). All life on Earth, including humans, will eventually be threatened by climate change (Pecl et al., 2017).

Maintaining a city's average infrastructure has proven difficult due to individuals' attitudes and experiences with municipal infrastructure control. In Turner's (2011) embodied "sustainability", urban infrastructure gives a chance to examine people-nature linkages at personal and neighbourhood levels. There are numerous benefits to urban infrastructure that are aligned with sustainability and liveable community goals, such as healthy living (Ghose & Pettygrove, 2014), intergenerational and multicultural interaction, a feeling of belonging, and the empowerment to make positive change in one's community (Armstrong, 2000), and

knowledge sharing (Datta, 2019; Ghose & Pettygrove, 2014; Tidball & Krasny, 2007). Despite this, urban infrastructure faces several challenges, including a lack of or inadequacy of the required numbers of it; poor planning and management; population exploitation; investment and technical know-how in innovation; secure land tenancy; inter-personal conflicts; organisational issues; and the possibility of ecological injustice spreading through cities because of unequal access to resources (Lovell & Taylor, 2013).

In addition, Africa's infrastructure is being destroyed by environmental degradation. Environmental and health issues are becoming more prevalent in densely populated places, mainly slums. Managing the consumption of non-renewable resources like oil, gas, and coal is made much more difficult by the fact that cities serve as the engines of economic activity and growth. These metropolitan hubs are where most of society's institutions may be found, including educational institutions, medical facilities, governmental offices, transit hubs, and media hubs. They help people find work and a place to live. However, Africa's demand for infrastructure services has outstripped Africa's financial ability to provide them. As recently as 2004, it was estimated that urban growth would necessitate an annual expenditure of \$250 million in infrastructure for the next 25 years (de Morais Sarmiento, & Hussein, 2017).

In sub-Saharan African cities, infrastructure availability and sustainable living conditions are characterised by fast urban population growth that outpaces infrastructure provision. More than half of the world's population now lives in cities, up from 3.3 billion in 2008. It's estimated that by 2030, this will have risen to more than 5 billion. The number of people living in cities across Africa and Asia is projected to increase by more than three times that amount by the year 2030. (United Nations Population Fund [UNFPA], 2007). African urban infrastructure developments, which are critical to inclusive development and sustainable growth, have resulted in an overall ranking of Africa's urban infrastructure provision in 2016 that is lower than the global average, according to Moreno et al., (2016), even though 87 per cent of Africa's population does not have access to it.

The Arimah (2016); and UN-Habitat (2016) studies also analysed the quality and relative development of the infrastructural components supplied in the cities. The UN-Habitat's (2016) expert survey verified the relative poverty of African cities' infrastructure. Traffic, poor pedestrian facilities, power outages in homes, and a lack of drinkable water supply were among the top difficulties contributing to the African cities' rankings. The documented inequalities

and weaknesses jeopardise cities' economic wellbeing in their infrastructure across different locations. Earnings or progress, economic growth, the pace of urbanisation, and physical features all play a role in these economic wellbeing discrepancies. In addition, it is essential to emphasise that infrastructure development is a means of accelerating economic growth. Africa's annual an approximate \$45 billion will be spent on infrastructure, which is roughly 6 per cent of the continent's gross domestic product (GDP) (Foster & Briceno-Garmendia, 2010). In East Asian countries, this is not the case. A comparison showed that with an increase from 5.7 per cent of the GDP in 1998 to 14.4 per cent of the GDP in 2006, China has focused on infrastructure-oriented growth since 1990 (Roy, 2010). India has also strengthened its infrastructure spending from 4.1 per cent to 5.6 per cent.

According to the Falola et al.'s (2018) study, nearly 70 per cent of Nigeria's total population lives in urban poverty, which is another issue. Most of the population is urban dwellers and because many cities in Nigeria and sub-Saharan Africa cannot adequately deliver vital urban services the ever-increasing population of cities, this has resulted in inadequate essential services. Nabegu, (2010) found that only half of the cities' residents have access to water, and many towns do not have efficient methods for collecting solid waste. Most cities in developing nations lack sewage system connections and sanitary landfill facilities.

The supply of infrastructure that is not inclusive is one of Africa's most pressing infrastructure issues. For example, most road projects do not consider pedestrians' requirements. There are no walkways, overhead bridges, or pedestrian crossing points on the highways, and pedestrian traffic signals are absent or poorly maintained. However, in Conakry, Douala, Lagos, Ibadan, Kano, Onitsha, and Kinshasa, walking accounts for 60-70 per cent of all trips (Kumar & Barrett, 2008). Moreno et al. (2016) states that 89 per cent of local African experts believe that Africa's non-motorised road infrastructure is inadequate. Lafia, Gaborone, Johannesburg, Lagos, Lokoja, Nairobi, Lusaka, Algiers, Minna, and Addis Ababa are the worst-performing cities as it is not uncommon for pedestrian non-motorised infrastructure to be poor. In other cities, they have been taken over by commercial operations that have been rejected, and this occurrence validates the statistics on traffic-related deaths in African cities (Kumar & Barrett, 2008).

Liveability, sustainability, and inclusion are all threatened by the inadequate urban road systems in Africa, a crucial a vital part of the public mass transit in a great number of African

cities. Public-owned transportation businesses face difficulties in terms of profitability because of the lack of public-operated mass transit in some cities. As a result, the private sector is responsible for most city transportation in Africa. This is frequently seen in the form of used minibuses and microbuses, shared taxis, and more recently, commercial motorcycles and three-wheelers. More than 500,000 individuals were directly employed by Lagos' 100,000 minibus and 200,000 commercial motorcycle fleets in 2007 (Kumar, 2011). The argument favouring these vehicles is based on their capacity to manoeuvre in traffic, travel on terrible roads, and be flexible in their operations, but they are less efficient than public transportation and more prone to traffic crashes. In addition, they exacerbate the air pollution caused by fossil-fuel-powered vehicles, which is especially noticeable in heavy traffic during peak hours.

Other African cities face the same issues that are plaguing Nigeria's urban environment. Urban development and infrastructure provision in Nigerian cities are a significant component of the country's rapid growth (Ayedun et al., 2011). Human settlements and the environment have become increasingly intertwined due to the exponential increase in population. As a result, people and the environment are suffering from poverty, and the quality of life has deteriorated. Additionally, human and environmental resources are being underutilised. According to Ayedun et al. (2011), more than 70 million people worldwide live in poverty.

Infrastructure, essential services, and housing are in short supply in urban areas as they grow; Pipe-borne water, power, and waste disposal facilities are in short supply. Many people in the country are also confined to poverty and lack necessities such as schools, health care, or leisure activities since they live in so-called slums (Obi-Ani & Isiani, 2020). To add insult to injury, the country's development initiatives tend to favour urban areas over rural ones, resulting in the absence of coordinated and organised efforts to enhance rural areas, and ultimately in a lack of market access for rural goods and services. Most non-disabled males and females are compelled to relocate to the country's urban centres due to the dismal status of education, health, transportation, water, and sanitation services in the rural areas, all of which contribute to the country's urban ills (Ayedun et al., 2011).

Managing urban growth and development and disaster responses are all aspects of the liveability and sustainable living challenges that must be addressed (Maheshwari et al., 2016). Cities that use short-term, project-based tactics instead of long-term strategies are unsustainable (Djurasovic & Knieling, 2015). Urban administration decentralisation shows that

many governments have delegated some of their duties to local authorities (Ebinger et al., 2011). Hence, local governments now have a more vital role in urban development planning and decision-making (Shen et al., 2019). However, funding does not always correspond with the devolved responsibilities (Keating, 2005). In addition, governments at all levels must work together to implement decentralisation. Cities are currently being considered as living ecosystems and attempts are being made to balance the social, economic, and environmental concerns to achieve sustainable urban growth (Hassan & Lee, 2015). Nigeria and North-Central Nigeria's sustainable liveability and infrastructure inclusivity assessment can thus be launched by developing a conceptual model to guide cities that will operate without the observable urban ills identified earlier (Ijuo & Musa, 2021).

1.3 Significance of the Study

According to various studies, sustainable urban development encourages the responsible and acceptable use of resources, especially the shift from non-renewable to renewable resources—a position espoused in diverse literature following the establishment of the sustainable development agenda in Rio de Janeiro in 1987. Urban liveability is a development concept that focuses on enhancing space users' health and wellbeing through infrastructure provision, but with caution. As a result, there have been severe misconceptions among professionals who believe that concept development planning and spatial change concepts are the same. A city's physical development is mediated by the ideas of inclusive development, urban management, and environmental consciousness. Consequently, the differences between sustainable urban development, which aims to promote rigorous and controlled resource consumption within the urban space, and liveability (which emphasises the importance of well-being infrastructure), should be noted.

In conceptualising this research's significance on the nexus of sustainable urban development, urban liveability, and inclusive physical growth, two significant strands have been identified and presented in this research section. These two strands of discourse are the urban planning practice's significance and urban planning research, and this research section is presented based on these strands of significance.

1.3.1 This research's significance for urban planning practice

As a result of this research, planners will better understand the definitions of ideas and the drawbacks associated with these definitions. To begin, it has been determined that there is a lack of consensus on the purposes of these three terms. Development that satisfies the demands of the present without jeopardising future generations' ability to meet their own needs has been referred to as "sustainable development" (World Commission on Environment and Development [WCED], 1987, p. 43). The notion stresses the importance of protecting the environment to maintain a high standard of living and human-environment interaction. Social equity, both between and within generations, is a stated goal of sustainable development. The preservation of historical and cultural legacy is based on this term, which has traditionally been utilised primarily in the context of the environment. However, sustainable urban development appears to limit the human use of space and the functions of the environment due to this discovered gap (Agnoletti, 2014; Foster, 2020). At the same time, keep in mind that the shifting demographics significantly impact how the notion is defined (Marzbali et al., 2011).

A critical methodological outcome that is implicit or explicit in most discussions on global ecological adjustments is the relative trade-off between economic development and environmental quality, which can and must be examined in at least two cases if we begin to analyse cities because of the concept of sustainable urban growth. Infrastructure, hygiene and cultural circumstances that are linked to economic growth in poor cities will improve the environmental quality, and future development will be necessitated in affluent towns when environmental quality is prioritised (Hitztaler, 2010; Larssen, 2018).

Oversimplification of reality can be helpful in a short-term analysis in both cases (van der Aals, 2010). Technology, organisation, social values, and public policies are only a few examples of the socio-economic variables considered, all these being equal (Lambin & Meyfroidt, 2010; Millock & Nauges, 2010). The long-term effects of these variables can be unpredictable, especially in a dynamic environment like cities, where many variables interact with one another, and people's tolerance for change is high (Helbing, 2012; Fitzhugh et al., 2019; Papachristos & Kirk, 2015; Shaw & Osborne, 2011). Because of this, a long-term interpolation between short-term trade-offs is needed to chart an evolutionary trajectory of the link between the environment and economic growth. Depending on the city's current state of development, these trajectories can either be excellent or negative (Camagni, 2017; Eggimann et al., 2017).

Another problem is that people's interactions with their surroundings are increasingly centred on local (and urban) characteristics (Caldeira, 2012). This interaction means that its effects will be felt over a lengthy period, perhaps spanning several generations (Gardner & Davis, 2013; Twenge, 2017). As a result, the effects of these policies should be referred to as affecting both present-day and future generations. This enables us to overcome the logical and methodological issues (including philosophical and moral problems) that arise when future generations' interests are considered and the most classic instruments of public choice and rational behaviour analysis are used (Dunn, 2015; Farber & Frickey, 2010; Kavka, 2021).

Cities are best viewed as multidimensional archetypes, in which each of the city's functions is given equal importance (Medayese et al., 2021). A place where economies of scale and proximity occur, where mobility and social ties are strengthened, where contact with the outside world is fostered, and where a harmonious balance between the natural environment, cultural heritage, economy, and thus employment and community results in the greatest possible well-being for all parties involved (Medayese et al., 2021). The established theoretical framework for defining liveability has a significant drawback, which may be seen. Based on descriptions that have come from cities in terms of best categorising them, liveability literature has attempted to describe better or define the definition of liveability (De Jong et al., 2015). As a result of the preceding, the concept of habitability has been revisited in urban discourses over the years. For Vuchic (2002) the functional notion of urban living highlighted living standards as popularly understood to include the protection and economic opportunities and well-being of people's health and well-being and their ability to move around and have fun. More than a quantitative measure, urban liveability refers to the relative attractiveness of being a "desirable" place to live, work, invest, and do business (Kashef, 2016).

The term "liveability" can describe various concerns related to "quality of life and well-being". A "place-based" notion refers to those aspects of a home, neighbourhood, or city that enhance its residents' quality of life and well-being. People's well-being is closely linked to their quality of life, and the two ideas have a lot in common. Some more subjective quality-of-life measures include social capital and qualitative representations of personal contentment, while others are more objective, such as human capital (Ley & Newton, 2010).

The central obsession with the notion of urban liveability can be summarised as the search for human-friendly spaces. On the other hand, sustainable development advocates support creating human spaces that consider future generations' needs. Human capital, social capital, and environmental satisfaction are essential aspects of well-being, yet the consumption of ecological resources is unavoidable. This gap has been discovered to create human spaces that successfully encourage these critical aspects of well-being.

An inclusive development strategy aims to enhance the well-being of the city's poorest residents by focusing on non-economic factors such as education and health. However, as previously noted, financial development is not the main factor in a country's educational and health advancements (Groce et al., 2011). At whatever income level, there is a wide range of accomplishments that can help to make inclusive development a reality, and direct action along these dimensions is needed to enhance the lowest achievements (Medayese et al., 2016).

The inclusive physical development bias emphasises the needs of society's most vulnerable members, such as migrants, women and children, and promotes women's equality and children's safety and well-being (Ben-Arieh et al., 2013; Jordan & Graham, 2012; Kevany & Huisingh, 2013; Marlier & Atkinson, 2010). However, the issue at hand is the preponderance of urban infrastructure, such as housing, transportation, and commerce, on the planet's limited supply of environmental space. The urban liveability notion takes a broader approach rather than focusing solely on the city's most vulnerable residents (de Haan et al., 2014; Mitlin & Bartlett, 2018; Spaans & Waterhout, 2017). The study's conclusion contradicts the definition of sustainable development, which emphasises environmental preservation and resource conservation. As a whole, given the definitional gap between the three concepts (sustainable urban development, urban liveability, and inclusive physical development), one key objective shall be to develop a matrix of measures that consider most of these indicators to generate an integrated model that considers the specificities of the selected cities in the North-Central Nigeria region.

1.3.2 Significance of the study for urban planning research

An additional way in which these findings are essential to future research is that they fill a significant knowledge gap that was previously created by studies looking at the triple nexus, in terms of the disparities between the number of studies conducted in different parts of the world

as well as their depth and breadth of coverage of the discourse in general. As a result, to bolster the notion that there is a scarcity of high-quality research and publications on the subject, this section lists the various studies that have been conducted, their names, authors, and the study locations.

Studies on inclusive physical planning literature worldwide include a plethora of different examples. Inclusion in rural infrastructure and development support was conceptualised by Chin & Daud (2017) in the Philippines, a country in Asia, was the site of this investigation. A comparative assessment review of measurement instruments for disability-inclusive development effectiveness was conducted by Gougou et al. (2017) in Australia. Chin & Daud (2017) on the other hand, studied the Philippines' inclusive economic growth and development.

Additionally, Heeks et al. (2014) developed a new model for inclusive development innovations in Manchester in the United Kingdom (UK). Also, in Ottawa, Canada, Santiago (2014) conducted a study on inclusive physical development. Research on inclusive growth in North-Central Nigeria was not included in most publications and research on inclusive growth in Asia, Europe, and other regions, nor did any research address this topic in North-Central Nigeria.

Valcárcel-Aguilar et al. (2021) offered a composite indicator for sustainable urban living in Spain; Gao et al. (2017) developed an urban living commentary; Springgay & Truman (2017) researched embodied living geographies and public spaces in Australia, and there were various other urban living studies. According to a study conducted by Douglas et al. (2017) in the Netherlands, a scarcity of recreational activities harms the liveability of cities. Bolleter (2016) examined the effects of background infill on Perth, Australia's urban liveability. Higgs et al. (2019) investigated the urban liveability index in Melbourne, Australia, establishing a policy-relevant composite measure of urban liveability and examining correlations with transportation mode choice.

Further studies on urban liveability include those of Valcarcel-Aguar et al. (2021) in Caruna, Spain; Pacione (2003) in Glasgow in the United Kingdom; and Salama & Wiedmann (2016) in Doha, Qatar, which investigated the perception of urban liveability in an emerging migrant city. *"Victims of their success: urban discourse and expert knowledge generation in the liveable city, London, United Kingdom"* was a study conducted Mcarthor (2019) and Higgs et

al., (2019) asked, “*How liveable is Melbourne?*” Alderton et al. (2019) in their paper titled: “*The meaning of urban liveability for the city in a low to middle income country*”, looked at Bangkok, Thailand, to contextualise urban liveability.

The urban liveability environment was also reviewed by Duncan & Ley, (2013) and Manchester’s business improvement districts (BIDs) have been studied by Ward (2007). According to Walter and McCrea (2012) urban consolidation can hurt the quality of life in inner and outer Brisbane suburbs. Holden and Seeri (2013) conducted a study comparing the liveability of Melbourne, Australia, and Vancouver, Canada, titled, “*More than this; liveable Melbourne meets liveable Vancouver*”. Badland et al. (2014) published a review titled, “*Emerging lessons from Australia for exploring the potential for indicators to measure the social determinants of health*”. According to the literature described above, most of the conversations on urban liveability have taken place in the western world, from Europe to Australia, and from the Americas to Asia. This leaves a significant void in the literature on urban liveability in Africa and in Nigeria as a specific case study. The minimal scholarly literature on urban liveability found in North-Central Nigeria is also a fundamental research gap that this study aims to remedy once it is completed.

Sustainable urban development is the final concept examined in this study. There is a plethora of literary examples. A handful of the papers mentioned are included in the section to emphasise the study’s significance in terms of its ability to add to the body of knowledge. “*Sustainable urban development and urban crime prevention through environmental design for British cities: towards practical urban environmentalism for the 21st century*” was published by Cozens (2002). A study conducted by Kenworthy, J. R. (2006) and a monograph written by Wheeler (2000) focused on sustainable urban development in California in the United States. An article on decision-support systems for sustainable urban development was recently published in Liverpool Campos-Sánchez et al (2019). It was based on research done in Beijing, China, by Wei et al. (2015).

Chinese researchers Liu et al. (2014) investigated sustainable urban development in China, and Tweed and Setherland (2007) examined cultural heritage and sustainable urban development in the United Kingdom. Their studies are also examined for further research gaps. “*Climate change: an urban viewpoint*” by Reckien et al. (2017) explored equality and sustainable development goals. A study published by ECLAC (2018) titled “*The 2030 Agenda and*

Sustainable Development Goals: an opportunity for Latin America and the Caribbean” outlined Latin America and the Caribbean’s opportunities in the region.

According to the literature above, most of the discourse on sustainable urban development was conducted in Europe, Asia, and other developed regions. African and Nigerian literature on sustainable urban development is notably lacking. This affects Nigeria’s North-Central region, where the lack of scholarly literature on sustainable urban development is much more acute.

Further study on sustainable urban development can be found in Ayedun et al. (2011). They compiled a list of issues and options for ensuring sustainable urban growth and development in Nigeria. It is observed that this research was based on data from government programmes, which presented methods for fixing some of Nigeria’s major environmental, poverty, and infrastructural concerns. However, actual data on the impact of these tactics has been woefully missing from work. Additionally, the research did not address the most crucial component of the topic, which was the need for research to investigate sustainable urban development efforts, methods, and the impacts on the people for whom development was intended.

The research by Ayedun et al. (2011) on sustainable urban development neglected the unique characteristics of Nigeria’s regions and states, a flaw that this study seeks to rectify. Last but not least, the indicators of sustainable urban development, urban liveability and inclusive physical development indicators have not been investigated within the African City context. Consequently, my research in Nigeria’s North-Central region addresses these shortcomings in the research literature and practice.

1.4 Aim and Objectives of the Study

1.4.1 Aim

This research focuses on analysing the intricate linkages between sustainable urban development, urban liveability, and inclusive urban development and determining the relevance of these planning paradigms in the selected cities of North-Central Nigeria.

1.4.2 Objectives

The research objectives will help achieve the declared goals:

- i. Analyse the land use land cover change in the selected cities in North-Central Nigeria between 1990 and 2020.
- ii. Examine the spatial dimensions of the physical development projects implemented by the governments in the selected cities in North-Central Nigeria from 2000 to 2020.
- iii. Develop a matrix of indicators to appraise the extent of the sustainable urban development, urban liveability, and inclusive physical developments in the selected cities in North-Central Nigeria.
- iv. Evolve an integrated model for sustainable urban development, urban liveability, and inclusive physical development for the selected cities (*Hangwurian City Development Model*).

1.5 Research Questions

1. What is the land use land cover change in the selected cities in North-Central Nigeria between 1990 and 2020?
2. What are the indices for sustainable urban development, urban liveability, and inclusive urban development in the relevant literature?
3. How can a matrix of indicators be developed to appraise the extent of the sustainable urban development, urban liveability, and inclusive physical development in the selected cities in North-Central Nigeria?
4. How can the governments' physical development project types and spatial dimensions in the selected cities in North-Central Nigeria from 2000 to 2020 be described?
5. What is an integrated model for sustainable urban development, urban liveability, and inclusive physical development in the selected cities?

1.6 Study Hypothesis

This research's hypothesis premises that sustainable urban development and urban liveability are the same thing and ultimately culminate in inclusive physical development in the selected cities in North-Central Nigeria.

1.7 Study Area

1.7.1 Brief historical review of Nigeria

Nigeria is a country on Africa's west coast, bordering the Gulf of Guinea on three sides. It is located within the tropical belt, between the north latitudes of 4° and 14° (Odekunle et al., 2005). One of the countries on Nigeria's eastern border is Cameroon, a former German colony transferred to France (Dze-Ngwa, 2015). The British government is currently responsible for a portion of Cameroon, and this territory is managed as if it were part of Nigeria (Caxton, 2017).

In a country as large as Nigeria, physical constraints differ significantly across space (Haagsman & Mazzucato, (2014). There is a vast delta in the Gulf of Guinea because of the enormous volume of water from the Niger River, which has deposited much sand in the Gulf of Guinea (Anthony et al., 2019). The sandbanks are held together by the roots of mangrove trees that thrive in the shallow brackish water, but the land is flat and swampy (Macnae, 1963). On the dunes that flank the shore, the pounding waves of the Atlantic Ocean may be heard for miles (Sargent, 2004). An ever-present threat to shipping is the sand bar formed by the many rivulets in the delta as they reach the ocean floor (Segovia, 2013). Other parts of the country's coastline are protected from the ocean by glaring white sandy beaches and mangrove swamps or shallow lagoons with tranquil waves and the Niger River that gives Nigeria its name is its most notable physical feature (Burns, 1929).

From Timbuktu, a significant French settlement, the Niger River runs eastward for about 200 miles before turning south-easterly and flowing to Lokoja, 340 miles from the coast (Burns, 1929). The Benue, the river's most significant tributary, joins the river on its left bank and it continues south until it reaches Abo, where the delta begins (Burns, 1929). For 100 miles along the coast and another 140 miles inland, the delta has a complex network of channels and creeks connecting it to other parts of the river and other river systems (Burns, 1929). As a result, it is difficult to tell which streams are part of the delta and which are part of other river systems (Burns, 1929).

It is estimated that the basin of the Niger River covers an area of more than 500,000 square miles, and approximately two-thirds of the river's length lies inside French territory (Shantz 1943; Hinrichsen, 1999; Barlow & Clarke, 2017). Due to rainfall, there is a 35-foot variation

between the high and low water levels in the Niger and Benue rivers (Rice et al., 2010). The rivers widen to several kilometres from bank to bank when in flood, forming navigable waterways (Abam, 1999). These narrowing rivers have multiple courses because of the massive sandbanks that appear over the rainy season (Abam, 1999). As a result of their geographical separation, the Benue and the upper Niger rivers experience their lowest water levels in March and April, with a minor temporary rise in water levels in August (Andersen & Golitzen, 2005). The upper Niger reaches its highest water level in June (Andersen & Golitzen, 2005). However, the lower Niger below Timbuktu only reaches its highest water level in January, falling again in February and March and reaching its lowest water level in April (Andersen & Golitzen, 2005). Both streams' influence can be felt below the confluence during April and May (Andersen & Golitzen, 2005). There are large water level changes in June (Andersen & Golitzen, 2005). By the end of August, the water level has risen to its most significant height, and in October the river begins to recede once more and in January there is a modest increase in the water level (Andersen & Golitzen, 2005). The country is partitioned into six major geographical zones: The North-West, North-East, North-Central, South-East, South-West, and the South-South. This research predates North-Central Nigeria's various sustainable development and urban liveability challenges. Figure 1.1 shows Nigeria and its administrative partitions. Nigeria's North-Central geographical zone comprises of six states: Benue, Nassarawa, Plateau, Kogi, Niger, and Kwara, as highlighted in Figure 1.1.

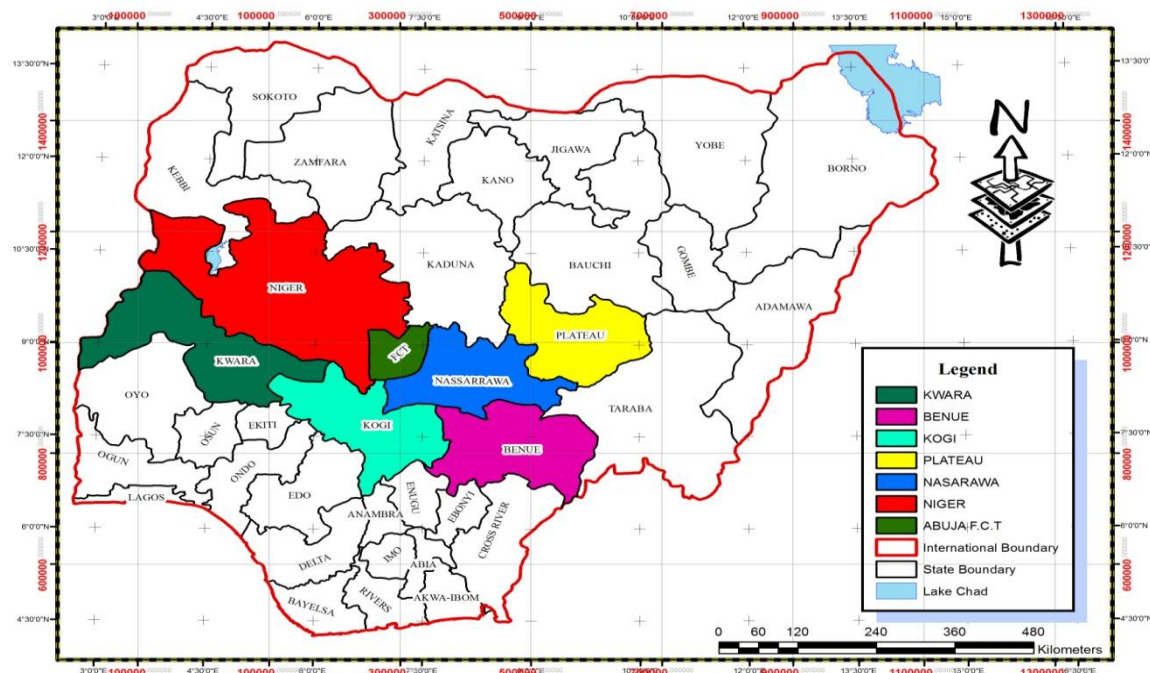


Figure 1.1: Administrative Partitioning of Nigeria

Source: Diva Geographic Information Systems (GIS) (2018)

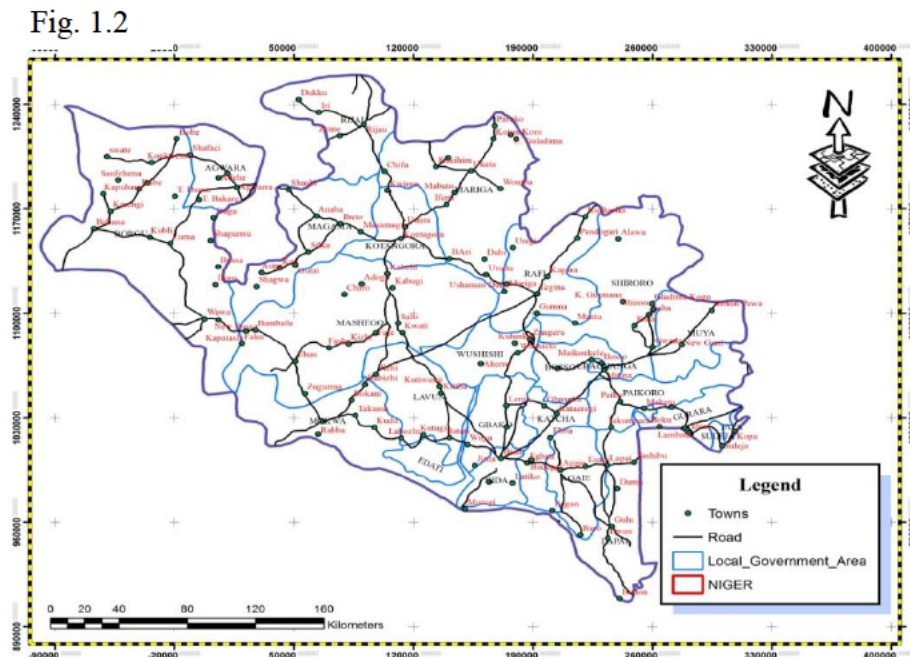
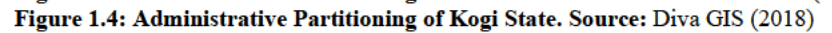
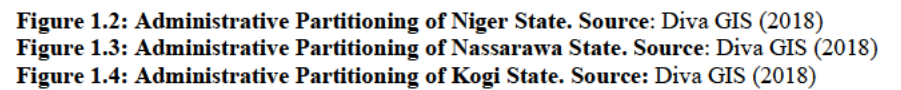
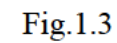
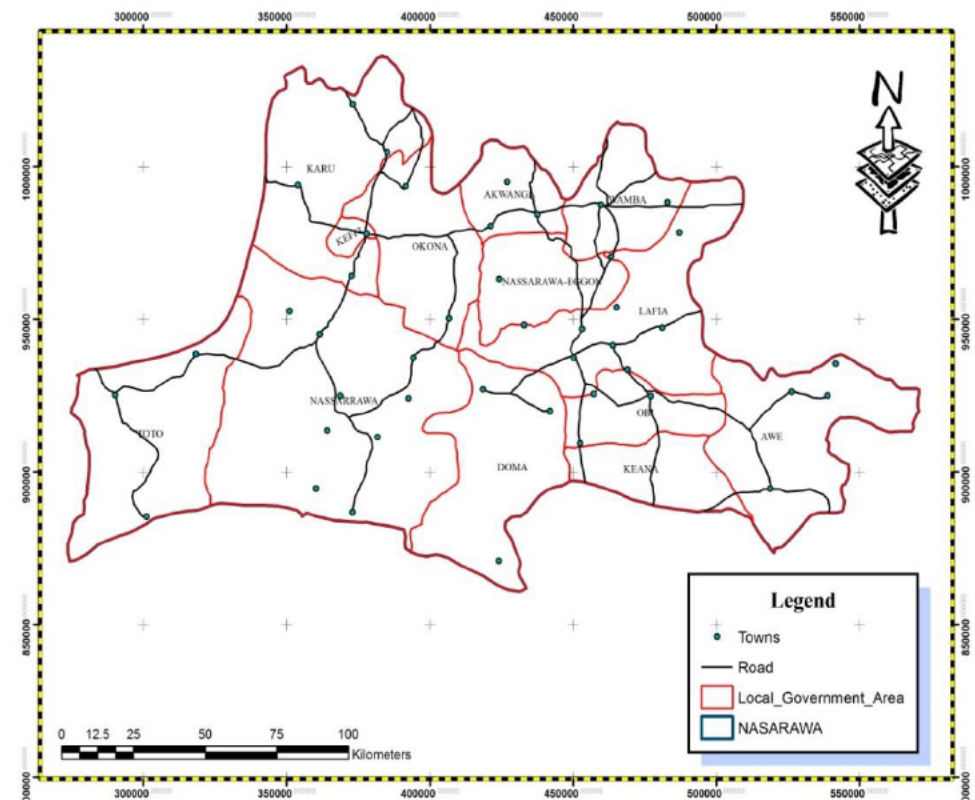
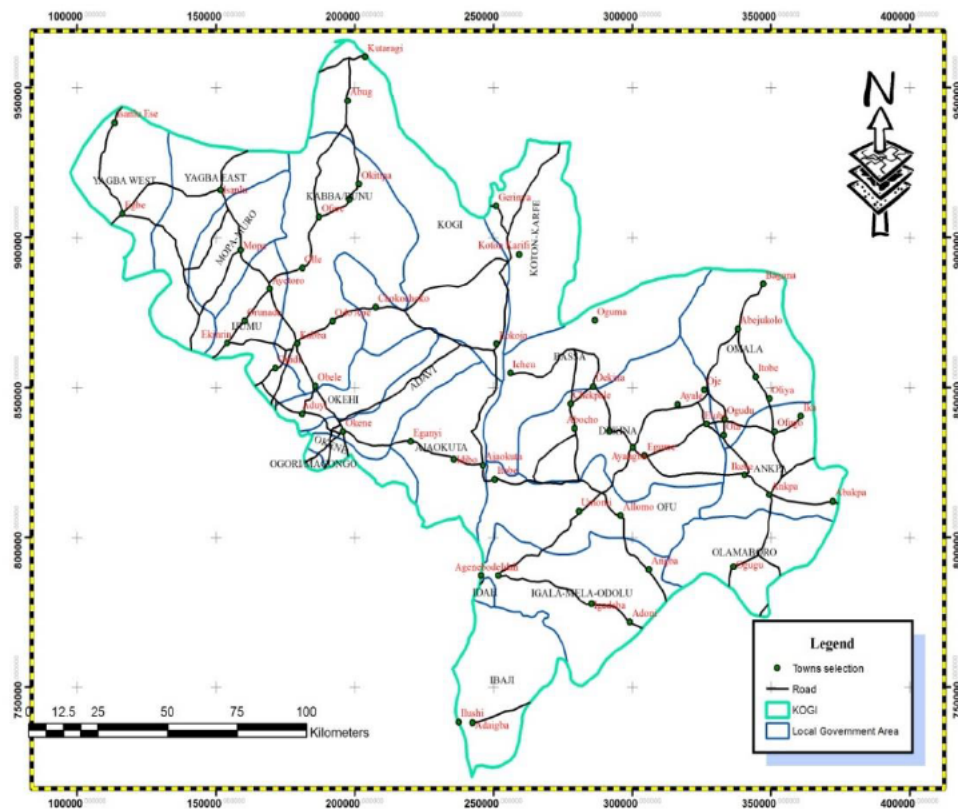
1.7.2 Climatic and geographical array of North-Central Nigeria

North-Central Nigeria has a tropical climate. The average annual rainfall and relative humidity are 1247.52 millimetres and 51.43 per cent respectively, while temperatures range from 22.55°C to 33.54°C. The temperatures, precipitation, and other climate factors measured in the area are within the normal limits for a region in the tropics. North-Central Nigeria receives far more annual rainfall than is necessary to support the many temporary ground pools and other large-scale surface water reservoirs (Garba, 2014). In addition, the high yearly rainfall increases the relative humidity of the air above the ground. In northern central Nigeria, the rainy season lasts from May to October, making up more than half the year. As a result, the average rainfall for each rainy season exceeds the threshold for building productive larval habitats (from 59.88mm in May to 274.23mm in August). At least 80 millimetres of precipitation falls on average each month (Martens et al., 1995; Trenberth, 2011).

In North-Central Nigeria, the average temperature ranges from 22.55°C to 33.54°C. These temperatures are ideal for mosquito breeding and development (metabolic functions that support blood meal digestion and egg maturation) and dramatically reduce the time it takes for mosquito parasites such as the malaria parasite to develop within mosquitoes. According to research, mosquitoes are most active at temperatures between 18°C and 32°C (i.e., an indication of infective bites). There are rapidly increasing numbers of parasites (Olayemi 2014; Mara, 1998) and thus an increase in mosquito-borne diseases in the population.

1.7.3 Geographical partitioning of North-Central Nigeria

Nigeria's North-Central region is divided into six states, namely Niger, Kogi, Plateau, Benue, Kwara, and Nassarawa states. The partitioning of these states is based on the linkages between them and their major cities, and on the contiguous nature of the cities' significant geographic, political, and socio-economic indices. This region falls between latitudes 6° 30' and 11° N and longitudes 2° 40' and 13° E (Adedayo et al., 2010). There are numerous ethnic groups in North-Central Nigeria and multiple languages and dialects are spoken in West Africa as a whole. These include the Yoruba language and Hausa/Fulani dialects. Crop and livestock farming provide for most of the region's residents' employment. The geographical partitioning of Niger, Kogi, and Nassarawa states, home to the cities selected for this research in North-Central Nigeria, are shown in Figures 1.2, 1.3, and 1.4.



1.8 Structure of the Thesis

This Doctoral thesis is compartmentalised into eleven chapters representing the different issues dealt with and the different activities undertaken in the research. This spans from the introduction and preliminary discussions in Chapter One. Chapter Two addresses the methodological underpinnings of the thesis, showing the step-by-step process and the protocols used for data collection, analysis, and results presentations. Chapter Three of this thesis presents the theoretical underpinnings, the fulcrum of the effective and philosophically balanced research work.

The third chapter presents the Participation, Infrastructure, Modernisation, and Dependency Theories from which the thesis draws its theoretical antecedents. The fourth chapter of this thesis is laced with various conceptual discourses upon which a model is proposed. These concepts evaluated include spatial concepts such as sustainable urban development, urban liveability, inclusive physical development, environmental awareness, and urban governance and management, all crystallised in terms of their intricate strengths and weakness to arrive at a balanced spatial concept named the *Hangwurian Concept of City Development* which seeks to ensure that cities are developed without worries for any of the elements of the city. Literature is reviewed in Chapter Five of the thesis, examining various definitional issues, urban infrastructure, urban land use, cities, and sustainable development. This chapter also looks at various case studies relating to spatial growth and development in the global space connected to the thesis and its research subject.

The sixth chapter of this thesis looks at the spatial extent and growth of the selected cities in North-Central Nigeria from 1999 to 2019. It analyses spatial development and its dimensions in the selected cities. This chapter also ensures using an amalgamation of add-ins to the Q-GIS Mollusca and subjecting their algorithm to the Artificial Neural Network (ANN) to arrive at a projected spatial expansion image for the selected cities between 2019 and 2029. The research also ensures an analysis of the urban expansion and creates the scenario for stemming land use/land cover change in the selected cities. Chapter Seven of the study effectively considers the infrastructure production and provision drives of the successive governments in North-Central Nigerian cities, carrying out a nearest neighbour analysis of the infrastructure showing the patterns and volumes of the infrastructure in the selected cities.

Chapter Eight of this thesis examines the stakeholders' and gatekeepers' views of the physical and infrastructure development in the selected cities. These are drawn from interviews with the stakeholders in planning, the planning boards, and spatial engineering professionals. They articulate their thoughts and ideas using the word cloud analysis to arrive at consensus positions on development and the efforts by the governments in the selected cities. This chapter establishes that most of the cities in North-Central Nigeria are currently developing without a good masterplan or, at the very best, they are observed to be using an outdated one in the selected cities. The ninth chapter of the research appraises the development of indicators for the proposed *Hangwurian City* development. These indicators are a product of the interactions with residents about their positions and value orientations, and their dispositions towards the various entries of spatial development within the selected cities. These responses are analysed with mean values, index values, and a Cronbach's alpha computed for each indicator.

The tenth chapter of this research uses partial least square structural equation modelling to evolve the *Hangwurian City Development Model*, using 2nd order SmartPLS analysis to determine the structure of the development framework of the model. The chapter analyses the model's strength at the city and regional scales. The model also predicts the various indicator variables, both the endogenous and the exogenous variables, to determine their significance to the model. The last and final chapter, Chapter Eleven, crystallises all the research findings, summarising them to evolve recommendations for effective spatial development in North-Central Nigeria and concludes the best ways to ensure worry-free development (*Hangwelani*).

CHAPTER TWO

METHODOLOGY

2.1 Introduction

The intrinsic linkages between urban sustainability, urban liveability, and inclusivity are complex interactions. Therefore, it demands a detailed methodological approach to collecting data and then analysing it to obtain results that will explain the nature of interlinks. This chapter aims to justify the research methodology and techniques proposed by this research to achieve the study's aim. Firstly, section 2.2 Research Philosophy and Approach outlines the philosophical underpinning of the research approach considered and examines the dominant research paradigms within sustainable urban development, inclusive development, and urban liveability discourse. Subsequently, the rationale for the research design and the criteria for evaluating the research design are discussed. Section 2.3 Data Sources and Instruments presents two subsections, the first of which is 2.3.1 Primary data requirements and sources in which an analysis of the research surveys is presented. These are the household questionnaire's administration, the stakeholders' interview, direct field observation, and mapping. Then, 2.3.2 presents the secondary data requirements and the sources of data. Section 2.4 examines the sampling technique and procedure, and section 2.5 examines the data capture, processing, analysis, and the tools deployed for the research. Finally, the ethical considerations are examined.

2.2 Research Philosophy and Approach

2.2.1 Research approach

Depending on the needs, urban sustainability and liveability can draw on various disciplines, including social and natural sciences and management and engineering (Dainty, 2008; Fellows & Liu, 2008). Table 2.1 shows that there is no one-size-fits-all strategy to research. Instead, it is a matter of finding a middle ground (Amaratunga et al., 2002). Due to the inherent advantages and disadvantages of each strategy, the type of research topic, the kind of data, and the conclusions to be reached all play a role in determining which approach to use. Research methods were examined before a final choice was made to find the best plan for gathering, analysing, and interpreting the data for this project.

Table 2.1: Comparison of Four Research Paradigms Considered in this Research

	Positivism	Realism	Interpretivism	Pragmatism
Ontology: <i>the researcher's view of the nature of reality or being.</i>	External, objective, and independent of social actors.	Is objective. They do exist, but they are understood through social conditioning (realist and critical realist).	Socially created, subjective, potentially malleable, and numerous.	The best way to address the research issue is to take an external, multiple-perspective approach.
Epistemology: <i>the researcher's view regarding what constitutes acceptable knowledge.</i>	Credible data facts can only be derived from things that can be seen. Reduces phenomena to their most basic components by focusing on causality and lawlike generalisations.	Facts based on actual events can be gleaned through empirical evidence. Inaccuracies in sensations are caused by a lack of information (direct realism). On the other hand, phenomena elicit feelings that can be misinterpreted (critical realism). An explanation should be given in a context (s)	Social phenomena and the interpretations people have of them. Put your attention on the specifics of the issue, the truth that lies beneath the specifics, and the subjective meanings that drive your behaviour.	According to the research question, observable phenomena and subjective meanings can supply sufficient information. Prioritise real-world research applications and consider integrating many vantage points when interpreting the results.
Axiology: <i>the researcher's view of the roles of values in research.</i>	Value-free research is conducted; the researcher maintains an objective position while collecting and analysing data.	The researcher's worldview, cultural experiences, and background influence their research. Taking these into consideration will affect the study.	Research is intrinsically value-bound; the researcher is an integral element of the subject under investigation and cannot be separated.	The researcher's subjective and objective perspectives heavily influence the interpretation of results.
Data collection techniques are most often used.	Highly structured, huge samples, measurements, quantitative or qualitative.	The method chosen must fit the subject matter, whether quantitative or qualitative.	Small samples, in-depth research, and qualitative analysis.	Quantitative as well as qualitative mixed method designs.

Source: Saunders et al. (2009, p. 119)

2.2.2 Quantitative research approach

Positivism, which deals with observable facts, significantly influences quantitative research. According to Positivism, human behaviour may be described by social points that can be analysed using approaches that adhere to the deductive logic approach of natural science (Amaratunga et al., 2002). For example, Neuman (1997) says that Positivism has been linked to rational choice, structural-functional, and exchange-theoretic frameworks. Proponents of Positivism adhere to a deductive approach based on hypothesis testing, which adheres to empirical and philosophical reality (Ponterotto, 2005). Experiments and surveys, which generate data that can be analysed statistically by positivists, are preferred methods (Neuman, 1997). Exact measurements and objective research, where hypotheses are tested to discover the nature of reality, are selected by quantitative researchers. As a result, it is thought that findings from a small sample can be extrapolated to the broader population. Behaviourism and empiricism are two research philosophies that fall within the positivist paradigm (Amaratunga et al., 2002; Neuman, 1997).

Data can be gathered by a questionnaire, utilising precise and accurate measures, testing hypotheses and generating representative data through random sampling in a quantitative research approach (Stiles, 2003). Following is a concise summary provided by Lincoln and Guba (1985) of the principles that underlie a positivist approach. The discovery of laws that lead to an explanation and prediction should be the objective of both social and natural sciences. Using the hypothetico-deductive method – the hypotheses and deductive method – empirical categories should define the concept, that there is uniformity in nature in time and space (speaking to the existence of an actual, identifiable reality), that the law of nature is derived from data, and that a large sample suppresses idiosyncrasies in data and reveals general causes or the ultimate laws of nature.

Quantitative research, according to Nau (1995), focuses on distinguishing traits, fundamental property differences, and empirical bounds. Awodele (2012) concludes that the quantitative technique is appropriate for research relevant to the current study because of its applicability in evaluating the behavioural characteristics of the built environment.

2.2.3 Qualitative research approach

Hermeneutics provides the intellectual foundation for phenomenological researchers that use qualitative research methods. Text, an image, written facts, or a discussion call for in-depth study and inquiry (Neuman, 1997). Interpretivists, or qualitative researchers, hold that the outside world can only be accessed indirectly, through the constructions that people have built of it, according to Ormston et al. (2014). As Stiles (2003) argues, interpretivism depends on the individual's ability to make sense of the information, supporting Stiles's claim. People's interpretations of the world are viewed as the primary source of the world's existence. Ardley (2008) further states that interpretivism considers the individual's experience and the linkages between human awareness and objects existing in the natural world.

When it comes to analysing organisational methods and characteristics in terms of rationalist approaches, interpretivism contends that the current study cannot hope to offer anything relevant to social reality (Dainty, 1998). There is a lack of consideration of sustainability and liveability performance and qualities in positivist research techniques, according to Dainty (1998). As a result, these methodologies may limit the researcher to simple, "unproblematic" observations or well-understood phenomena. A phenomenological method was taken into consideration by the researcher. While not philosophically anchored in interpretivism, this study was informed by the phenomenological notion of identifying significant elements of the organisation that could disclose the intricacy surrounding their performance.

According to Dainty (1998), reality is both complex and disputable. No two cities are exactly alike; each one is unique. Because the interplay between urban sustainability and liveability is diverse, this research needed to utilise an interpretive method to investigate the links and tensions between urban environmental liveability and the larger view of built environment sustainability.

2.3 Mixed Methods Approach

All fields are beginning to accept the use of mixed methods research. Some researchers believe that using a mixed methods approach to social science research is the best option because it incorporates

quantitative and qualitative data (Johnson *et al.*, 2007; Molina-Azorin, 2012). According to Christ (2009), mixed techniques are more than just procedures; they also include quantitative and qualitative research. In other words, paradigms, philosophical assumptions, theoretical viewpoints, and research questions and interpretations are all part of mixed methodologies. When it comes to research, “*mixed methods embrace the entire process, not just the methodologies*”. Using a more specific definition, Johnson *et al.* (2007: 112-133) state that it is “*the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches*” (so the use of qualitative and quantitative viewpoints for the general purposes of understanding and corroboration is an example of mixed methods research).

According to Boyd *et al.* (2005), quantitative and qualitative research methods complement each other. Using high-quality research from both paradigms helps speed up the dialogue on urban sustainability and liveability. Researchers in sustainability and liveability believe, as Love *et al.* (2002) do, that there is a need to provide answers to the problems in the built environment. This philosophical approach considers that both ontological and epistemological viewpoints are required. If urban environmental researchers do not embrace this stance, they will not be able to comprehend the aspects that link urban sustainability and liveability altogether. According to Dainty (2008), most built environment studies can be classified as sociological research since they seek to understand the industry’s structure and the myriad of interactions that go into its development, and there are too many variables to be revealed by just one approach.

A mixed methods approach was used because of the values mentioned above to enhance the quality of the results obtained through this investigation. As a result, the outcomes of these mixed techniques might be seen as more reliable, more valid, and more likely to spur methodological creativity and innovation (Easterby-Smith *et al.*, 2012). It has been suggested that mixed methods can aid in synthesising and integrating theories by combining confirmatory and exploratory research at the same time, resulting in more diverse views and more strong findings. Some have questioned the approach’s reproducibility, however. The study design’s relevance to the questions to be addressed was viewed as a drawback, so to deal with these challenges, this research used a methodological approach that was highly selective.

2.3.1 Research approach and strategy adopted for the study

Investigating a conceptual model's interaction between the various constructs demands careful consideration of the appropriate research method. Consideration was given to the research's fundamental question, the rational analysis of the nexus of the data acquired and analysed, and the findings. Because of this, the practical method was used for this investigation. An approach known as pragmatism justifies combining qualitative and quantitative research techniques (Bryman, 2006).

Sustainable urban development, urban liveability, and inclusion in physical development were all part of the study's overall goal. A positivist strategy was used to achieve this goal. Built environment research's distinguishing characteristic, behaviour, can now be studied using this method (Amaratunga et al., 2002). Built environment research employs qualitative and quantitative methods, as documented in the literature (Amaratunga et al., 2002; Dainty, 2008; Love et al., 2002), and a qualitative strategy, it has been said, is the best way to deal with the complicated issue of organisational performance (Amaratunga et al., 2002).

A single quantitative technique was used in specific research on strategic management in the construction industry (Kale & Ardit, 2003; Pamulu, 2010; Tan et al., 2012). According to Amaratunga et al. (2002); and Ankrah (2007), the essence of investigating is to introduce a new perspective to an existing body of information for which a quantitative technique is appropriate. Dainty (2008); and Love et al. (2002) argue that to understand the built environment's complexities, researchers should use a multi-method approach that draws from the strengths of both techniques (qualitative and quantitative approach sections). Based on this claim, a mixed methods methodology was recommended for this investigation. The inference gained helped to understand better the underlying processes being measured.

Six study methodologies were identified for mixed methods research by Creswell and Plano Clark (2011), and they used different data types in a mixed methods approach (Christ, 2009). The research challenge and the rationale for combining methods influence the research design ultimately chosen when conducting research (Creswell & Plano Clark, 2011). The convergent parallel design, the explanatory sequential design, the exploratory sequential design, the embedded design, the

transformational design, and multiple designs are among the mixed methods strategies that benefit researchers. This study used a convergent parallel design.

2.3.2 The convergent parallel design strategy

Multiple/multi-method research, convergence validation, concurrent triangulation (between or across method triangulation), integrative research, and mixed research are all terms used to characterise this concept in the extant literature (Creswell et al., 2003; Johnson et al., 2007; Teshakkori & Teddlie, 1998). According to these distinct conceptualisations, qualitative and quantitative methodologies are complementary, not competing methods. Concurrent or convergent mixed method data collecting procedures are used to validate the quantitative data gathered with the qualitative data gathered, to alter the data for comparison, or to address multiple issues in a study (Creswell & Plano Clark, 2007). When qualitative and quantitative data are gathered from the same individuals' comparisons may be drawn quickly, and the study's questions can be answered using both forms of data. It is said that Creswell and Plano Clark (2011) describe the convergent design as a methodology in which two separate data sets are combined, integrated, or fused in a two-stage, single-phase study. Then the researchers look for points of meeting, disagreement, contradiction, or relationship between the two data sets.

Sustainable urban development, inclusive development, and existing tensions in the city space were the main issues that this study sought to understand. Between or across triangulation and concurrent triangulation of the approaches was also employed, as per Denzin (1978). According to Jick (1979), when two or more divergent procedures are congruent and produce comparable data, triangulation is the primary medium for cross-validation. This study used several methods to arrive at the same conclusion and better understand the underlying phenomenon, as it was best to use a combination of approaches to study the dimensions of the research problem.

Mixed methods research designs are more flexible and dependable because they allow for simultaneous qualitative and quantitative data collection. In addition, the two sets of data can be more easily analysed and interpreted on their own. However, the contemporaneous nature of data collecting and various samples and sample sizes necessitate a significant amount of time and

expertise because the specifics of the results and their generalisation may be affected (Creswell & Plano Clark, 2011). To overcome the challenges of data collecting, the researcher enlisted the assistance of colleagues and drew on existing literature. An illustration of the convergent parallel mixed method research technique conceptualised for the study may be found in Figure 2.1

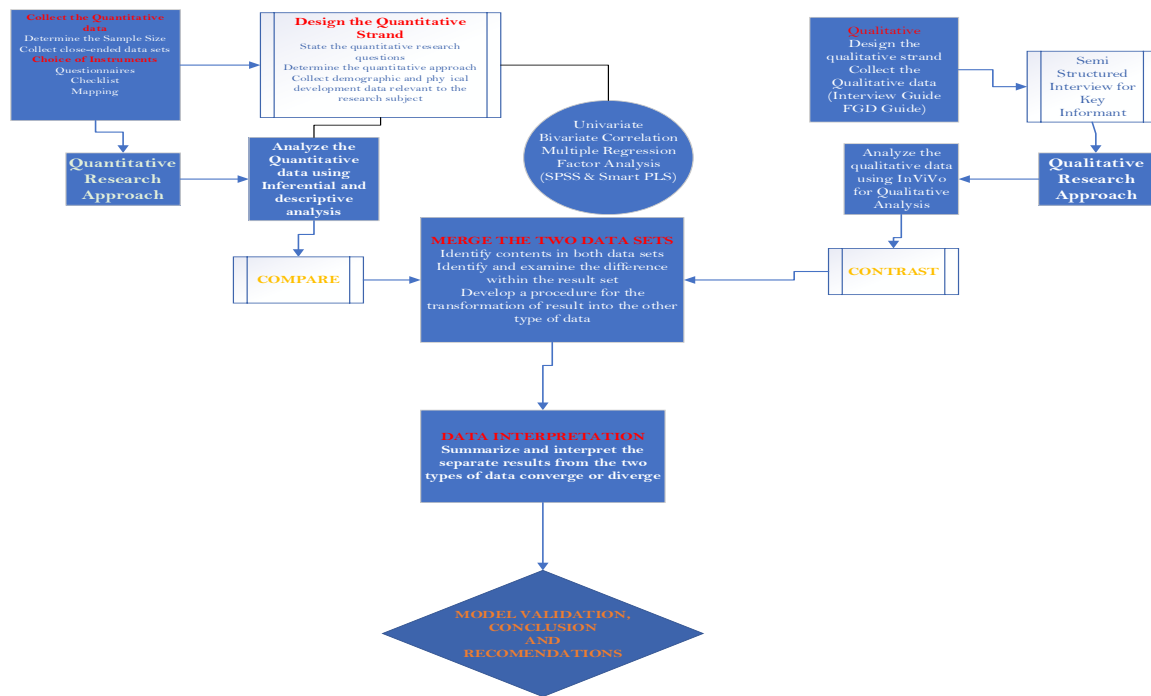


Figure 2.1: Convergent parallel mixed method research design

Source: Author's Research (2020)

When using the concurrent mixed methods design, Creswell and Plano Clark (2011) identified four procedural steps that convergent mixed methods researchers should follow:

- Collect qualitative and quantitative data concurrently but consider the data sets as separate and independent.
- The two data sets are analysed separately and independently using typical quantitative and qualitative techniques.
- The next stage is the merging the data, which may include comparing the results or converting them to enhance their combined interpretation. The results must be interpreted to understand

to what extent or how the two data types deviate or combine to understand the study's primary aim better.

2.4 Data Requirement, Sources, and Instruments

The data sources for this research comprised of two strands, as for most empirical research. These strands included primary data requirements and sources and secondary data requirements and sources. These are presented in the sub-sections below.

2.4.1 Primary sources of data

The primary data for this research was obtained for the empirical and quantitative analysis required to answer the research question on the development indicators to measure the constructs identified in the study and to develop and propose an integrated development planning model.

2.4.1.1 Research survey

This sub-section of the research deals with the various methods used to collect the primary data during direct field sampling. The household survey questionnaire, interview guide, direct field observation, and spatial mapping are presented. All these are discussed in the sub-sections below.

2.4.1.2 Household survey questionnaire

The questionnaire's goal was to make it as simple as possible for respondents to answer the questions and increase the overall response rate. According to Creswell (2003), developing a questionnaire correctly is essential to obtaining accurate data. This study's questionnaire design was based on Easterby-Smith et al.'s (2012) five design principles. To ensure that the questionnaire adhered to these criteria, it was sent to four other sustainability and liveability researchers and the research supervisor for assessment.

Appendix B lists the items of measurement used to assess the study's constructs. A set of Likert scales was used to evaluate each of the questions on a series of 5-point Likert items (see Holt, 2014). There were eight sections to the survey. The first part of the questionnaire asked for general

demographic information. This contained the name of the locality, the years of existence, the size of the household, the income level, and other available socio-economic data sets.

In designing the questionnaires, the constructs used for the research were derived from an extensive review of the literature, both within and outside the sustainable development, inclusive development, and urban liveability research literature. These constructs consisted of all the variables included in the conceptual model generated. Table 2.2 shows the constructs examined in the questionnaire and the research from which the scales were sourced. Appendix C is the household survey questionnaire.

Table 2.2: Constructs for the Study and Sources of the Measurement Items

Constructs	Sub-Constructs	Number of Issues	Origins of the Measurement Indicators
Sustainable Urban Development	Economic Prosperity Social Inclusion Demographic Changes Public Health Climate Change and Energy Sustainable Consumption and Production Natural Resources Sustainable Transport Good Urban Governance Global Partnerships	5 4 3 2 2 3 4 3 3 3	Rinne et al. (2011) Pizzoli, & Gong, (2007)
Environmental Awareness	Motivation, Values, and Attitudes Environmental Knowledge Skills and Abilities	4 4 3	Mei et al. (2016)
Inclusive Physical Development	Inclusiveness Safety Resilience Sustainability	7 8 4 9	UN-Habitat (2016)
Urban Management (Mgt.) and Governance	Population Family Planning Youth Employment Hospital Network Services Credit Facilities and Funds for Development of Rural Areas	2 2 2 2	Flood (1999); Webster (2004).
Urban Liveability	Quality of Life Liveable Communities Place Shaping	4 7 5	Aulia (2016)

Source: Author's Compilation (2021)

2.4.1.3 Stakeholders' interviews

An interview was conducted with critical stakeholders as an essential component of the mixed methods research approach set out for this research. The interview guide for the stakeholders in the cities is presented in Table 2.3. The guided interview obtained responses to questions about the provision of green infrastructure, open space development, and consideration for vulnerable and migrant groups, and is shown in Appendix D.

Table 2.3: Breakdown of the Interview Respondents

SN	Type of Stakeholders	Number of Anticipated Participants
1	Government Ministries	3
2	Government Agencies (SDG Office and Urban Development Board)	2
3	Representatives of Women's Groups	1
4	Representatives of Residents and Community Associations	1
5	Representatives of People Living with Disabilities/Specially Gifted People	1
6	Faith-Based Organisations (FBO)	2
7	Academic Scholars	1
Total		11

Source: Author's Compilation (2021)

2.4.1.4 Field observations

As a critical issue in sustainable urban development, providing environmentally friendly infrastructure is vital. This infrastructure must ensure that it improves the liveability of the human settlement and ensures equity and justice for all classes of residents in the selected city. An observational checklist was used to gather information regarding the placement of infrastructure, such as greenery and work pathways on the roadways and a pedestrian bridge with ramps that matched the given standards. Appendix E, the observational checklist, was used to gather data on the state of various infrastructure components, the results of which were rated on a Likert scale of 1 to 5 and shown together with the precise position of each element. It was necessary to use the infrastructure coordinates to map out the corresponding infrastructure in the chosen cities. Analyses such as nearest neighbour, infrastructure range and the threshold were conducted. To answer the research question on how to generate the matrix of indicators for the proposed study, it was established that distance decay would serve as a solid foundation for further investigation.

2.4.1.5 Mapping

i. Selection of the study period

Spatio-temporal analysis of the geographical measures and statistical models was part of the methodology employed in this study. “The mapping technique can be broken down into six distinct sections. Land cover classification and change detection using Remote Sensing (RS) and Geographic Information Systems (GIS) were among the most critical aspects of the study. FRAGSTATS 4.2 was used to extract the built-up areas from the images, to use them as input data to describe and quantify the changing patterns and processes of the urban landscape (Zeller et al., 2012). The spatio-temporal dynamics of the spatial patterns and geographical weighted regression (GWR) were used to investigate the effects of urban expansion on the urban patterns. The regression model was used to examine the socio-economic impact of urban growth.

ii. Selection of the study area

As indicated by the available studies, there has been a significant shift in urbanisation in Nigeria during the last 30 years. Previous research has already looked into what has fuelled urbanisation in Nigeria’s major cities. Many studies show that rural-to-urban migration is causing rapid urbanisation and urban expansion in Nigerian cities. According to urbanisation specialists in Nigeria, rural residents have been forced to relocate to cities due to a lack of economic opportunities and poor living standards (Opoko & Oluwatayo, 2014).

In light of previous research, this study examined the policies and events that have led to urban growth to choose the best time period for the investigation. Between 1999 and 2019, Nigeria’s major cities saw a steady influx of people searching for a better life. Desperation fuelled rural-to-urban migration. Large numbers of people from rural areas moved into cities, leading to unplanned growth and urbanisation. In the previous few decades, population shifts reshaped the landscape and socio-economics of several Nigerian towns.

The year 1999 was chosen because it coincided roughly with the commencement of political authority in the country. Another factor in favour of this period was the accessibility of Landsat

images for the study area. Changes in land use and cover should be studied at five to ten-year intervals, according to Jensen and Im (2005). Accordingly, 2009 and 2019 were chosen as the second and third study years because they were ten years apart. According to research, a city's growth is influenced by its urban population. The yearly growth rate of Nigeria's urban population was 4.84 per cent, and the country's growth rate was 3.2 per cent, according to the National Population Commission [National Population Commission [NPC], 2011).

iii. Identification of study zones using the gradient model

The gradient model is a valuable technique for presenting the spatial and temporal changes in patterns between urban and rural areas. This study addressed the urban expansion of cities in North-Central Nigeria in both spatial and temporal contexts. To serve this purpose, a buffer gradient analysis was employed by integrating remote sensing and GIS prospects.

iv. Mapping and monitoring of land cover change

The land cover change information was obtained from the RS data by applying a range of visual interpretations, land cover classification, and change detection. The methodology generally applied to do this is illustrated in Figure 2.2.

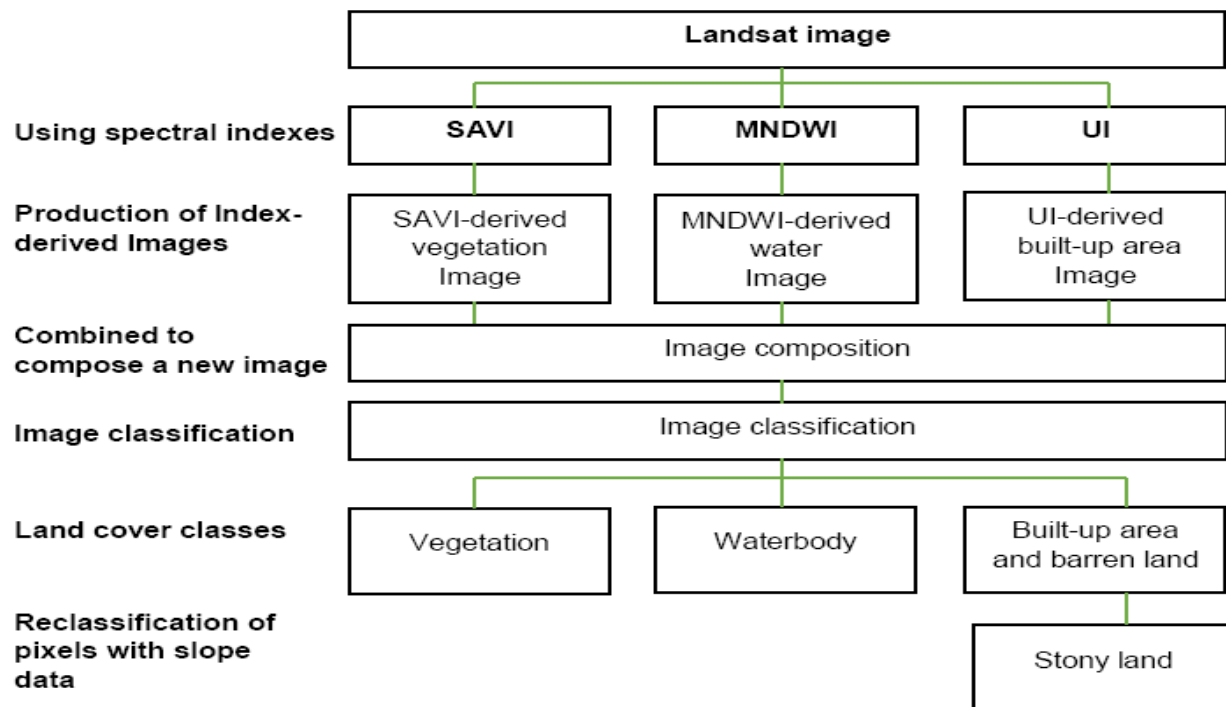


Figure 2.2: A Classification Scheme for Land Cover Mapping

Source: Yuan et al. (2005)

v. Image classification

Yuan et al. (2005) developed the Anderson categorisation system-level I with four types of land cover: urban (built-up), vegetation, bare ground, and water body. Urban areas are defined by a high level of land use and the subsequent modification of the landscape. The term “vegetation” encompasses some structures related to food production. Forests and farmland are part of the vegetation. The bare earth can also be distinguished by its thin soil and lack of vegetation in rural areas. A “water body” refers to any site that is occasionally covered by water. All bodies of water were accurately depicted during data collection. Despite its American origins, the approach has become the most extensively used one in land cover management worldwide (Yuan et al., 2005). At Anderson level I, the bare ground category includes areas devoid of vegetation and made up of rock or rock faces. The classification used in this study is the one described above, and the exposed bare ground in this study had a significant vertical component (See Table 2.4).

Table 2.4: Land Cover Classification System

Land Cover Categories	Sub-Categories
Urban or Built-Up Land	Residential, commercial and services, industrial, transportation, communications and utilities, industrial and commercial complexes, mixed urban or built-up land, and other urban or built-up land.
Vegetation	Cropland and pasture, orchards, groves, vineyards, nurseries and ornamental horticultural areas, confined feeding operations, and other agricultural lands Deciduous forest land, evergreen forest land, mixed forest land.
Water body	Streams and canals, lakes, reservoirs, bays, and estuaries.
Bare Ground	Dry salt flats, beaches, and sandy areas other than beaches. Rock faces on mountains, rockslides, and cliffs.

Source: Author`s Analysis based on the Anderson categorisation system (Yuan et al., 2005)

Even though classical classification design has been utilised extensively to map a wide range of land covers at various geographical and temporal scales, urban land cover mapping remains a challenge (Townshend, 1992). Multiple land cover categories can be contained in a single Landsat pixel because of the medium spatial resolution of the pictures. Using spectral features, it cannot be easy to distinguish between different land cover types (Ji & Jensen, 1999). As a result, traditional approaches' land cover maps frequently contain errors in classification. Satellite-derived land cover maps are often insufficient (Foody, 2002), so if multiple materials are blended, spectral indexes can be utilised to identify the individual land cover.

Impervious surfaces, green vegetation, exposed soil, and neglected water bodies are all included in Ridd's (1995) classification of the urban ecosphere. Research on urban surfaces must consider water as a significant component. Built-up terrain, bare ground, vegetation, and open water are all examples of urban cover. Three indices – Urban Index (UI), Landsat Soil Adjusted Vegetation Index (SAVI), and the Modified Normalised Difference Water Index (MNDWI) – were selected to represent the primary land cover types based on these four essential characteristics. Light reflectance in the red and near-infrared spectral ranges can affect vegetation index values in places with little vegetation and bare soil surfaces (Huete, 1988). SAVI can take advantage of strong plant reflectance in the Red and Near Infrared [NIR] area because of its high NIR spectral reflectance (TM band 4) and considerable pigment absorption of red light (TM band 3) (Jensen & Hardin, 2005). Nearly everyone

who works with remote sensing of vegetation is familiar with NDVI, although SAVI has a slight advantage over it in metropolitan settings with little plant cover.

SAVI was employed in this study to emphasise the characteristics of vegetation. NDVI is only reliable when utilised in areas with more than 30 per cent plant cover. However, SAVI can be used in places with less than 15 per cent plant cover (Homer et al., 2015). SAVI is referred to as follows in this context.

$$SAVI = \frac{(TM_4 - TM_3) \times 1 + I}{TM_4 + TM_3 + I} \quad (1)$$

Where

TM₄: Reflectance value of band 4 (near-infrared) of the Thematic Mapper [TM] sensor.

TM₃: Reflectance value of band 3 (red) of the TM sensor.

I am a correction factor ranging from 0 for very high densities to 1 for very low viscosity.

A value of 0.5 was used in this study to produce an enhanced vegetation image as the study region has an intermediate vegetation density. An increase in the SAVI range can present vegetation discrimination from built-up land or barren land.

After producing the vegetation image using SAVI, the built-up land image was produced using the Urban Index (UI) with the following equation:

$$UI = \frac{TM_7 - TM_4}{TM_7 + TM_4} \quad (2)$$

Where

TM₄: Reflectance value of band 4 (near-infrared) of the TM sensor.

TM₇: Reflectance value of band 7 of the TM sensor.

Multi-temporal photographs generated UI values to discriminate between urban and rural areas. When band seven is used instead of band five, the most satisfactory results are obtained (Bouhennache et al., 2015). Increasing the SAVI range can help identify vegetation from built-up or desolate terrain.

The MNDWI was created using many time-lapse images to identify water on a land-dominated backdrop. Based on the findings of Xu (2005), the MNDWI performs better than the Normalised Difference Water Index (2005). The MNDWI is determined as follows (McFeeters, 1996):

$$\text{MNDWI} = \frac{\text{Green} - \text{MIR}}{\text{Green} + \text{MIR}} \quad (3)$$

Water and built-up land are separated significantly when using the MNDWI compared to when using the NDWI, by increasing water features' values and decreasing built-up land values from positive to negative, where MIR is a Medium Infrared band like band 5 (Hu et al., 2012).

A new picture dataset was created using the three new SAVI images, MNDWI images, and UI images. Reduced correlation between the bands was achieved by reducing the number of multispectral bands from seven to three. Finally, the three new bands formed a new visual identity. A supervised classification method was utilised to identify the land cover characteristics in the freshly created pictures. The supervised classification was made using an algorithm based on the signatures of training areas. Thus, the four basic urban land cover classes of vegetation (high SAVI values), water (high MNDWI values), built-up areas (high UI values), and barren land (low UI values) were separated. Consequently, this study distinguished between rocky ground (rock faces on mountains and rockslides) and barren land. Slope data helped refine the post-classification classification. According to this study, stony terrain was expected on slopes steeper than 15 degrees. Pixels of bare ground with a slope angle greater than 15 degrees had rocky terrain applied.

Accurate results were ensured by conducting a quantitative accuracy assessment. You can use an error matrix to ensure that your remote sensing images are authentic (Foody, 2002). The error matrix compares a categorised picture to a reference for each class in the error matrix. The result was 352 random points. The reference data's mistakes were compared statistically to the categorised data's errors.

vi. Land cover change detection

In remote sensing change detection, the primary goal is to identify the geographic location, recognise and quantify the types of changes, and eventually evaluate the accuracy of findings. According to Im and Jensen (2005), land cover changes were detected in this study by using post-classification as a change detection approach. In addition to the “from-to” change information, a conversion matrix was generated as part of the post-classification step.

vii. Growth ratio analysis

Several studies have quantified urban expansion’s rate, volume, and intensity using growth ratio indices and GIS analytical approaches. These measures include the Landscape Expansion Index, the Urban Expansion Intensity Index, and the Urban Expansion Differentiation Index (UEDI). This research used various methods to determine how cities are growing. Figure 2.3 depicts the general methodology used to do this.

The Average Annual Urban Expansion Rate (AUER) is the first statistical index to calculate the average annual urban expansion rate. This index computes the mean yearly speed of built-up land expansion in the case study period (Acheampong et al., 2016).

$$AUER_i = \frac{[(ULA_{it2})^{1/\Delta t} - 1]}{[ULA_{it1}]} \times 100 \quad (4)$$

Where

AUER_i is the Annual Urban Expansion Rate.

ULA_{it2} and ULA_{it1} are the I unit area at times t₂ and t₁, respectively.

The AUER is not affected by the size of the spatial unit.

Δt is the period of the study.

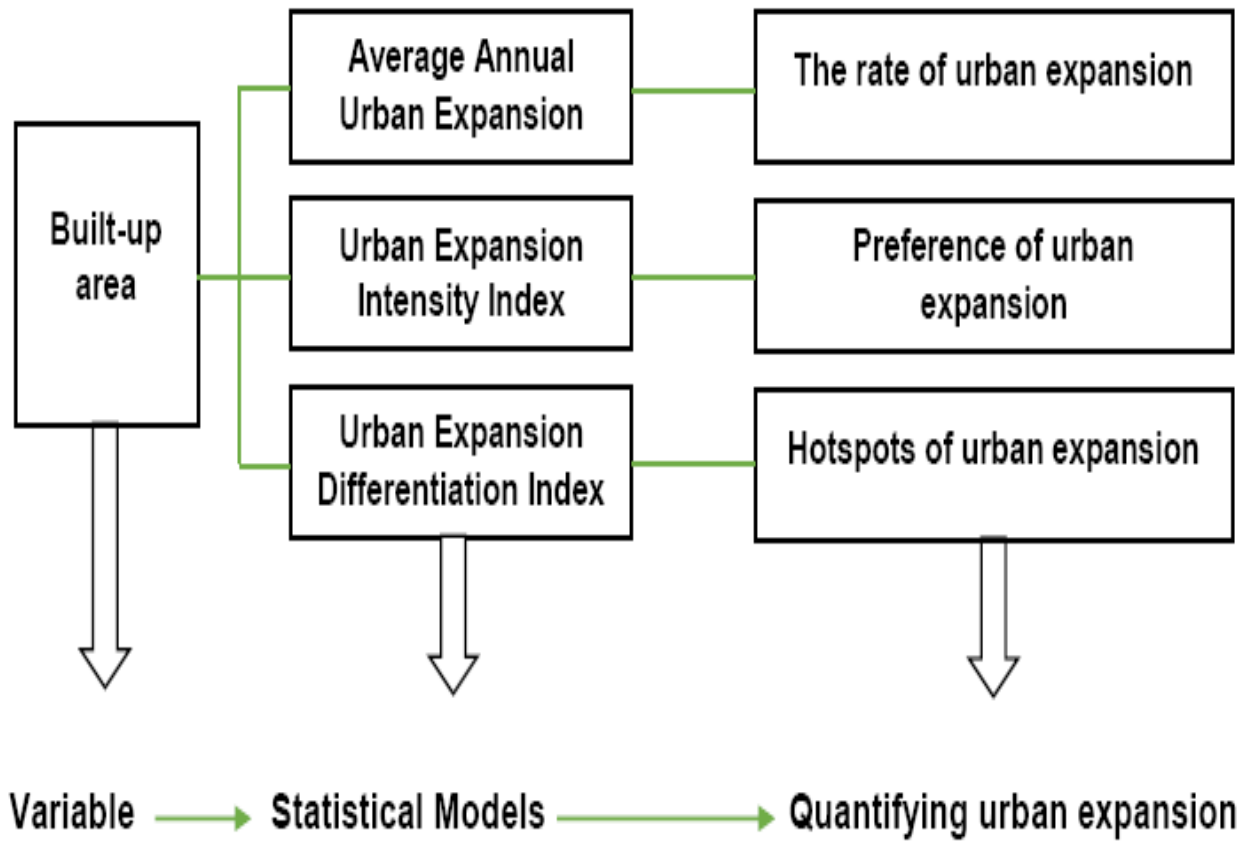


Figure 2.3: Spatial analysis flow Path

Source: Author's Illustration (2021)

The Urban Expansion Intensity Index (UEII) was also used. Based on the entire surface area of the spatial unit, as indicated in Eq. 5, this method calculates an average annual proportion of newly enlarged built-up land in that space unit (Herold et al., 2015).

(Xian et al., 2019) reveal the formula:

$$UEII_i = \frac{[ULA_{it2} - ULA_{it1}]}{TLA_i \times \Delta t} \times 100 \quad (5)$$

Where

UEII_i is the urban expansion intensity index in the i unit.

ULA_{it2} and ULA_{it1} are the areas in the i unit at times t₂ and t₁, respectively.

TLA_i is the total area in the i unit.

Δt is the period of the study.

Urban expansion intensity is a significant metric for measuring the changes in an urban area per unit of time when examining the spatial changes caused by urban growth. When it comes to expanding cities, there is no one-size-fits-all formula. This characteristic is a preference for determining urban expansion (Alsharif & Pradhan, 2013). This study relied on UEII to compile the statistical data on the urban development in the study area. The UEII was used to identify the importance of the specific periods for urban growth. The UEII analyses the speed and magnitude of changes in urban cover over time to assess future urban expansion potential. The spatial evolution pattern of the urban land growth can be revealed using the UEII scores of the regions' 21 concentric zones: 1.05-1.92 is medium-speed development, 1.05-1.92 is high-speed development, and >1.92 represents very high-speed development (Alsharif et al., 2015). Lists of urban growth intensity index values are shown in Table 2.5.

Table 2.5: Range of Urban Expansion Intensity Index Values

Range	Potentials of the Urban Expansion Rates
$0 > \text{UEII} > 0.28$	Lower development
$0.28 > \text{UEII} > 0.59$	Low-speed development
$0.59 > \text{UEII} > 1.05$	Medium-speed development
$1.05 > \text{UEII} > 1.92$	High-speed development
$\text{UEII} > 1.92$	Very high-speed development

Source: Modified from Acheampong et al. (2016)

The Urban Expansion Differentiation Index (UEDI) measures the proportion of the expanded urban area in a unit (balance) to the overall size change. Different spatial units can now be compared because the UEDI quantifies urban land expansion discrepancies (Acheampong et al., 2016). Urban land expansion differentiation and hotspots can be evaluated using this metric. Li et al. (2015) reveal the formula:

$$\text{UEDI}_i = \frac{[\text{ULA}_{it2} - \text{ULA}_{it1}] \times \text{ULA}_{it1}}{[\text{ULA}_{t2} - \text{ULA}_{t1}] \times \text{ULA}_{it1}} \times 100 \quad (6)$$

Where

UEDI_i is the urban expansion differentiation index in the i unit.

ULA_{it1} and ULA_{it2} are the total areas in the i unit at times t_2 and t_1 , respectively.

Generally, there are three possible categories of UEDI, which are shown in Table 2.6:

- i. When the constituent spatial unit (i.e., zone) has a differentiation index >1 , the district is categorised as a fast-growing area in the whole study area;
- ii. Where the differentiation index of the district is <1 , the district is categorised as a slow-growing area in the case study; and
- iii. When the differentiation index of the district is equal to 1, the district is categorised as a moderately growing area in the study area (Acheampong et al., 2016).

Table 2.6: Ranges of the Urban Expansion Differentiation Index

Range	Urban expansion differentiation
UEDI >1	Fast-growing area
UEDI = 1	Moderate growing area
UEDI <1	Slow-growing area

Source: Modified from Acheampong et al. (2016)

viii. Analysis of the urban spatial pattern

To better understand the processes in the studied area, land cover change and growth rate analysis were used. Accordingly, three dimensions were used to identify the primary patterns of urban expansion which had resulted in the city's spatial patterns. These dimensions should cover the practices of development. Figure 2.4 depicts the general methods used in this study. The fundamental causes and effects of the urban development were also investigated and examined.

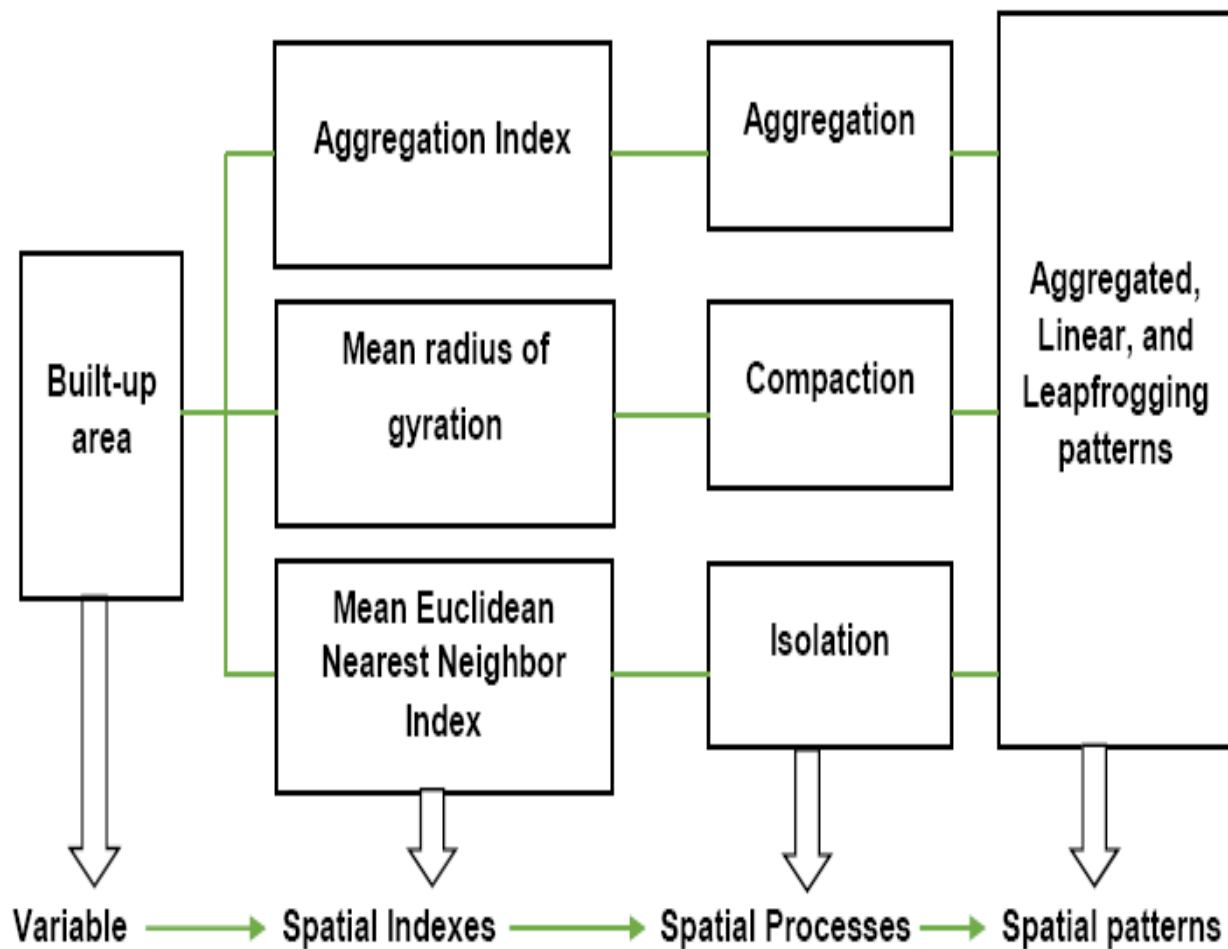


Figure 2.4: The methodology used for the spatial pattern analyses

Source: Author's Illustration (2021)

ix. Spatial metrics for quantifying urban spatial patterns

A city's spatial patterns can be traced back to its expansion in three dimensions. The analysis of a city's expansion is depicted in Figure 2.4. Several landscape metrics are generated by FRAGSTATS 4 to demonstrate urban spatial patterns (McGarigal et al., 2012). However, it is challenging to connect the metric numbers to practices. The majority of indicators are linked (McGarigal et al., 2012), however, a single metric does not fully reflect spatial patterns.

This study's purpose influenced the selection of measurements. There are two types of landscape heterogeneity: urban and non-urban. Built-up land was not included in the definition of urban land,

but non-urban land was. This study's objectives led to the selection of three class-level indicators sensitive to the changes in composition and spatial configuration in the study area. The study's spatial measurements are summarised in Table 2.7.

To analyse the urban pattern, it is necessary to determine the aggregate level of the spatial patterns (Hong et al., 2000). To concentrate on just one type of land cover, the Aggregation Index (AI) may be a better tool than the number of nearby land cover classes divided by the total number of nearby land cover classes (Alberti, 2008). This one is more accurate than other landscape indexes since it is class specific. The spatial pattern of a course can be linked quantitatively to a specific process using an AI-based approach. Ratio variables in the AI computation ignore map units. When comparing it to other landscapes and landscapes of the same or similar resolutions, it is possible (Hong et al., 2000). We may assess how near a city's footprint is to a circle using Compactness Indexes. The Mean Radius of Gyration (MRG) helps measure patch size and connectivity. It preserves the original measurement units (metres). The gyration index's mean radius (r) is equal to the cell's distance from the patch centroid (m) (Botequilha et al., 2006).

The Mean Euclidean Nearest Neighbour (ENN MN) determines the distance to the nearest neighbouring patch of the same type using the shortest straight-line distance between cell centres (McGarigal & Marks, 1995). There is no upper bound on the number of ENNs that can be greater than zero. Because of this, ENN approaches 0 as the distance between two neighbours gets smaller. This ENN is two times as large as when computed using the neighbour patch rule. The size of the block set the upper limit for this study's results. The ENN is undefined if there are no other patches in the same class as the patch in the study area (McGarigal et al., 2012).

Table 2.7: The Characteristics of the Applied Spatial Indexes

$AI = \left[\frac{g_{ii}}{m-x - g_{ii}} \right] (100) (7)$ Units: Per cent	g_{ii} = the number of like adjacencies (joins) between pixels of patch type (class) i, based on the single-count method. $max-g_{ii}$ =the maximum number of like adjacencies (joins) between pixels of patch type (class) i, based on the single-count method.
Range	$0 \leq AI \leq 100$, Given any P_i , AI equals 0 when the focal patch type is maximally disaggregated. AI increases as the focal patch type is increasingly aggregated and equals 100 when the patch type is maximally aggregated into a single, compact patch.
$MGYRATE = \sum_{r=1}^z (r = 1)^z \frac{h_{ijr}}{z} (8)$ Units: Metres	h_{ijr} =distance (m) between cell ijr [located within patch ij] and the centroid of patch ij (the average location), based on cell centre-to-cell centre distance; z =number of cells in patch ij .
Range	$GYRATE \geq 0$ without limit. $GYRATE=0$ when the patch consists of a single cell and increases without limitation as the patch increases in extent. $GYRATE$ achieves its maximum value when the patch comprises the entire landscape.
$ENNMN = \frac{\sum_{j=1}^n h_{ij}}{n_i} (9)$ Units: Metres	h_{ij} =distance (m) from patch ij to the nearest neighbouring patch of the same type (class), based on patch edge-to-edge distance, and computed from cell centre to cell centre.
Range	$ENN > 0$, without limit. ENN approaches 0 as the distance to the nearest neighbour decreases. The minimum ENN is constrained by the cell size and equals twice when the 8-neighbour patch rule is used or the distance between diagonal neighbours when the 4-neighbour law is used. The extent of the landscape constrains the upper limit. ENN is undefined and reported as "N/A" in the base name. "Patch file" is used if the patch has no neighbours (i.e., no other patches of the same class).

Source: Author's Compilation (2021)

Since the goal was to assess the urban land's spatial properties, metrics were computed class-by-class. The following aspects were considered when determining the spatial metrics: Index of aggregation:

- i. It provided a quantitative basis to correlate the spatial pattern of a class with a specific process (one of the research objectives) (Legendre & Fortin, 1989). It could be compared to classes from the same or different landscapes or even the same classes from the same landscape under different resolutions, and it could be applied to the same or different landscapes (Fahrig et al., 2011).
- ii. A class-level application of the Mean Euclidean Nearest Neighbour was possible, regardless of the patch size, and it did not require establishing a neighbourhood radius (Lee et al., 2008).
- iii. An excellent way to differentiate across the classes was to use the mean radius of gyration, which could be applied at the class level and weighted each patch based on its surface area (Leitão et al., 2012).

x. Exploring the effects of urban expansion on spatial patterns

The impacts of urban expansion on the spatiotemporal patterns were studied using the changes in the spatial metrics values as the dependent variables. The growth ratio indexes (UEII and UEDD) were used as the independent variables to understand the effects of urban expansion on the spatial patterns in the United States (US). The changes in the spatial metrics values (AI, GYRATE MN, and ENN MN) were used as additional dependent variables. The same was applied to this study.

Geographically Weighted Regression (GWRR) is increasingly used in regression analyses in geography and other domains (GWR). GWR constructs a local model for each variable in the data set by fitting each feature using a regression equation (Brunsdon, et al., 2002). In contrast to classical regression, which generates a single regression equation to characterise global correlations among the explanatory and dependent variables, GWR generates geographical data expressing the spatial variation in the interactions between variables. Maps based on these data are critical to understanding and interpreting spatial interactions. The GWR equation given by Fotheringham et al. (2002) is as follows:

$$\hat{y}_i = \beta_0(u_i, v_i) + \sum_k \beta_k(u_i, v_i) x_{ik} + \varepsilon_i \quad (10)$$

where

$\hat{y}_i$ is the estimated value of the dependent variable for observation i .

β_0 is the intercept.

β_k is the parameter estimate for variable k .

x_{ik} is the value of the k^{th} variable for i .

ε_i is the error term, and (u_i, v_i) captures the coordinate location of i .

Closely related observations have a more significant impact on the parameter estimations of those further away than those closer together. In a distance decay function centred on words, I determined the weights allocated to the various comments. When dealing with areal data, the polygon centroids determine the distance between two points in an area. A bandwidth setting with a fast-decreasing weight alters the distance decay function, which can take numerous shapes. The analyst can manually select the bandwidth or use an algorithm (CV) to reduce a cross-validation score. The bandwidth can be chosen by minimising Akaike's Information Criteria (AIC) score (Nakaya et al., 2005).

$$AIC_t = 2n \log_e(\sigma) + n \log_e(2\pi) + n \left\{ \frac{n + \text{tr}(S)}{n - 2 - \text{tr}(S)} \right\} \quad (11)$$

The AIC method is advantageous because freedom may vary among models on different observations. Moreover, the user may choose a fixed bandwidth used for every word or a variable bandwidth that expands in sparse observations and shrinks in regions of dense observations. Thus, in this study the AIC_t method was used for the GWR model. The model with a lower AIC_t value suggests the more vital ability of the regression model in reflecting reality (van Bruggen et al., 2019).

xi. Socio-economic patterns

This part aimed to characterise the cities' socio-economic form and distinguish compactness from sprawl. It defined each city's form in different dimensions, accompanied by appropriate quantitative indexes. The general methodology of this analysis is illustrated in Figure 2.5.

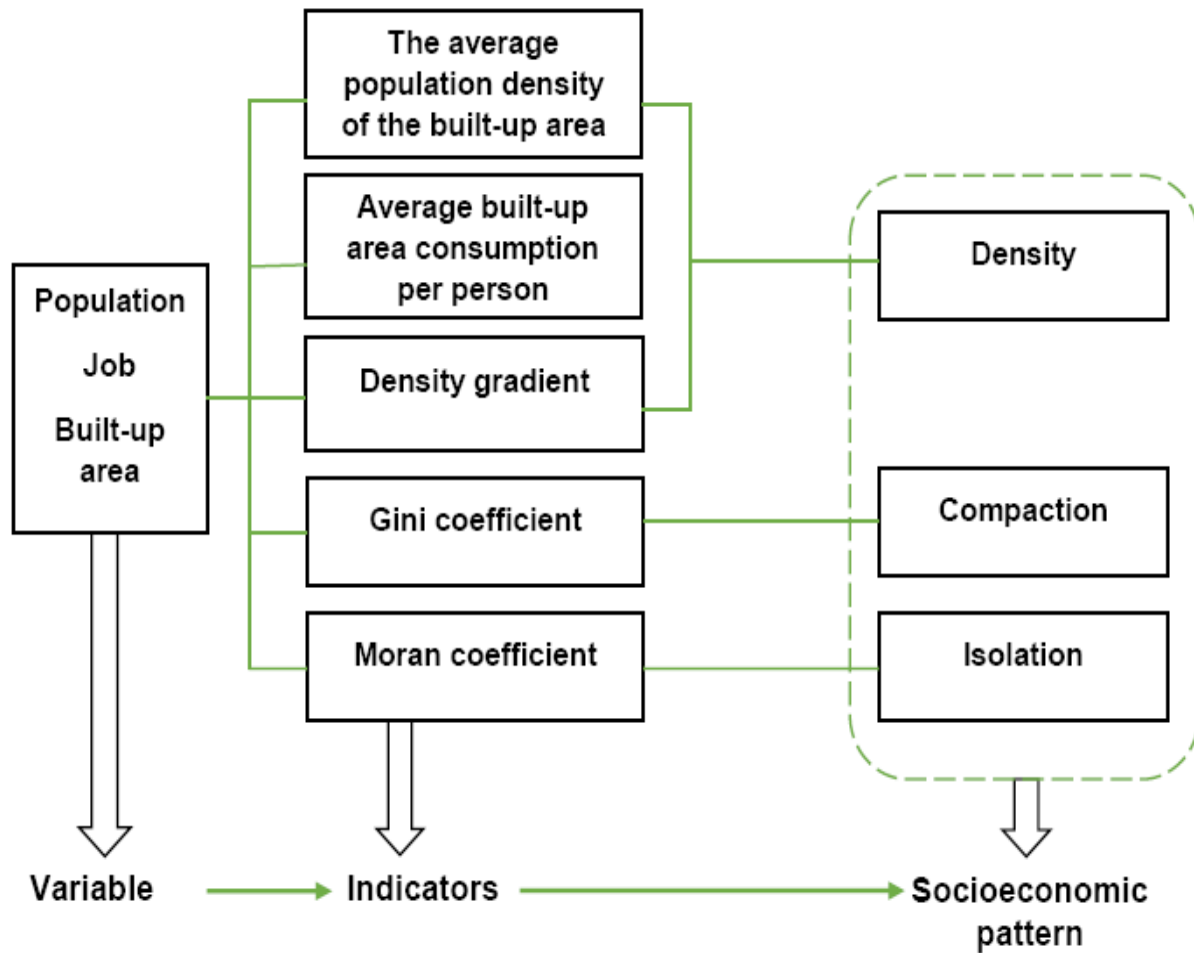


Figure 2.5: Illustration of the method of analysis

Source: Author's Illustration (2021)

xii. Urban density functions

In this study, the Euclidean Distance Algorithm was applied to quantify the distance to other areas, and four regression models were constructed: linear, exponential, power, and logarithmic regressions. The following equations were used to derive an urban density gradient for the three years considered:

$$\rho(r) = a + br \quad (12)$$

Linear regression: where

r = distance from the centre of the urban area (km),

b = slope, and

a= intercept (Alberti, 2008).

$$\rho(r) = ae^{-rb} \quad (13)$$

Exponential regression: where

a= maximum population density,

r= distance from the centre of the urban area, and

b= exponential decay coefficient or density gradient (km⁻¹).

$$\rho(r) = ar^b \quad (14)$$

Power regression: where

r = distance from centre of urban area,

$\rho(r)$ = population density at distance r from the CBD (km⁻²),

a = intercept (population density (km⁻²) at distance zero from the CBD, and

b = growth/decay rate.

$$\rho(r) = a + b \ln(r) \quad (15)$$

Logarithmic regression: where

r= distance from the centre of the urban area (km),

a is the intercept, and

b (ln) =slope.

The density function analysis used two variables: Euclidean distance r from the city centre and corresponding population density $\rho(r)$. Having two variables in GIS, the data set was exported for regression analysis. Such a density approach added essential elements to test the hypotheses about the relationships between the urban and ecological functions and the urban-to-rural gradient (Alberti, 2008). By comparing the changing pattern of density gradients over time, the process of spatial evolution could be assessed (Broennimann et al., 2012).

xiii. Degree of distribution

The research applied the Gini coefficient to measure the population or employment distribution inequality by spatial units in the urban areas. Higher Gini coefficients (i.e., close to 1) mean that the population or employment density is exceptionally high in fewer sub-areas. A Gini coefficient that is comparable to zero means that the population or employment is evenly distributed in an area. The Gini coefficient can be calculated as per Tsai (2005):

$$\text{Gini} = 0.5 \sum_{i=1}^N (1 - i)^2 (X_i + Y_i) \quad (16)$$

Where N is the number of sub-areas,

X_i is the proportion of land area in sub-area I, and

Y_i is the proportion of the population or employment in sub-area I (Yu et al., 2020).

It is worth noting that the first goal of this study was to conduct a land use/land cover change analysis and map out city infrastructure. This was to aid in the evolution of the city maps over a 20-year time frame (1990-2020). Based on the fact that it encompassed both the pre-millennium and millennium periods, this period was selected. The "Terra Incognita" application, a programme for downloading web source maps or local file maps for various programmes or GPS devices, was used to acquire the high-resolution satellite photos ("quick bird") required with a 15-metre resolution (Castro et al., 2019). For this study, the platform was changed to backdate the imageries for five-year intervals; from the 1990s to the early 2000s, 1995 to 1999, 2000 to 2004; 2005 to 2009; 2010 to 2014; and 2015 to 2019. A total of six imageries were acquired from this platform". The Spatio-temporal analysis was performed on these images, and conclusions were made from the results.

2.4.2 Secondary sources of data

It was necessary to use pre-existing data from the city-state ministries in charge of land use and surveying to supplement the information gathered during the fieldwork. The SDG offices provided the information for this report. A wide range of sources, including UNFAO, UN-Habitat, and other stakeholders, were consulted for information on the SDGs.

Data about city populations can be found in the people and household census documents, which can be used to track changes in the city's demographic composition through time. Data from the National Population Commission (NPC, 2011) was used in compiling this report. The documents divided the cities into districts to facilitate primary data collection. In addition, materials on the growth of each of these cities' respective states were sourced. The documents between 2000 and 2019 were categorised. This was done because of the democratic system in Nigeria, which constitutionally permits democratically elected politicians to stay in office for four years. The data on the development activities, strategies, and programmes was organised according to the four-year political time frames for the period from 2000 to 2019. This ensured that the cities' post-military rulers could get their hands-on important information”. This research was also done as armchair or office research and examined the literature reviewed for the study on theories, concepts, and principles Russell & Mugenyi, 1997; Scott, 2012).

2.5 Sampling Technique and Procedure

2.5.1 Data collection procedures

This study investigated the following questions:

- i. What was the land use land cover change in the selected cities in North-Central Nigeria between 1990 and 2020?
- ii. It described the types, volumes, and spatial dimensions of the physical development projects implemented by the governments in the selected cities in North-Central Nigeria from 2000 to 2020.
- iii. What were the indices for sustainable urban development, urban liveability, and inclusive urban development in the relevant literature?
- iv. How could a matrix of indicators be developed to appraise the extent of the sustainable urban development, urban liveability, and inclusive physical developments in the selected cities in North-Central Nigeria?
- v. What form did an integrated model for sustainable urban development, urban liveability, and inclusive physical development take in the selected cities?

The study sought to collect quantitative and qualitative data to address these issues comprehensively. Using the two methods, two separate study strands were formed, which generated both qualitative and quantitative data. According to Creswell and Plano Clark (2011), *"A research strand comprises the basic research process of performing quantitative or qualitative research: presenting research questions, collecting data, analysing data, and interpreting outcomes based on that information"*.

2.5.2 Retrieval of archival documents

The archival data relating to the urban development, sustainability, and liveability promoted by the various city managers was obtained officially with the assistance of the Department of Urban and Regional Planning of the Federal University of Technology, Minna. The university's Research Department served as the go-between between the researcher and the various data sources. Data was also obtained from the participating organisations' annual reports on multiple websites.

2.5.3 Pilot survey

Pilot testing was done to ensure the integrity of the data collected. Small-scale testing of questionnaires, interview checklists, or observation schedules are all examples of pilot tests. It reduces the risk of respondents answering the questions incorrectly and inaccurately recording data. It is possible to analyse the validity and reliability of the survey questions and the data that will be obtained using them (Saunders et al., 2009). Any questions that need to be clarified or refined in the questionnaire will be brought to light during the pilot survey process. The questionnaire for this study was distributed to four researchers in the Built Environment in South Africa to get their comments on the questions' thoroughness. A research assistant hired explicitly for this project sent 30 questionnaires to people of North-Central Nigeria. For the pilot survey, the questionnaire was administered to the head of each selected home.

2.5.4 Sampling technique, sampling frame, and sampling size

2.5.4.1 Sample frame

The sample frame for this research was the total population of the cities being researched. This included the people of Lafia in Nasarawa State, Lokoja in Kogi State, and Minna in Niger State.

Furthermore, the research's units of measurement were the household units in the cities. Two essential methods were adopted to obtain the total number of household units in the cities sampled. The first method adopted was to get the total population of the cities, and this population was then divided by the average household size for each of the cities. The total received was the sample frame of the research. The sample frame for the study was accepted as the aggregation of the population data from the three cities that were being researched and the projection of their population from the 1991 figures (as presented in Table 2.8). The research also adopted the method of population projection below to project the 1991 population of the study cities from 1991 to 2001: 2002 to 2012, and from 2013 to 2019.

$$P = P_o (1 + r/100)^n$$

Where

P= projected population

N=year interval

Po= base year population

R= growth rate

Table 2.8: Sample Frame Structure for the Research

S/No	State	City	1991 Census Figure	Projected Population 1991-2001	Projected Population 2002-2012	Projected Population 2013-2019	Total Number of Households=Total Population/5.4
1	Nasarawa	Lafia	240,656	329,756	451,845	563,315	104,318
2	Niger	Minna	230,169	315,387	432,143	538,748	99,768
3	Kogi	Lokoja	82,483	113,018	154,857	193,060	35,752
	Total		553,308	758,161	1,038,845	1,295,123	239,838

Source: NPC (2011)

The area's total population under consideration was 1,295,123; however, the unit of measurement for the research was the household. According to the NPC (2011), the average household size for the cities was 5.4 persons per household. Therefore, the total number of homes under consideration for the research was 239,838. Thus, the sample size of the study was drawn from the total number of households in the cities.

2.5.4.2 Sample size

The online sample size calculator was used to obtain the acceptable sample size for this research. The value was computed at a 95 per cent confidence level and 1-5 confidence intervals, which gave the study a 0.35 per cent sample size. Therefore, the sample size was 843, representing the total number of questionnaires administered across the region for the study. However, since the cities' population numbers were within the same range, the total sample size was divided by 3 to obtain 284 questionnaires for sampling for the research.

2.5.5 Sampling procedure

A pilot survey was carried out using the questionnaire before the actual study was delivered to test the validity of the questions set out in the questionnaire. The pilot survey showed the respondents' understanding of each question asked and the time required for each respondent to fill in the questionnaire to ensure that they were understood, and that sufficient time was allocated for the process. Some modifications were made to the presentation of the questionnaire and the wording of some questions, according to the feedback from the pilot survey. Before the data analysis began, the questionnaire's content reliability was examined using a statistical approach – Cronbach's alpha (α); the most common measure used to determine the reliability of a questionnaire. The Cronbach's alpha values of each item were calculated to test whether there were liveability elements that could negatively impact the reliability, and this effectively reflected the internal consistency of the questionnaire. The sampling procedure for the research is presented in Figure 2.6.

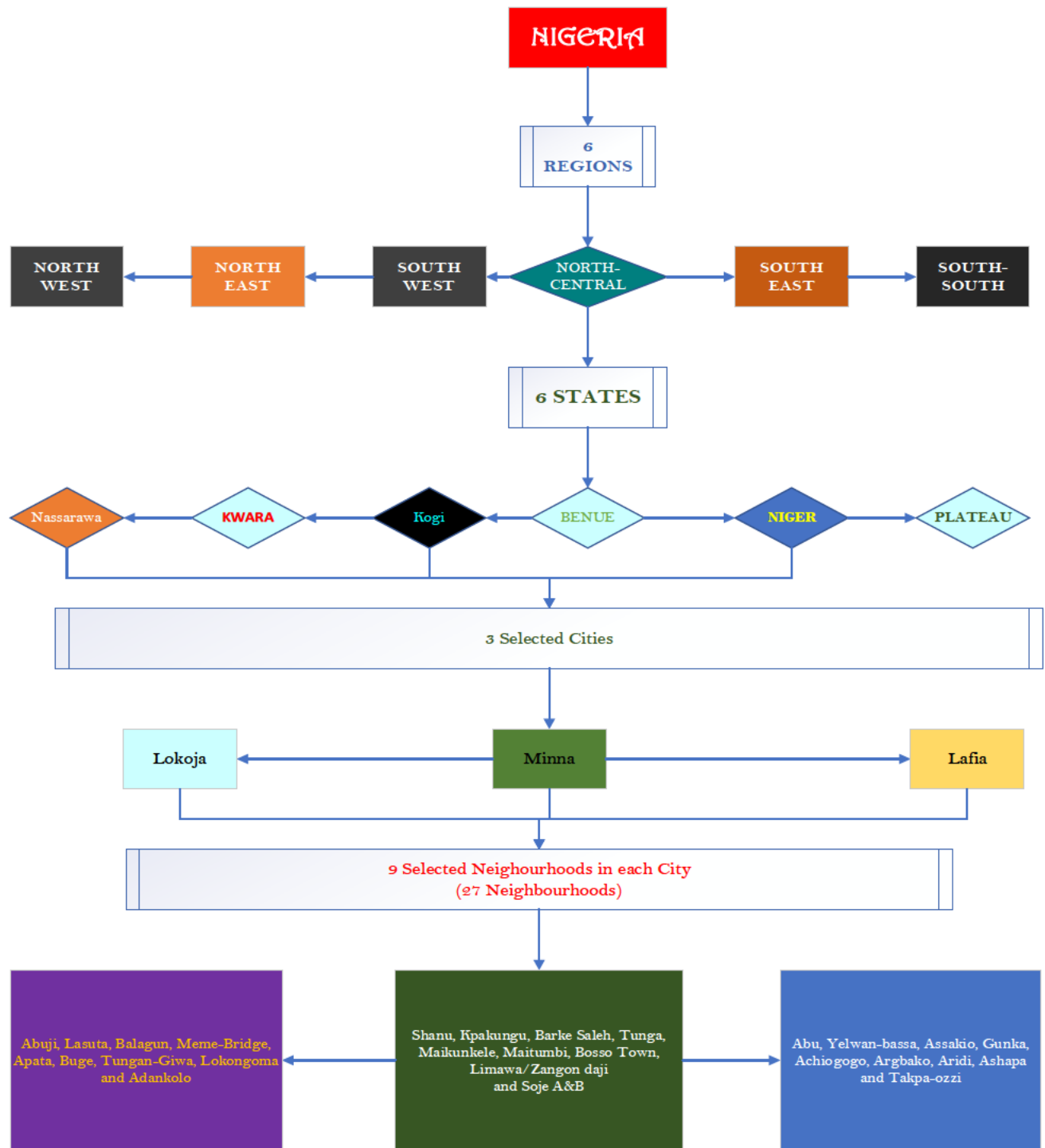


Figure 2.6: Sampling procedure/technique flow process

Source: Author's research (2020)

Table 2.9: Strategies for the Selection of Samples and Cases

	Type of Selection	Purpose
A	Random selection	To avoid systematic biases in the sample. The sample's size is decisive for generalisation.
	1. Random sample	To achieve a representative sample that allows for generalisation for the entire population.
	2. Stratified sample	To generalise for specially selected sub-groups within the population.
B.	Information-oriented selection	To maximise the utility of information from small samples and single cases. Cases are selected based on expectations about their information content.
	1. Extreme or deviant cases	To obtain information on unusual cases, which can be especially problematic or especially good in a more closely defined sense.
	2. Maximum variation cases	To obtain information about the significance of various circumstances for each case process and outcome, e.g., three to four cases that are very different in one dimension: size, the form of organisation, location, or budget.
	3. Critical cases	To achieve information that permits logical deductions of the type: 'if this is (not) valid for this case, then it applies to all (no) cases.
	4. Paradigmatic cases	To develop a metaphor or establish a school for the case's domain.

Source: Flyvbjerg (2006)

2.5.6 Pilot testing

Piloting the questionnaire process is essential to preparing for a successful interview, according to Turner (2010). Using pilot testing to assess interview questions, Kvale (2007) argues that the researcher can detect interview design flaws such as omissions or errors and improve the interview questions before conducting the actual data collection interviews. Researchers can alter their research questions during pilot interviews, if necessary. According to Turner (2010), it is crucial to do pilot testing of the interview questions with people who will be taking part in the actual study. For this reason, the research supervisor worked with urban planning groups in Nigeria on the interview process before pilot testing. Revisions to the interview instrument were made as a result of the input.

2.5.7 Data collection

Using semi-structured interviews, the management team members of the participating organisations were interviewed, and a document analysis was conducted. The use of multiple

sources enhanced the overall depth and richness of the data acquired. Interview questions should include open-ended queries, as this provides a way for participants to offer their thoughts without feeling constrained while simultaneously allowing the researcher to probe further with follow-up questions (Turner, 2010). As Knox and Burkard (2009); and Polkinghorne (1994) claim, in-person interviews are more reliable because the interviewer can foster a sense of trust and openness in the subject. This, in turn, helps alleviate the participants' need to manage their impressions and allows them to reflect on their personal histories more deeply. When conducting semi-structured interviews, the most problematic component is coding the information (Creswell, 2007).

The fundamental objective of this phase of the study was to discover the interrelationships between each organisation's culture, strategies, and the environment. The same questions were posed to every participant (see Appendix D). I used the qualitative data analysis technique described by Blaxter et al. (2006) to break the data down into themes. The qualitative analysis of the data from the responses and remarks of the senior managers in planning and urban management construction companies was bas'd on the study's conceptual framework.

2.5.7.1 Criteria for judging the quality of the research designs

Yin (2009) identified four criteria that can be used to measure the quality of a research design at various research stages: construct validity, internal validity, external validity, and reliability. This section explains how the quality of the research design or the potential quantitative and qualitative design's approach and adoption was assessed. According to Creswell and Plano Clark (2011), the concept of validity is different in quantitative and qualitative research. However, both approaches are used to ensure or check data's quality, results, and interpretation. Quantitative researchers design their studies to reduce the threats to the internal and external validity of the instrument used.

2.5.7.2 Validity and reliability in quantitative research

- **Internal validity**

Instead of being accidental, an association between two variables that their causal connection can explain is called "internal validity". As far as internal validity is concerned, the quality of respondents' responses and their accuracy in concluding are the most critical variables in a survey design. Therefore, all scientists must consider the validity of notions, criteria, and the

content of studies. Content validity (CV) refers to the extent to which the questions on the questionnaire accurately reflect the underlying concepts being studied. Before the study began, a thorough literature review was conducted to ensure the validity of the questionnaire materials. Whether the test's results are in line with those of other tests of a similar type determines whether it is valid. To achieve this kind of validity, the measurements of the constructs were correlated (Pertusa-Ortega et al., 2008).

How well an item's dimensions match the description of its intended use (Creswell & Plano Clark, 2011) determines its construct validity. The questionnaire's construct validity was tested using both convergent and divergent validity. There was a calculation of the positive and significant correlations and the average values of each scale's elements. Valid evidence for convergent validity is provided by data on the significance and correlation of factor loadings (Isik et al., 2010). To conclude, archival documents (annual reports and financial records) were used to assess the quantitative and qualitative data sets (Creswell & Plano Clark, 2011; Edward & Holt, 2010).

- **External validity**

External validity is a term used to describe how a study's findings may apply to a larger population or setting (a fundamental goal of quantitative research). Ecological and population validity are two subcategories of validity. "Population validity" refers to generalising results from a small sample to a larger population. A non-biased strategy was used to ensure that the model was representative of the entire population, as opposed to ecological validity (Creswell & Plano Clark, 2011; Fellows & Liu, 2008; Yin, 2009) which is concerned with generalising from one specific location or situation to other sites or situations.

- **Reliability**

Data collected from respondents is considered reliable if shown to be stable over time (Creswell & Plano Clark, 2011). Internal consistency must be analysed statistically to ensure the scores are credible. It is common to utilise Cronbach's alpha (α) to evaluate the consistency of test results (which is also a prerequisite for validity).

The research constructs employed in this study are shown in Table 2.10 by Cronbach's alpha (α). Cronbach's alpha will be utilised to assess the internal consistency and the degree of

covariation among the items assessing each construct (Chew et al., 2008). According to Nandakumar (2007), 0.6 is a reasonable alpha value for exploratory studies like this one, although other authors have advocated for 0.7. According to Van de Ven and Ferry (1979), a Cronbach's alpha coefficient of 0.55 is acceptable for measuring broad constructs in a study.

Table 2.10: Reliability Values of the Scales

Questionnaire Section	Measured Constructs	Alpha Value
Sustainable Urban Development	Economic Prosperity Environment Social	0.822
Urban Mgt. and Governance	Population Management Credit Facilities Information Flow Family Planning	0.803
Urban Liveability	Quality of Life Liveable Communities Place Shaping	0.762
Environmental Awareness	Motivation Values Attitudes Environmental Knowledge	0.892
Inclusive Physical Development	Safety Resilience Equity Environmental Justice	0.871
<i>Hangwurian</i> Urban Development	Consumption Pattern Access to the City Equity	0.843

Source: Author's research (2021)

2.5.7.3 Validity and reliability in qualitative research

The utilisation of multiple-case studies was employed to examine the validity of the population. Interviews and document analysis were used to explain observations to improve the validity of the findings. Critics accuse case study researchers of failing to build a reliable set of measurements and collecting subjective data to gather information (Ntiyakunze, 2011), so several methods of validation were used to address this issue. There was triangulation –f the

results - evaluating the hypothesis provided in this study utilising theoretical replication logic to construct a chain of evidence and develop analytical generalisations (Yin, 2009).

2.6 Data Capture, Processing, Analysis and Tools

2.6.1 Data analysis

Researchers must use appropriate data analysis methodologies to analyse the field survey data (Ankrah, 2007). Qualitative and quantitative data were both gathered. As a result, several analysis methods were used in this study to enhance the validity and reliability of the findings. A detailed description of the data-gathering process is shown in Table 2.11.

Table 2.11: Data Capture, Processing, Analysis and Tools

Research Objective 1	Analyse the land use land cover change in the selected cities in North-Central Nigeria between 1990 and 2020
Data Requirement	• High-resolution satellite imageries (Quick Bird) • Infrastructure coordinate • Locational coordinates of the cities
Data Type and Sources	• Quick Bird images
Method of Data Collection	• “Terra Incognita” application
Instruments for Data Collection	• Global Positioning System (GPS) • Computer
Method of Data Analysis	• Spatio-temporal analysis • Locational analysis • Nearest neighbour analysis
Expected Research Outcome	• Spatial changes in the cities over the years to establish the space consumption patterns
Software Requirement for Data Analysis	• Arc GIS
Research Objective 2	Identify the indices for sustainable urban development (SUD), urban liveability (UL), and inclusive Physical development (IUD) from relevant literature
Data Requirement	• Literature on indicators of SUD • Literature on indicators of UL • Literature on the indicators of IPD
Data Type and Sources	• UNFAO reports • UN-Habitat reports • UNDP reports • Scholarly publications on indicators

	• Types of indicators • Applications of indicators
Method of Data Collection	• Literature review
Instruments for Data Collection	• Journals • Reports • Conference proceedings
Method of Data Analysis	• Armchair analysis
Expected Research Outcome	• Generate a catalogue of indicators to measure the constructs and sub-constructs observed in the literature
Software Requirement for Data Analysis	Microsoft Word
Research Objective 3	Develop a matrix of indicators to appraise the extent of the sustainable urban development, urban liveability, and inclusive physical developments in the selected cities in North-Central Nigeria
Data Requirement	• Indicators of SUD as perceived by the sampled households • Indicators of UL as perceived by the sampled households • Indicators of IPD as perceived by the sampled households • Level of environmental awareness of the households • The roles of urban governance and city management
Data Type and Sources	• Primary data and sources from residents and stakeholders • Secondary data and sources on environmental awareness level standards from the UNFAO and UN-habitat
Method of Data Collection	• Questionnaire administration • Literature review
Instruments for Data Collection	• Questionnaire • Journals and internet articles
Method of Data Analysis	• Inferential statistics, i.e., factor analysis, correlation, principal component analysis, and analysis of variance
Expected Research Outcome	• Develop homemade indicators for measuring SUD, UL, and IPD
Software Requirement for Data Analysis	• Microsoft Excel • SMART PLS 3
Research Objective 4	Examine the physical development projects implemented by the governments in the selected cities in North-Central Nigeria from 2000 to 2020
Data Requirement	• Data collected included data on infrastructure provision • Numbers of the infrastructure

	• Planning and implementation of the infrastructure provision • Process of conceptualisation and implementation of projects
Data Type and Sources	• Secondary data sources were explored for this purpose • These could be quantitative in terms of the number of projects implemented, • Or qualitative in terms of the documents prepared for these projects
Method of Data Collection	These data were obtained from the official government archive of the agencies, ministries, and government departments
Instruments for Data Collection	Direct requests were made during the interviews with the government officials
Method of Data Analysis	Thematic analysis was carried out on the data obtained Comparative analysis Trend analysis of the infrastructure and development drives in the cities
Expected Research Outcome	Draw comparative and trend analyses of the city governments' infrastructure and physical development efforts and the roles of planning and management in the provision and maintenance of the infrastructure
Software Requirement for Data Analysis	Microsoft Word and Excel
Research Objective 5	Evolve an integrated model for sustainable urban development, urban liveability, and inclusive physical development for the selected cities
Data Requirement	The SUD, UL, and IPD indicate environmental awareness as the moderator and urban management and city governance as the mediator (<i>Hangwurian City Development</i>)
Data Type and Sources	Primary data
Method of Data Collection	• Questionnaire administration • Key informant interviews • Field observations
Instruments for Data Collection	• Questionnaire • Interview Guide • Observational Checklist
Method of Data Analysis	• Regression Model • Comparative Analysis • Factor Analysis • Principal Component Analysis
Expected Research Outcome	Generate an integrated model for development in North-Central Nigeria (<i>Hangwurian City Development</i>)

Software Requirement for Data Analysis	• SmartPLS 3 • SPSS 26

Source: Author's research, 2021

2.6.1.1 Quantitative analysis

Descriptive and inferential statistical techniques were employed to analyse the quantitative data. The descriptive statistics (including percentiles and mean scores) were diagnosed with the background information. The inferential statistics employed with the Partial Least Squares Structural Equation Modelling technique were used to develop and validate the conceptual framework presented in Chapter Four.

• Mean scores and indices

A series of Likert-scaled questions (e.g., 5 points or 1 point) were included in the questionnaire, and all of the “variables were analysed to discover the most critical aspects of each construct. The mean was utilised to analyse the responses with a wide range of viewpoints. For example, a very high mean score could be indicated for the variables of sustainability or liveability, with relatively medium-to-low mean scores for other parameters, according to a resident's assessment of the environment's impact on sustainability and liveability. Chew et al. (2008); and Jusoh and Parnell (2008) used the mean score, which was calculated for each component in their studies, using the formula presented below:

$$\text{Mean Score} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{n_5 + n_4 + n_3 + n_2 + n_1} \dots\dots\dots 2.1$$

Where n_1 = the number of respondents who answered, “very low impact”.

n_2 = the number of respondents who answered, “low impact”.

n_3 = the number of respondents who replied, “moderately low impact”.

n_4 = the number of respondents who replied, “High impact”.

n_5 = the number of respondents who answered, “very high impact”.

The respondents were asked to rank each factor on a Likert scale of 1-5 for the "level of significance", where 1 was "very low" and 5 was "very high. An evaluation was then made of the relative importance and influence of the various variables based on the total Frequent equation

Frequency index = (Cityverityty x 100%..... (i)

Index = ((Σ(i))/NI) x 100 %..... (ii)

City Index = ((Σ(if))/NIF) x 100 %..... (iii)

Spillane et al. (2012) applied the equations to arrive at the severity index for each element. To calculate the results, I used a Likert scale with a rating from 1 - 5 to represent the relevance of the weighing and the frequency with which the survey participants gave that weighting”. There were just two potential grades for each factor: I and F (being 5 in both cases). In this case, N was the total number of respondents who provided usable data on the factor, 847.

- **Development of indices for measuring model constructs**

The questionnaire was administered, and the outcome was measured against the Human Development Index (HDI) with a 4-point measuring scale from 0.0 to 1.0 (Watkins, 2006). This scale and the measuring label are shown in Table 9.1.

This scale ranking adapted from the Human Development Index (HDI) recommends that indicators with rankings between 0.0 – 0.49 are deemed to have performed poorly, a ranking between 0.5 – 0.75 is considered moderate. Any ranking above 0.75 is considered substantial for developing countries, and a ranking between 0.8 -1.0 is considered substantial for developed countries (Arndt et al., 2018; De Groeve et al., 2015; Wood, 2006). This ranking was used to compute the correlation between the individual indices and the primary construct. This was also employed to determine the Cronbach’s alpha for the indices. The computation of the Cronbach’s alpha determined the validity of the individual indices on the constructs and determined to a large extent how well an index performed. This analysis followed the trend where only indexes with a Cronbach’s alpha of 0.7 and above were deemed significant for the proposed model development.

Chapter Nine comprises of three main sections. Section 9.1 addresses the performance of the indicators measured in Lafia City; 9.2 looks at the indicators’ performance in Lokoja City, and 9.3 presents the indicators’ performance in Minna City. Furthermore, the chapter also comprises several sub-sections which address the various sub-constructs of the significant constructs or indicators to provide a holistic evaluation of the measuring indicators for the development paradigm being proposed. These indicators are the basis for modelling, which is

at the core of this research work. A copy of Table 9.1 has been inserted below for ease of reference.

Table 9.1: Four-Point Likert HDI Ranking for Indicator Development

Index	Label
0.0-0.29	Very Low
0.3-0.49	Low
0.5-0.75	High
0.76-1.0	Very High

Source: UNDP (2006)

- **Correlation analysis**

Correlational statistics “were used to show the links between the variables under investigation. When two metric variables have a positive or negative relationship, this statistical tool can determine how strong that link is (Hair et al., 2010). It is possible to have a perfect positive correlation coefficient (+1), a perfect zero correlation coefficient (0), or an ideal negative correlation coefficient (-1). Correlation analysis is one of sustainability and liveability experts' most used statistical tools. Studies by Chew et al. (2007); Li and Ling (2012); Nandakumar et al. (2010; 2011); and Tavitiyaman et al. (2012) are examples of studies that have used this method. The development of regression models necessitates statistical correlation (Hair et al., 2010). The correlational analysis conducted in this study studied the relationships among the research constructs.

- **Factor analysis**

Hair et al. (2010) describe a multivariate statistical method that looks at interrelationship structures and the underlying constructs in many different variables. Using this method, researchers can identify which variables are strongly associated, generating clusters or groupings of variables that are understood to be tied to a familiar concept. Methods for generating the variables' structure are divided into two primary categories. Analysis methods include principal component analysis (PCA) and factor analysis (Field, 2013). Factor analysis and PCA compress many variables into smaller dimensions known as 'factors' and 'components' respectively in these two techniques.

Factor analysis is divided into confirmatory and exploratory methodologies, according to DeCoster (1998). Confirmatory factor analysis evaluates how well-assessed variables represent fewer constructs to test a theorised dimension. Structural equation modelling (SEM) is employed in this process (SEM). An inductive technique generates a factor structure through exploratory factor analysis, which involves bringing together related variables.

Strategists such as Allen and Helms (2006); and Jusoh and Parnell (2008) have utilised this approach to discover and differentiate strategic qualities. To reduce the number of variables, factor analysis is employed to find and isolate a small number of uncorrelated variables from the vast number of correlated variables. As a result, the PCA approach can be utilised for factor extraction, where the retrieved components can be used to generate new variables for later analysis.

The minimum size for factor analysis has been a subject of discussion in the literature (Cattell, 1978; Comrey & Lee, 1992; Hair et al., 1979; Mundfrom et al., 2005; Tabachnick & Fidell, 2007). A sample size of 50 was identified as a realistic and acceptable number for exploratory factor analysis by De Winter et al. (2009) following a thorough review of studies on small sample sizes. Sample sizes less than 100 and factor loadings of more than 0.75 have been proposed as reasonable by Hair et al. (2010); and Field (2013), consistent with their findings. There were 843 participants in this study, thus any factor loading below 0.60 would be statistically insignificant. When determining which variables loaded onto which factors, only factor loadings greater than 0.60 were considered. Table 2.11 shows that the sample size for this investigation was 843, which was higher than the recommended minimum of 50 (De Winter et al., 2009; Hair et al., 2010). Because of this, factor analysis was a feasible next step.

Table 2.12: Guidelines for Identifying Significant Factor Loadings Based on the Sample Size

Factor Loading	Sample Size Needed for Significance
.30	350
.35	250
.40	200
.45	150
.50	120
.55	100
.60	85
.65	70
.70	60
.75	50

Source: Hair et al. (2010, p. 117)

- **Partial least square structural equation modelling (PLS-SEM)**

The conceptual model described in Chapter Four was developed and validated using PLS-SEM in this study. The most crucial phase in the construction of a model is model validation. Researchers in fields like planning are increasingly being asked to test their theories and conceptions empirically. As a result, causal modelling methods such as Structural Equation Modelling (SEM) have become increasingly popular (Fernandes, 2012; Hair et al., 2012; Hulland, 1999). A second-generation multivariate analytic strategy, SEM combines the first-generation methodologies, such as principal components and linear regression analysis, into a single tool. Using SEM, complex theories, concepts, and models can be tested since it estimates the composite relationships between variables (Chin, 2010; Robins, 2012).

Covariance-based SEM (CBSEM) and variance-based partial least squares (PLS) path modelling (also known as PLS-SEM) are two examples of SEM-based techniques for modelling (Hair et al., 2012; Hair et al., 2013). CB-SEM is a confirmatory technique for estimating correlations between variables based on theoretical parameters. As a result, the model's suggested covariance matrix is more consistent with the sample covariance matrix (Hair et al., 2012). Contrast this to the predictive strategy of PLS-SEM, which focuses on the

model's endogenous target constructs (such as the R² value) to extend explained variance (Hair et al., 2012).

Studies have employed various statistical tools, like regressions and structural equation modelling, to validate models on the issue of sustainability and liveability (e.g., Ankrah, 2007; Isik et al., 2010). This study used PLS-SEM as a multivariate technique to investigate the correlations between one or more predictor factors and outcome variables, either continuous or categorical.

PLS-SEM is a prediction-oriented, variance-based multivariate approach with adjustable distributional assumptions of normality needed for maximum likelihood-based SEM estimations (Hair et al., 2012). The predictive power of PLS-SEM can be achieved even when the sample size is small, unlike SEM, because it uses ordinary least squares regressions (Nandakumar, 2008; Reinartz et al., 2009). All direct causal paths are estimated simultaneously, yielding an overall goodness-of-fit measurement for the model. Even if models get sophisticated, PLS-SEM is not hindered by identification difficulties, as is CB-SEM (Hair et al., 2011).

Using the quantitative data gathered, the SmartPLS (Version 3.0 (M3)) application was used to assess the PLS-SEM. Firstly, PLS-SEM produced the conceptual construct in Chapter Four that connects the indicators and the constructs based on the theories and reasoning stated in Chapter Four (Hair et al., 2014). For the model to work, it relied on the input of city dwellers as an exogenous, or independent, variable. City dynamics, resource availability, environmental awareness, and urban management strategies were endogenous or dependent variables. Exogenous variables were those whose variation was influenced by factors outside the model, which affected the model's other variables. One or more model variables explained its variation (Lleras, 2005). As Gudergan et al. (2008) indicated, the study reflectively specified the outer model, and the reflective indicators were applied in measuring the constructs.

2.6.1.2 Qualitative data analysis

Qualitative data can be analysed using a variety of methods. Three categories are used by Madill and Gough (2008) to classify the four types of qualitative data analysis. One method of data analysis is content analysis, which Fellow and Liu (2008) describe as either qualitative,

quantitative, or structural. By categorising the techniques into five categories - pattern matching, explanation building, time-series analysis, logic models, and cross-case syntheses - Yin (2009) validated and enhanced the classification offered by Madill and Gough (2008). Therefore, Yin (2009) advised that replication logic be employed to improve the generalisability of a research effort by including several case studies.

In this study, thematic analysis was used in the form of Blaxter et al.'s (2006) five-step approach, which includes: bracketing and phenomenological reduction; delineating units of meaning and clustering them together to form themes; summarising each interview; validating and where necessary modifying it; extracting general pieces of information from all of the discussions; and then making a composite summary. A qualitative data analysis tool, INVIVO, was utilised as a protection against premature conclusions because it aids in the efficient handling of data. The software can handle data in a meaningful way, provide multiple properties, and use various display approaches (Meyer & Avery, 2009). The analysis and presentation of qualitative data using this method are highly accurate and flexible. Each transcript was coded using Excel, with each row defining a codable unit and each column defining an attribute of that unit. Using this method, coding provided an easy-to-understand interpretation of the interview questions.

Researchers who work with qualitative data must balance being overwhelmed by its complexity and being shackled by tactical reductionism (Richard, 1999). A new set of themes was discovered following the initial coding and data familiarisation phases of this study". In accordance with Bowen et al. (2012), the articles were reviewed, described, and labelled. Based on this coding, Nigeria's cities' sustainability, liveability, and inclusion levels were established.

2.7 Ethical Considerations

As the study was planned and carried out, the concern was with ensuring that all of the techniques employed were ethical. According to Shah (2011), ethicists describe ethics as a set of standards for acceptable and inappropriate behaviour. Ethics considerations were seen as part of the system or perspective utilised to decide how this study's investigation was to be carried out. Jimoh (2012) argues that when researchers follow ethical guidelines, their work gains credibility. Ethical factors such as honesty, integrity, informed consent, confidentiality,

and the right to privacy were vital when conducting this study (Leedy & Ormrod, 2005; Resnik, 2007; Shah, 2011).

Therefore, in the beginning, the researcher ensured that the respondents were adequately informed of the specifics of the study. Their consent was sought and gained through letters of invitation (see Appendices F, G, and H) and several e-mails to the various planning organisations. At the point of questionnaire administration, efforts were made to educate the respondents about the fact that the study was purely an academic undertaking. The participants were given the option to discontinue or withdraw from the research. The study was designed to keep the participants anonymous.

The data was collected with the support of 16 field assistants in each of the selected cities, using the Android phone-enabled KoBo Collect or open data tool kit. The field support assistants understood Hausa, the most dominant language spoken in Northern Nigeria. The field assistants were trained for two weeks to administer the questionnaires using the KoBo Collect or open data tool kit. The data collection process lasted nine months, between February and October 2021. Household and officials' questionnaires were administered at the houses of the respondents and at their offices, respectively, with the help of trained research assistants.

CHAPTER THREE

THEORETICAL UNDERPINNING OF THE STUDY

3.1 Introduction

Theories are targeted at enhancing the understanding of phenomena. Theories are used to explain phenomena and predict the various questions that will guide discussions on the issues when the phenomena are being reviewed or studied. A theoretical framework serves as the backbone of a study and provides the basis for arguments, propositions, and discussion linkage. This position is further reinforced by Sunday (2015), who avers that theories serve observatory, predictive, and explanatory roles and provide frameworks that can link a researcher's abstractions, realities and expositions to generate future research directions.

Four theories were used for this research, and they were amalgamated in order to understand the strengths of the arguments of this research. These were the Citizens' Participation Theory by Arnstein (1969; Gaber, 2019) which was viewed within the context of procedural theories laying down the various methods of development planning undertakings and exposing the challenges of the multiple processes, while at the same time examining five critical analytical approaches to explain the outlook of planning and development resulting from actions taken. The other theories utilised were the Modernisation Theory (So, 1991), the Infrastructure Theory (Friedmann & Hudson, 1974), and the Dependency Theory (Prebisch, 1952).

3.2 Citizens' Participation Theory

As the name suggests, citizen participation is a process in which community members actively take part in initiatives that aim to improve the quality of their daily lives and access to resources in the community. According to Midgley et al. (1986), the history of citizen engagement may be traced back to western ideology, community development, and social work. Taking responsibility for health and well-being is essential for community participation. Individuals and small groups can grow and evolve in the context of a community. It is common to refer to community development and community organising as a strategy for improving people's lives and their communities.

Public participation is the inclusion of the public in any organisation or project activities. According to Hubley (1980), citizens' participation covers many different actions. In

Arnstein's (1969) thinking, participation redistributes decision-making power, and Blum and Abbott (1996) add that citizens' participation is equal to the development of society.

Citizens' engagement in implementing projects by integrating the varied personal viewpoints in a community has been defined in research (Blum & Abbott, 1996; Imparato & Ruster, 2003). Participation is a process through which people share resources, train, implement policies, and execute programmes. An early promotion strategy that involves members of low-income groups and those in dire need must enlist the public's help. National political participation implies deciding on government policies to solve social challenges. The democratic system or force that produces a sense of collective control over resources and institutional choices is called citizen inclusion.

Public engagement is defined as an interchange between the government, individuals, stakeholders, and corporations to facilitate dialogue on a given issue or problem (Webler et al., 1995). In this larger concept, communication and power are shared among various players in a collaborative and mutually beneficial process. Arnstein's Ladder of Engagement in the 1960s made the notion of citizen participation renowned in the U S (Arnstein, 1969). Later, it was brought to Africa and Asia during the colonial era. Following Arnstein's experiences in 1960s American cities, she offered her methodology for measuring citizen engagement.

Her participation ladder is a generalisation of reality, but it can explain some essential participation and non-participation among citizens in a community. According to her Ladder of Participation, there are eight types of participation and non-participation, which are: manipulation, therapy, informing (*non-participation*), consultation, placation, partnership (*tokenism*), delegated power, and citizen control (*citizen power*) (Arnstein, 1969; 1971) (see Figure 3.1).



Figure 3.1: Arnstein's Ladder of Participation

Source: Arnstein (1969; 1971)

1. **Manipulation** (non-participation) at the bottom of the ladder of citizens' participation is the lowest form of public involvement and might also be called non-participation. Often, the projects have nothing to do with helping the disadvantaged groups and more to do with officials' interests.
2. **Therapy** (non-participation): A plan/project is proposed, it is usually the best for the citizens, and the participation process aims to achieve public support.
3. **Informing**: The most critical first step to legitimate participation is informing. However, too often, the emphasis is on a one-way flow of information and there is no channel for feedback from citizens.
4. **Consultation**: Again, a legitimate step towards participation, i.e., attitude surveys, neighbourhood meetings, and public inquiries. However, there is also only a one-way flow of information. Informing and consultation enhance participation, allowing people to hear and voice their decision-making, but there is low public participation.
5. **Placation**: People can play advisory roles, even though power holders still control the decision-making. The higher levels of the ladder signify that citizens are in total control of the decision-making.
6. **Partnership**: People can debate and involve themselves in negotiations with power holders at this stage.
7. **Delegation**: Community members holding a clear majority of seats on committees and have delegated powers to make decisions.
8. **Citizen Control**: At this level, people handle the entire process of planning, policymaking, and managing a project.

In the colonial era, citizens' participation improved local welfare and trained the administrations' local people. This was usually a top-down approach. As a result, various methods developed have successfully gained broad support from the major players in the spatial development sphere.

Three approaches to citizen participation exist:

- *Government/municipal control = top-down approach;*
- *Independent organisations/community involvement = bottom-up approach; and*
- *Partnership approach = government and citizens are working together.*

The ideology of community participation emphasises the importance of involving the entire community. According to Mabogunje (1981), city development entails an all-encompassing restructuring and mobilisation of the city's inhabitants to better prepare them for the challenges they face on a day-to-day basis, as well as the shifts that result from this. Residents as players in city growth may not always be sustainable, but public participation is essential for sustainable urban development. According to Hubley (1980), individuals and major groups must work together to increase the citizens' participation in their communities, and town hall meetings are commonplace at the beginning of a programme since they allow everyone to engage in the conversation.

Citizens' Participation is a fundamental procedural theory that grounded the current development research. However, it was also necessary to find the proper analytical concepts to support the claims of Citizens' Participation in physical development. Based on this assumption, additional theories were chosen to supplement public engagement in physical growth and to indicate the connections between sustainable urban development, urban liveability, and inclusive physical development.

3.3 Modernisation Theory

After World War II, a global communist movement was established and the former Soviet Union's influence extended beyond Eastern Europe to China and Korea. New countries were created in the Third World as European colonial powers collapsed in Asia, Africa, and Latin America. Smelser (2013) claims that modernisation has produced the challenge of integration and coordination of the activities in diverse surroundings.

In a political sense, Coleman (1968) stresses three main features of modern societies:

- Differentiation of political structure.
- Secularisation of political culture - with the ethos of equality, which
- Enhances the capacity of a society's political system (Coleman, 1968, pp. 276-278).

According to Rostow's Economic Development Theory, modernisation is a five-phase process central to the Modernisation Theory of Development for any civilisation undergoing modernisation (Shareia, 2015). As time goes on, civilisations increasingly resemble one another since the modernisation patterns are such that the more highly modernised countries become, the more they resemble one another (Levy, 1967, p. 67).

Complacency toward countries in Western Europe and the United States is a common theme in discussions of "modernity" and "modernisation." Economic growth and democratic stability are unparalleled in these countries (Tipps, 1976, p. 14), and once the process of modernisation has begun, it is impossible to stop. This means that once Third World countries meet the West, they will be unable to resist the urge toward modernity (Tipps, 1976). Coleman (1968) argues that modern political systems are more equipped than old ones to deal with national identity, legitimacy, penetration, participation, and distribution. In the long term, development toward modernity is not only unavoidable but also desirable.

As the last point, modernisation takes time and is a gradual shift, rather than a radical one. As a result, its full significance is typically only realised over several decades or even centuries. These presuppositions are taken from evolutionary theory in Europe and the United States (Huntington & Nelson, 1976). It is based on the functional-structuralist approach that stresses the relevance of structural factors at a cultural level and equilibrium; a built-in process of change in social institutions. These notions are based on Parsons' sociological theories (So, 1991).

These assumptions are as follows:

- Modernisation is a systematic process. The attribute of modernity forms a consistent whole, thus appearing in a cluster rather than in isolation (Hermassi, 1978);

- Modernisation is a transformative process, and for a society to move into modernity, its traditional structures and values must be replaced by a new set of values (Huntinton & Nelson, 1976); and
- Modernisation is imminent due to its systematic and transformative nature, which builds change into the social system.

Rostow's concept of five stages provides the basis for economic modernisation theory. The Marshall Plan and the Latin American Alliance for Progress may be seen in action. Other writers have expanded the idea into other fields such as religion and the pajanes villages of South-East Asia. Modernisation Theory was popular in the 1950s but came under fire by the end of the 1960s. Third World nations are viewed as old-fashioned, while Western countries are seen as being new. Developing countries must absorb and adopt Western ideals to progress.

Critics of modernisation argue that there is no one set of traditional values in Third World nations; their value systems are quite diverse. Conventional and contemporary transactions do not always have to be mutually incompatible. For example, China appears to be operating on traditional ideals despite its rapid economic progress. Both classical and modernisation studies examine the impact of modernisation on society, however, there are fundamental differences between classical and new modernisation studies. Tradition hinders progress, but the practice is an enabler in the new system. The new approach uses specific case studies presented in a historical context. The new way of looking at international relations departs significantly from the traditional one-way road toward the United States and European models. The new approach places a higher priority on external elements such as conflict and potential sources of conflict (So, 1986).

3.4 Infrastructure Theory

In 2005, Frischmann came up with the concept of Infrastructure Theory. Continual public access to infrastructure is critical in this approach, which argues that it adds value to society. For Frischmann (2005), free access to infrastructure impacts the community substantially and positively. Per the proponent of this view, the government is typically responsible for supplying infrastructure through various funding sources, including state resources and taxes on residents and institutions. The components that improve local inhabitants' socio-economic status and well-being have been identified as various types of infrastructure, which act as catalysts for

and a signal for growth through time and space (Oguzor, 2011).

Isolation does not necessarily translate into a better quality of life regarding infrastructure. According to classical social contrast theorists, maintaining public facilities for infrastructure development is essential for achieving its stated goals (Smith, 2010). Several studies, including those by Satish et al. (2007); and the World Bank (1994) found that infrastructure such as piped water and power supplies, telecommunications, sewerage and solid waste facilities, as well as roads, interurban railways, ports, waterways, airports, and drainage systems can improve urban liveability and consequently the well-being of city residents. Urban infrastructure is essential for long-term viability, a high quality of life, and equitable growth. It also helps cities compete economically.

As a result of Ndulu's (2006) study results, there has been an increase in studies on the importance of infrastructure in Africa's economic productivity. Microeconomic evidence at household and business levels and infrastructure's direct influence on macroeconomic (production-related) indicators are the focus of these research interests (UN-Habitat, 2013). The Infrastructure Theory was developed in the 19th century to explain the rise of people and places. Even today, the idea may be used to uncover and dissect the role that infrastructure plays in society's development, and research confirms that infrastructure is critical to economic growth and higher output.

The consequences of infrastructure might be both favourable and/or adverse. To grasp the implications of infrastructure more fully, it is necessary to consider the various types of it with economic and factual data and social and cultural cues (Havel, 1996; World Bank, 2002). It is impossible to comprehend or implement this model fully unless it is coupled with other aspects. This study's adoption of the Infrastructure Theory was based on the idea that infrastructure could serve as a helpful tool or resource for decreasing costs (at the individual or household level), fostering social integration, and improving the quality of life for local citizens. Realising that city people's existence depends on the enhanced availability, accessibility, and affordability of traditional social amenities is not as nebulous as it first looks. Acknowledging and accommodating urban inhabitants' social demands as part of the overall space is essential for the long-term viability of the entire context (rural and urban).

Frischmann (2017) argues that a user's choice of how to utilise a given location's infrastructure is up to them, and its provision cannot be overstated. The human capacity to optimise resource potentials varies across an area since the value or importance placed on social facilities or services is frequently subjected to the narratives of the suppliers (public/government or private players) and the consumers (the public or urban residents). Furthermore, it is essential to remember that collaborative management by both producers and consumers, based on equality of duty, boosts the government's ability to expand public provision, which generates a multiplier impact for private operators and cannot be disregarded (Udah & Bassey, 2017).

3.5 Dependency Theory

The Dependency Theory originated in the 1950s from the Economic Commission's study of Latin America and the Caribbean, and Raul Prebisch was one of the best-known proponents. The main points of the Prebisch model were:

- Regulating the monetary exchange rate, placing more emphasis on fiscal policy rather than monetary policy.
- Establishing conditions for development inside a country.
- Encouraging a more effective role for the government in national development.
- The creation of an investment platform that gives national capitals a priority role.
- Enabling the entry of external capital according to national development priorities.
- Boosting Latin America's industrialisation process by promoting a more effective domestic demand in domestic markets.
- As a result, higher wages and salaries for workers would impact internal market aggregate demand in a positive way.
- This included more effective government coverage of social services to disadvantaged sectors, and
- A national strategy based on the import substitution model that protected national output by introducing tariffs and quotas on external markets (Bodenheimer, 1970).

The Reliance Theory influenced Prebisch and ECLAC's proposal in the early 1950s (Prebisch, 1952). However, authors such as Falleto and Dos Santos also contributed as these critics claimed that ECLAC's growth objectives had failed, leading to the establishment of the Dependency Paradigm. This more advanced theoretical model was published somewhere between the end of the 1950s and the mid-to-late 1960s. Andre Gunder Frank and Raul

Prebisch were the primary developers, with input from others such as Theotonio Dos Santos, Enrique Cardozo, Edelberto Torres-Rivas, and Samir Amin (Bodenheimer, 1970). Neo-Marxism, Keynes' Economic Theory, and liberal economic concepts developed in the United States and Europe due to the Great Depression of the 1920s are all incorporated into this Theory of Dependency.

The four pillars of Keynes' Theory of Interdependence are as follows:

- To achieve higher levels of national development.
- It is necessary to acknowledge that the industrial sector is essential since it can provide more value-added products than the agricultural sector.
- To increase workers' income to generate more aggregate demand in the national market conditions.
- To promote a more effective government role to reinforce national development conditions and increase living standards (Dos Santos, 1971).

Classical Marxism and Neo-Marxism are very different approaches to social revolution. Foster-Carter (1973) argues that the classical movement predicted the need for a bourgeois revolution when national transformation processes began. From a Neo-Maoist position, it is imperative to "jump" to a socialist revolution in Third World countries.

Although the Modernisation school of thought and the Dependency school of thought are conflicted in many areas, they also have certain similarities, the most important being:

- Research focuses on Third World development circumstances.
- They are methodologies with high levels of abstraction and they focus on the development process, using the nation-state as a unit of analysis.
- The theories have polarising structural visions. On one hand the structure is that of tradition versus modernity - modernisation. On the other, it is core nations versus peripheral nations - dependency (Friedrich, 1970).

Cox (2019) contends that the Third World's rise requires the subordination of the core nations, unlike that of the core States. Latin America, particularly Brazil, is an excellent place to look for examples. Peripheral nations see their most significant economic growth with weaker ties to their centre. According to Maricato (2010), core countries recover from crises that divert

their attention away from the periphery, stifling the Third World's industrialisation efforts. Dos Santos (1971) contends that industrial-technological production rather than financial ties to more developed nations contributes to reliance in less developed countries.

Some of the most vocal critics of the Dependence Theory point to an absence of empirical evidence to support its claims. There are numerous abstractions used in this theoretical framework. Additionally, many say that the transfer of technological know-how from one country to another is detrimental to the nation's economic well-being. Brazil, formerly a colony, however, managed to break the cycle of underdevelopment in the US when it became a recipient of technological know-how from the US (Kay, 2019).

There are two researchers to thank for the new Dependence Theory investigations: Cardoso, Fernando and Enzo Faletto (1979); and Zirker (1998). Some researchers have focussed on the interrelationships between countries at all levels of government, including the systemic, sub-systemic, and internal linkages that bind them together. O'Donnell et al. (2019) studied the degree of independence between economic and political issues while working in Third World countries, particularly in South-East Asia. The comparative advantage of Brazil with its South American neighbours was addressed by Evans, whereas Gold focused on the dependency aspects of Taiwan's transition into a nation (Epstein & Knight, 1997).

In contrast to the classic Dependency perspective, which maintains that governments have no genuine autonomy from powerful elites, the new school of Dependency studies promotes the idea that national governments have some flexibility in achieving their goals. These concepts owe a great deal to Nikos Poulantzas. According to this political scientist, the governments of Third World countries have some degree of autonomy from the country's actual axis of power (Epstein & Knight, 1997). Nationalism is still a key source of criticism for the ideas of modernisation and reliance now in use.

The most recent movements have centred on global commerce, the global financial system, global technology, and military collaboration across borders. In Modernisation and Dependency theories, the idea of cultural transition is emphasised, with a shift from traditional to more Westernised or modern modes of living (So, 1991). Because individuals' lives are likely to adapt to match the source of the infrastructure, the availability of infrastructure is a

significant factor in both models of cultural change. A look at how Infrastructure Theory works is thus necessary.

3.6 Linkages between the Theories Adopted and the Research

3.6.1 Community Participation Theory and sustainable infrastructure development

The environmental movement has created a new paradigm for development: that of sustainable growth. Sustainability is the ability to meet current needs without compromising the potential of future generations. The concepts of sustainable development are included in the creation of sustainable infrastructure. Global economic growth has slowed due to national governments treating it seriously in the last few years.

Sustainable growth requires a balance between environmental constraints and growth. Government officials insist that everyone's basic needs be satisfied and that everyone, regardless of money, has the opportunity to pursue their aspirations. The four pillars of Boswell and Walker's (2004) definition of sustainable development are environmental protection and resource conservation, social advancement that considers all needs, and steady and safe economic growth that promotes job creation. Sustainable development is one of the most significant accomplishments of the 20th century, according to Shah and Sachdev (1999). Economic, environmental, and social fairness are essential components of a complete definition of sustainable development (Abidin et al., 2009; Odedairo et al., 2011). A country's physical assets, such as its transportation and communication infrastructure, power plants, and schools, are referred to as infrastructure (Brixiova & Kangoye, 2016; Olanipekun et al., 2014). The non-physical aspects of infrastructure include, for example, administrative management.

A long-lasting item must be able to withstand specific conditions to do so. Sustainable infrastructure is a term used to describe infrastructure that is both good for the environment and good for the economy (Olanipekun et al., 2014). Sustainable development and sustainable infrastructure are two different aspects of sustainability. There is no "all-inclusive" meaning for "sustainability". A more comprehensive understanding of the notion can be gained by combining the terms "sustainability" and "growth". Instead of seeing progress as pluralistic, Lawal and Oluwatoyin (2011) argue that development is about improving the material well-being of everyone. Building infrastructure in every civilisation should be fully encouraged where possible. The construction of more environmentally friendly infrastructure while also

meeting the demands of the present and future generations is referred to as sustainable infrastructure. Building infrastructure following green principles is essential to sustaining economic growth.

Policy reform based on community input is the goal of the "*Movement for Democracy, Justice, and Sustainability*", an activist group. There can be no prosperous metropolitan region without the active participation of its citizens (Kalsoom et al., 2018; Ribot, 2003; Shrestha & McManus, 2008). It is more likely that a community strategy will be developed by a neighbourhood organisation actively involved in planning and implementing it than otherwise (Healey, 1998; Sarker et al., 2008; Shrestha & McManus, 2005). To achieve equality, efficiency, and sustainability, it is critical to include previously underrepresented communities' unheard voices. Unfortunately, disadvantaged and oppressed groups are typically kept out of the political process, and their participation is often reduced to mere tokenism. Does it make sense to include the poor and other marginalised groups in the initiatives of government agencies and political parties at the national level?

The literature on community participation in urban planning is growing, and it shows how it helps bring together information and expertise from various backgrounds to improve outcomes (Margerum, 2002); achieves mutual learning and personal growth for participants (Healey, 1997; Sager, 1994); creates a sense of control over outcomes; and generates consensus over policies and support for implementation (Healey, 1997). Stakeholders' participation helps to ensure a more democratic decision-making environment and increases the ability to plan and implement projects (Jenkins, 2001). Australian planning is governed by influential politicians and senior bureaucrats focused on short-term economic aims rather than long-term objectives. There is no consideration for the interests and wishes of public organisations when they are invited to speak.

When stakeholders are involved in the decision-making process, they are more likely to have a voice in the outcome. They will miss out on the rewards of any action they take if they are not allowed to participate in improving their lives. The term "involvement" was used by Ofuoku (2011) to characterise activities such as taking an active role in community decision-making, raising knowledge of local concerns, attending public meetings, and making related attempts to influence planned initiatives through individual and group acts.

The degree to which citizens should have a say in state policy is at the heart of community participation. Changing the balance of power in, for example, tourist planning and growth requires involving community stakeholders. Tourism is merely one facet of everyday economic and social life in an urban area, but many people fail to recognise the importance of their municipalities and neighbourhoods. Policy studies literature emphasises community involvement in community leadership, citizenship, and community organisation. In this study, the author examines the relationship between academic disciplines and the intersection of practice and theory. This widely discussed metaphor has six rungs, dependent on the source, to distinguish between the various levels of engagement, from authoritarian consultation to collective citizen power. Anyone who works or lives in a given area has a right to be informed about the air pollutants and participate in the decision-making that directly impacts their region. A more flexible framework will be created if people from various interest groups are involved.

3.6.2 Community Participation Theory and urban liveability

Urban planners and policymakers must move beyond the use of social-environmental measures to improve the city. To make cities more liveable, it is necessary to consider how many people can do so simultaneously. For a notion to become a universal philosophy, it needs to be examined in detail. According to some critics, the term "urban liveability" has predominantly been used to describe the quality of life in cities (Kaal, 2011; O' Donnell et al., 2014). Despite their significance, problems of government and citizenship are rarely discussed. Liveability and how a community's political environment are affected by a place's quality of life are topics that are seldom discussed in the media (Kaal, 2011; O' Donnell et al., 2014). According to several studies, the urban poor in Africa have been negatively affected by state and municipal administrations' inability to interact with and incorporate the perspectives of marginalised populations into development efforts (Narsiah, 2010; Parnell, 2005; Pieterse et al., 2008).

According to Van Kamp et al. (2003), "liveability" has multiple meanings. The definition of what makes a place liveable is constantly changing and is directly proportionate to where a person likes to live. Vine's (2017) philosophy of everyday living is reflected in the concept of liveability.

The emphasis on individuality, democracy, and the nuclear family in Australian culture has

recently resulted in a fall in place-based culture (Davison & Hyland, 2006). There has been an increase in social division and segregation, consumerism, and the establishment of a postmodern community. However, there has also been a progression in information and communication technology (ICT) and advancements in physical and social mobility, educational options, and residential choices (Hampton & Wellman, 2001).

Faster social connections and support networks have arisen because of these advancements (Bauman, 2013). Because of that, they have progressively eroded the community's geographic base, which has been built up over time through meaningful local experiences (Pocock, 2003). A site is no longer a requirement for a community, according to Ziller (2004), so what are the ramifications for the design and delivery of liveable communities if this is true? People's overall quality of life in urban surroundings can be attributed to urban liveability, and quantitative and subjective indices to measure urban liveability have been proposed by Pacione (2003). Depending on the individual, these indices/categories include the geographic location, geographic size, and domain specificity, among others.

3.6.3 Community Participation Theory and inclusive infrastructure development

The term "community participation" has a wide range of interpretations. Many additional phrases, such as "community involvement", "community inclusion", and "community integration" are used interchangeably in the literature (Cobigo et al., 2012; Overmars-Marx et al., 2014). Many other concepts, such as social inclusion, include "community participation" in their definitions (Simplican et al., 2015). To inform physical development, the concepts of inclusion, involvement, integration, and social participation are all used to define community participation in this chapter. It is viewed as a joint obligation of society and individuals to participate in communal life (Cummins & Lau, 2003; Hammel *et al.*, 2008; van de Ven *et al.*, 2005).

Participation is both a right and a fundamental principle that underpins the fulfilment of other demands. A citizen's right to engage in public affairs and decision-making processes is guaranteed under Articles 27 of the UDHR and Article 25 of the International Covenant on Civil and Political Rights (ICCPR) (Hammerstad, 2000). An approach built on the concepts of civil liberties honours these ideas and empowers people to alter their relationship with the government and the formal power structure (Fox, 2006).

As government power grows, so does community involvement. Further compounding this in many developing countries is the former colonial authorities who failed to establish residents' and communities' participation and instead excluded most of the inhabitants from utilising much of the infrastructure. The colonising governments held absolute power in most of these countries, which contributed to the earliest protests and rights agitation long before the Universal Declaration of Human Rights was adopted (UDHR).

Professionals such as planners, architects, and civil engineers considered communities ill-equipped to contribute effectively and withdrew themselves from communities. While the goal of professionalisation was to improve the infrastructure, it did not include feedback from the people who would benefit from it (Medayese et al., 2016). Increased demand for services and a higher standard of living are two benefits that might result from community involvement in infrastructure development. Communities' and citizens' participation also play an essential role in defining the residents' culture, acceptability, and overall perception of infrastructure and service delivery (Epstein & Knight, 1997; Noguera, 2001).

3.6.4 Modernisation Theory and sustainable infrastructure development

The International Union for the Conservation of Nature and Natural Resources (IUCN) initially coined the term "sustainable development" in its World Conservation Strategy in 1980. In 1987, the World Commission on Environment and Development (WCED) published *Our Common Future (Brundtland Report)*, which gave it its current meaning (Wackernagel, & Rees, 1997). Wackernagel, & Rees (1997) defines sustainable development as "*development that meets the present requirements without compromising the potential of future generations to meet their own needs*", yet this definition is an ambiguous one. Despite its ambiguity, the world community has embraced the Wackernagel, & Rees definition.

The concept of sustainability also proposed a way out of the catastrophic scenarios of the past decades, and the notion swiftly established a dominating worldwide discourse on ecological concern (Dryzek, 1997). In the 1980s, environmental modernisation was the most common method for implementing sustainable development policies. Environmentalism was argued to be essential to economic prosperity. International collaboration to combat climate change might be considered to have elevated the issue of global warming and the climate problem.

New environmental technologies enable increased economic growth and competitiveness because of their role in this policy area. Since ecological modernisation is now the leading global environmental discourse and strategy, the battle against climate change fits perfectly with this new area of focus. As a result, technical advancements and renewable energy are accepted as a life raft to keep humanity from the ultimate environmental catastrophe by improving energy efficiency and reducing carbon emissions. It is well acknowledged that energy efficiency can be used to reduce throughput. Reduced use of natural resources and waste generation will also then be achievable, resulting in a more cost-effective manufacturing process. With such an outlook, a new relationship between environmental and energy policy is inevitably brought to the fore.

In the 1950s and '60s, the Modernisation Theory took hold, and researchers sought to explain why poorer countries were unable or unwilling to develop into modern societies (Aboderin, 2004). Traditional beliefs and cultural characteristics are thought to impede a country's progress (Phinney & Baldeomar, 2011). Policies designed to help the poor improve their quality of life frequently involve distributing information about more efficient production methods (Weimer & Vining, 2017). Modernisation theorists contend that it is an evolutionary process that necessitates a country's progression through various stages (Inglehart, 2018).

New ways of doing things are advocated by Modernism Theory. According to Holmes (2013), people's perceptions of the options accessible to them are influenced by their use of language. According to Adekoya and Ajilore (2012), there must be communication for any laudable sustainable growth. Ecological Modernisation Theory asserts that the only "*possible route out of the ecological catastrophe is by going farther into the process of modernisation*" (Hajer, 2020). Modernist institutions, such as markets, technology, industrialism, and the state, are capable of reversing human society's environmental destruction. With the simultaneous "decolonisation of the economy" and the "economisation of ecology," modernity will improve environmental sustainability. Economic growth becomes less dependent on natural resources as resource use gets more eco-efficient. Although the economy may continue to hurt the environment, the magnitude of the impact of economic development on the environment will decrease over time.

3.6.5 Modernisation Theory and urban liveability

The term "liveability" is a highly malleable concept that has undergone numerous definitional shifts (Joss et al., 2013). It is possible to study historic industrial landscape regeneration by examining liveability articulations (Cherchi, 2015). Urban planning, environmental protection, and social and economic progress determine whether a location is liveable (Sofeska, 2017).). As a result of new urbanism and neo-traditionalism, the pre-automobile urban patterns of American cities have been given new life (Medayese et al., 2021; Passell, 2013; Pradhan, 2017). These plans do not feature the toxic industrial uses that previously dominated the waterfronts of those regions (Gould & Lewis, 2018).).

In another way, a city's ability to access and reclaim nature is significant in determining its liveability. This depends on the country's status; whether it is a developed or developing one. Most of the top cities are medium-sized, located in wealthy countries, and have relatively low population densities. An example of one of these top cities is the city of Vienna, which has a well-developed infrastructure that can adapt to the city's changing needs. The population of these cities was 306 million in 1950 and it is expected to be about 3500 million in 2030.

Between now and 2050, these cities will have to accommodate an additional 2.7 billion people. It is impossible to simplify modernisation to a single factor or dimension because it affects every aspect of human thought and behaviour. Its components are industrialisation, urbanisation, social secularisation, media mobilisation, increased political participation, and improved literacy. Modernisation began in Europe, but it has now spread worldwide. After the Industrial Revolution, many people associated urbanisation with secularisation, meaning that urbanisation and secularisation were considered part of the city's modernisation (Williams, 2011). Cities grew in population due to urbanisation's materialism and market fundamentalism, which exposed people to a broader range of lifestyles and made them more reliant on rationality. However, as has been the case with most previous secularisation predictions, there has been no clear association between the rise of urbanism and secularism (Casanova, 2011).

3.6.6 Modernisation Theory and inclusive physical development

Communism and capitalism were two of the main modernisation approaches that emerged after World War II. Social Change Theory is heavily influenced by stories (Meier, 2001), and

Realism and Modernisation theories are no exception. Lerner, Levy, and Eisenstadt have all made significant contributions to the Modernisation Theory. To address social and economic concerns like poverty, community-based economic activities may be helpful. Still, market-based solutions are necessary, but they must rein in the worst excesses and recognise the omissions of free-market capitalism.

The goal is to build mechanisms of social feedback that improve the relationship between those in power and the rest of the group. Solid Economic Modernisation's scope includes Reflexive Modernisation. Those who favour these reforms acknowledge that bringing "outsiders" in to positions of authority runs the risk of them being co-opted. The design challenge is to redesign the power structures so that collective input may be accommodated.

3.6.7 Infrastructure Theory and sustainable infrastructure development

Brett Frischmann's Economic Infrastructure Management Theory is tested when figuring out how best to provide socio-economic growth with adequate infrastructure. According to this theory, making public facilities available to the general public has numerous advantages, and having easy access to resources significantly increases human productivity and potential (Frischmann, 2005). Buildings should be used for projects that benefit society and according to Frischmann, the state should ensure that the public has access to many revenue sources, including taxes and state funds (2005).

The concept of sustainable development incorporates sustainable infrastructure development. It is possible to find synergies in developing nations between the efficient administration of trash and recycling, the provision of safe drinking water and sanitary facilities, and the use of renewable energy sources. Jump-starting investment in a green industrial transformation can result in more jobs for young people in the labour force. Three pillars support sustainable development (economic development, environmental protection, and social justice). Infrastructure that maintains financial and ecological viability can be classified as sustainable infrastructure.

One of the essential aspects of sustainability is its potential to expand when used with another phrase like development. It would appear that building infrastructure is the key to the advancement of our world. In developing countries, notably Nigeria, the pursuit of sustainable

infrastructure development is most desirable. Construction methods, materials used, and whether or not infrastructure should be built are all considered when determining whether or not a project is sustainable. Nigeria's mission is to promote economic growth and alleviate poverty simultaneously. There must be a balance between economic and environmental change. Environmental protection measures must be implemented by decision-makers to accompany infrastructure development, and the policies put in place should promote resource efficiency and reduce supply chain waste.

3.6.8 Infrastructure Theory and urban liveability

Investing in infrastructure is essential to a city's economic, social, and environmental success. As a measure of minimising economic harm following the 2008 financial crisis, enormous sums have been allocated to urban infrastructure upgrades: evidence of its significance. It is anticipated that between 2005 and 2030, almost USD 41 trillion will be required worldwide to repair and create new infrastructure systems in established and quickly expanding cities (Doshi, 2015). Different countries (and their cities) confront various obstacles in developing urban governance systems, delivering infrastructure, and improving urban liveability. When it comes to the quickest urbanisation and population growth rates, many cities in low- to middle-income nations (especially in Asia and Africa) are vulnerable (UN Department of Economics and Social Affairs, 2018).

Increasing socio-economic imbalances, unemployment, unstable working situations, traffic congestion, and having to guarantee access to nutritious food are only a few of the issues that have been cited as hampering urban liveability (Baker et al., 2017; Medayese et al., 2022). Inequitable access to modern infrastructure is a worry (i.e., appropriate sanitation, clean drinking water, and mass transit systems). An increase in urban transportation capacity could facilitate high-density, mixed-use development near the nodes. Additionally, cities' social equity is affected due to long-term improvements in infrastructure programmes (Manaugh, et al., 2015). There is a growing recognition among many urban growth regimes that the environment is no longer an option, but an essential part of the equation and governments worldwide are beginning to take environmental issues into account when formulating policies to ensure the economic growth of their cities, regardless of any new physical or political restrictions imposed by the climate (Pulido, 2017).

3.6.9 Infrastructure Theory and inclusive physical development

This study focused on the relationship between national income and infrastructure. In theory, excessive investment must be made in infrastructure to spur economic growth, but a large body of data suggests that most developing countries cannot support rapid expansion. People's fundamental human rights, inequality, and redistribution are the foundations of social inclusion (Easterly, 2007; Gupta *et al.*, 2015; Meier & Terán, 2012; Sen, 2000; Thorbecke & Nissanke, 2006). No one is excluded from the goals of social inclusion, and this includes improving participation and building human capital for those who need it most.

Inclusionary development policies aim to improve well-being by focusing on vulnerable areas, sectors, and arenas. They try to decrease vulnerability to dangers such as natural disasters and civil strife. Local ecological inclusion aims to safeguard local control over and use of resources. The Anthropocene, according to the author, is seeing an increase in the demand for limited resources and vegetation such as land, water, and air. To flourish and be happy within these constraints, one must adopt a new perspective on wealth and well-being. Perverse incentives for a materialistic society question the necessity for constant growth.

Differences in income, wealth, opportunities, and access between the rich and the poor are social inequities. It is predicted that by 2016, the wealthiest 1 per cent of Americans will own more than the rest of the population, up from 44 per cent in 2009. Scholarly engagements in inclusive development are necessary to counteract the effects of structural inequities. Thirteen of the seventeen Millenium Development Goals (MDGs) are concerned with social inclusion and consider ecological or interpersonal factors. With the first goal of eliminating extreme poverty, the third goal is to improve overall health and well-being (Ionescu *et al.*, 2020).

There is little emphasis on involving everyone in the development process for most of the goals. Violence and death, abuse, trafficking, and torturing of children are all addressed in the goal 8. According to Klinenberg (2018), social infrastructure is a broad term. The defining trait is that it allows for a sense of community, regardless of race or ethnicity. A city's social infrastructure relies heavily on public institutions that are open to the public and meant to serve the public.

This has gotten much attention, as you can expect. There are debates about who should be involved in the design process and just how public a library is, for example, because of its

value. Cities like London, which have a significant immigrant population, can benefit significantly from a vibrant high street, and infrastructure like libraries' social spaces can be surprisingly imaginative. A city's population is likely to require a variety of religious buildings, such as synagogues, mosques, gurdwaras, and churches, and "community life, welfare, and well-being" have been made possible by commercial spaces tailored to specific social groupings within the community.

3.6.10 Dependency Theory and sustainable infrastructure development

According to Dependency Theory, economies in the Global South's periphery are trapped in a position of dependence. Despite Modernisation Theory's insistence, the domestic bourgeoisie are not seen as a source of progress. Instead, they are viewed by Dependency Theory as rent-seekers who reap the rewards of their country's underlying exploitation. The methods by which the international capitalist order damages the economies of developing countries are the focus of Dependency arguments. The system is dominated by advanced economies, which transfer economic excess from underdeveloped countries via international trade and investment. Underdevelopment is exacerbated by trade imbalances that skew trade threats towards developing countries.

3.6.11 Dependency Theory and urban liveability

The Dependency Theory is among the theories that look at development from a Third World perspective (Kabonga, 2016; Santos, 1970). According to Stuteville and Jumara (2010), institutional restrictions can limit transformation in public administration. These researchers found that Wilson and Weber's traditional teaching was the most difficult to alter. The Dependency Theory approach to urbanism aims to revive the importance of human factor and a sense of location in the city. They have advocated for returning to traditional building forms and urban space types. Conventional and modern urban design ideas are combined in this normative approach, known as Urbanism.

3.6.12 Community Participation, Modernisation, Infrastructure, and Dependency Theories' relevance to the operationalisation of sustainable urban infrastructure-urban liveability-inclusive physical development nexus research

Regardless of the number of ideas studied, this research will fail to meet its stated objectives if they are not directly linked to the investigation. For this reason, the hypotheses reviewed

here must be connected to actual research. The ideas provide a compelling framework for describing the research's rationale. In light of the preceding, it may be concluded that the proposed study is connected to the Sustainable Development Goals in a complex way. The Sustainable Development Goals are divided into three concentric rings, with the inner circle emphasising people-oriented welfare (Goals 1, 3, 4, 5, 10, and 16), which is a crucial element of urban liveability and fosters fairness, a prerequisite for equitable development and balancing inequalities in space and between people. This is shown in Figure 3.2 and the sustainable development context is provided by Kumar et al. (2016).



Figure 3.2: Sustainable Development Framework

Source: Kumar et al. (2016)

Providing infrastructure within the living space is advocated in the middle ring. Two, six, seven, nine, eleven, and twelve are the linked urban infrastructure sustainability and development goals that make up the central ring. Providing infrastructure is, therefore, an essential part of city development. Hence, theories such as Infrastructure, Modernisation, Dependency on outside sources, the global system, and globalisation must be considered while developing city space.

The macroeconomic evidence that a variety of scholars have examined supports this claim. How the availability of facilities affects production, human growth, and productivity has been examined. Findings from a 1989 study on the macroeconomic implications of road infrastructure show that infrastructure's economic impact significantly impacts the elasticity

of the national GDP. According to Romp and de Haan (2005), infrastructure boosts efficiency, productivity, the creation of new jobs, and private sector investment. Similarly, microeconomic research shows that infrastructure availability and provision directly impact household health, mobility, and literacy, and literature has focused primarily on road infrastructure (Kumar, 2011).

A significant percentage of headcount poverty indexes can be found in an area with a long commute time, according to Gibson and Rozelle (2003). The cost of transportation rises because of a lack of capital investment in road infrastructure. In their research in Cameroon, Gachassin et al. (2010) found that road infrastructure creates prospects for employment development, which is an evident benefit of road infrastructure. It is critical to consider how roads will affect people's well-being and economic development in the long run.

Using data from Nigeria, Udah and Bassey (2017) studied the link between infrastructure, human capital, and industrialisation in terms of time frames. According to the authors, positive externalities and multipliers for industrial growth are generated through inter-sectoral infrastructure linkages (Udah & Bassey, 2017, p. 59). For this reason, Hall (2018) advocates for public participation in financing infrastructure to encourage the public to view infrastructure as a common good.

Investments that boost a country's industrial output are referred to as "productive investments". Speculative investments, on the other hand, typically lead to quick gains in the stock market but they do not create a solid base for long-term economic growth and, thus, are more volatile. According to Peet and Hartwick (2009), the theory of Dependency is based on ideas that are like those of the theory of Underdevelopment, namely that Europe and America have developed a Marxist approach to development that prioritises European and American countries as central for growth while treating Third World countries as peripheral (Peet & Hartwick, 2015).

During the Enlightenment era, civilisations' social and cultural formulations became too exhausted to establish social and economic control throughout communities. This was conveyed through the evolutionary paradigm change to Modernism. Capitalism, colonial power, and centralised rule were also used to plunder resources in Third World countries, making them dependent on Western countries for survival (Matunhu, 2011).

When looking into the theory's flaws, Peet and Hartwick (2009) conclude that one of the primary causes of underdevelopment in Third World nations is corruption. One of the critics of Modernism, Andre Gunder Frank's theory derives from the Marxist viewpoint and justifies this. As Frank points out,

Underdevelopment is not attributable to the persistence of archaic institutions and the existence of capital shortages in regions that have stayed separated from the stream of world history. While economic growth resulted from the emergence of capitalism, underdevelopment was produced by the same historical process (Frank, 1966 as cited in Peet & Hartwick, 2009, p. 168).

Since the Dependency Theory is a recent phenomenon, it has been argued that its emergence is exploitative because capitalist wealth production is concentrated in central places, such as metropolises (Friedmann & Wayne, 1977; Kapoor, 2002). Because of their structural and exploitative attitude, the central bourgeoisie affects peripheral regions (Kapoor, 2002), leaving such areas in a more impoverished state than before, and hence their dependence on the central areas.

Citizens' participation is also seen as necessary for the sustainable growth of cities in the present era in this study. Citizen's Participation (Aistein, 1969; Buchy & Hoverman, 2000; Midgley et al., 1986) idea has its roots in the built world, where people work together to create consensus and coordinate their actions through reasoned debate, agreement, and collaboration. It is better than a strategic move to serve individual wants (Lyytinen & Hirschheim, 1988). Tewdwr-Jones and Allmendinger (1998) dispute the concept of citizen participation, however, because it fails to consider the role of power and how it affects participation both inside and outside of the formal system. As a result, integrating a web of theories is necessary for developing the physical area of cities in Africa, Nigerian cities as well as other cities within their respective regions, and developing the physical locations of the cities across Africa.

CHAPTER FOUR

CONCEPTUAL DISCOURSE

4.1 Introduction

This research chapter is concerned with linking concepts to generate a model as a critical point of the study. The concepts considered are sustainable urban development, urban liveability, inclusive development, environmental awareness, and urban governance. These concepts shall be webbed together through various indicators to evolve the proposed integrated model for city development in North-Central Nigeria. This chapter shall include sections and subsections that deal with the definitions of the concepts, the principles of the concepts, the origin of the concepts, their strong points and limitations, indicators for the measurement of the concepts, and the concepts' relevance to the research.

4.2 The Concept of Sustainable Urban Development

The term, “sustainable development” was used for the first time in the 1980 International Union for Conservation of Nature (IUCN) report, “*World Conservation Strategy: Living Resources for Sustainable Development*”. The World Commission provided the most common definition of sustainable development for the environment and development in “*Our Common Future*”, also known as the *Brundtland Report*, published in 1987:

Sustainable development meets the needs of current generations without compromising future generations' ability to meet their needs. It contains within it two key concepts: the concept of needs, the essential needs of the world poor to which overriding priority is given; and the idea of limitations imposed by the state of technology and social organisation on the environment's ability to meet present and future needs (WCED, 1987, p. 43).

Agenda 21 defined sustainable development as a typical human development goal during the 1992 United Nations Conference on Environment and Development (US Coordination Centre for the UN Conference on Environment and Development, 1992). Since 1992, sustainable development has gained popularity as a political term and destination at all levels of government, from the national to the local level. Environmental degradation and pollution were linked to economic growth in the 1960s, giving rise to a growing interest in sustainable development.

The goal of human flourishing is at the heart of sustainable development. As a result, it emphasises the significance of balancing economic expansion with environmental protection, unlike many others. Development (improvement) and sustainability (maintenance) are the two fundamental aspects of sustainable development (SD) that are considered universally (to be maintained). Because of this, SD believes in all three of these factors when making decisions (Goodland & Daly, 1996). Three pillars of SD are sometimes referred to as these three aspects. People's well-being is enhanced as the environment and resources are protected (in the broadest biophysical and socio-economic meaning), and there will be no disadvantage to future generations. The pillars of environmental concerns and economic development through time and space must be linked to sustainable development. While prior development theories focused on economics, SD has thus far emphasised its social and environmental dimensions in politics, practice, and research (Oino et al., 2015).

Environmental, social, and economic factors are all intertwined, as seen in Figure 4.1. There is a connection between these three pillars. The social pillar (empowerment, inclusion, consultation, government, and institutions) is crucial to society since it is considered that the economy (growth, efficiency, and stability) exists inside the club. Environmental resilience, biodiversity, natural resources, and pollution are essential components of a healthy ecosystem. The environment directly impacts the energy and raw materials needed for housing, transportation, and other industries. Being able to meet the demands of the current and future generations is an integral part of sustainability. Thus, the ecological structure continues to be diverse and prolific for many generations, as explained by this concept. Human well-being is protected in this system, which includes environmental, social, and economic safeguards (Ban et al., 2019).

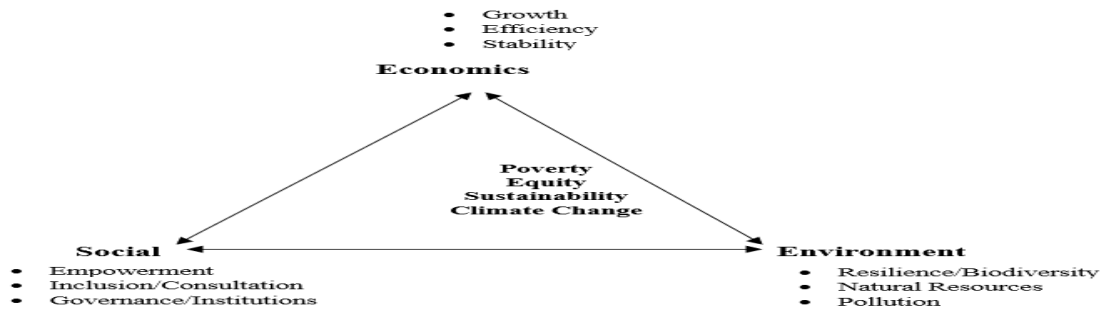


Figure 4.1: Sustainable Development Triangle

Source: Adapted with modification from Encyclopaedia of Earth (n.d.)

4.2.1 Difference between sustainable development and sustainability

There is much overlap between sustainable development and sustainability, yet they have very different meanings. Researchers have found it appealing to broaden an alternative expression of the relationship between environmental and social issues known as sustainability, which is conceivable but not surprising. The phrase “sustainable development” has been adopted by governments, the corporate sector, academia, and non-profit organisations (Bendell, 2017).

Ecologists in government and academia see development as a synonym for economic expansion, meaning that long-term sustainability aims to enhance rather than limit economic growth. Sustainability depends on a human being's ability to adapt to the environment. Various formulations in the literature have contested the United Nations' notion of sustainability. As a result, multiple academics have approached it from various angles.

The phrase "sustainable development" has varied connotations for different academics, and this is one of its most notable features. Several authors, including Mebratu (1998); Pinfield (1997); Robinson (2004); Rosales (2011); Godemann et al. (2011); and World Economic and Social Survey [WES] (2018), take a three-dimensional approach to sustainable development, focusing on the human condition, the environment, and the economy. Other researchers, including Gibson (2010); Giraud (2021). Spangenberg and Bonniot (1998); Tanguay et al. (2010); Wenger et al. (2016); and Xu and Coors (2012) regard sustainable development as a relationship between people and the environment. As definitions change over time, sustainable development becomes unworkable. A few academics argue that sustainable development is analogous to truth and justice, which is to say that it has notions that are not eagerly grasped in

their exact meaning by the general population. Others argue that, although it is a challenging concept, it may be implemented rationally and harmonically. Multifaceted systems are at the heart of sustainable development's physical and social sciences (Hunter, et al., 2015).

Good environmental performance assessment, environmental risk reduction, the integration of ecological strategies, the more efficient use of natural resources, the measurement of the environmental and carbon footprint, the management of emissions, environmental risk management, and ensuring compliance by communities, states, nations, and the entire world are the most critical strengths of sustainable development (Lee & Min, 2015).

The process of sustainable development is viewed as collaborative. A tiny group of technocrats or policymakers is not thought to have the power to compel sustainable development from the top down. The Rio Declaration's Principle 10 states that environmental challenges are best handled with the participation of everyone who is affected. Because of this, stakeholders play an essential role in determining what must be done and how (Guy & Kibert, 1998). Three different factors are included in the concept of sustainable development:

- Balanced growth (trade-offs between social, environmental, and economic interests).
- It was possible to have equity and shared responsibility in any place and period.
- Participation.

Environmental degradation and pollution are not included in that definition. Gains at one of sustainability's pillars hurt those at the others (Hosta & Zabkar, 2021 Sala, Farioli, & Zamagni, 2013).). It is impossible to define sustainability exclusively because there are so many responsibilities to achieve it. A more scientific and accurate description of sustainability is needed because different professions use the term in different ways, but essentially, it means enhancing human well-being while remaining within the ecological system's carrying capacity (Sassi, 2006).

In light of these challenges, it is not surprising that various interpretations of the meaning of sustainable development and sustainability tilt towards demonstrating the political and philosophical perspectives of the experts in question. It is generally agreed that sustainable development is defined as a course of action that is economically viable, socially equitable, and environmentally safe. To attain an appropriate ecological balance, sustainable development

must consider the three pillars, both individually and collectively. Sustainability is also considered at various levels, ranging from the project level to the national or continental level. Some consider sustainability as little more than a political statement, while others see it as an essential component of progress toward freedom and justice (Blewitt, 2008; Heolden et al., 2008; Mori & Christodoulou, 2006).

The idea of sustainability has been challenging to define because it spans a wide range of academic disciplines. According to recent events, sustainable development discourse relies heavily on scientific research (Nordensvård & Poelina, 2022; Cuthill, 2009; Vavik & Keitsch, 2010). Every stakeholder has a role to play in addressing sustainability issues, and those roles come in numerous shapes and sizes.



Figure 4.2: Schematic Representation of Sustainable Development

Source: Adapted from IUCN (2006)

Sustainable development is presented in visual terms Figure 4.2 indicates the relationship among its three pillars, the environment, society, and the economy, as three circles within circles, showing how this linkage can be understood. The economy is assumed to exist within community typology because all parts of the human economy require interaction. Social interaction is an essential element of society. The community, in turn, exists entirely within the environment with resources and energy obtained from the environment. The environment surrounds culture because man's needs can never be larger than the environment.

4.2.2 Different interpretations of sustainable development

Even though sustainable development may appear to be a basic concept, many researchers have attempted to use natural science to develop a shared understanding of it (Johanna et al., 2004; Murphy, 2012; Olewiler, 2006). As much as sustainable development is driven by the desire to better the lives of current and future generations, it also involves balancing the economic, environmental, and social dimensions. This implies that there have been several debates and counterarguments about achieving this balance. Disagreements among economists, environmentalists, and social scientists are primarily to blame. This suggests that its definition is not tenable long-term (Hilgenkamp, 2005; Ravetz, 2000).

Despoliation, degradation, and exploitation are some researchers' interpretations associated with "sustainable development", as is global resource extraction (Casula-Vifell & Soneryd, 2012; Atapattu et al., 2021; Dempsey et al., 2011), and these varying interpretations must be comprehended. These discrepancies have been categorised in several ways (Allenby et al., 1998; Dahl, 1997). These categorisations incorporate many assumptions regarding the relationship between man and nature, some of which value it (intrinsic value) and others which focus on the interests of the human race. Sustainable development policy and practice have a lot to do with these implicit and implicit assumptions that we all make subconsciously and unconsciously (Mabogunje, 2002; Stenmark, 2002; United Nation Development Commission. [UN], 2004). A variety of factors influence a person's standard of living, including the amount of pollution they are exposed to, the extent to which they are involved in decision-making, and how much time, money, scope, and geography they have to do so (Xu & Coors, 2012).

Assumptions about ethics or the nature of the economy can influence how sustainable development is defined (Adams, 2006; Banerjee, 2003). Some emphasise the potential to solve problems through growth and a free market economy, while others emphasise equality. On the other hand, other groups emphasise the significance of equity for all living things. It is general knowledge that there are two levels of sustainability: weak and strong (Bell & Morse, 2003; Vitousek et al., 1997). It is predicated on the assumption that welfare is not primarily dependent on a particular kind of capital and may, in most situations, be maintained by replacing manufactured capital with natural capital, which is weak sustainability. On the other hand, strong sustainability stems from a perception in which it is less evident that manufactured

capital can be substituted for natural. Environmental qualities such as irreversibility and uncertainty play a key role in strong sustainability arguments (Cash et al., 2003; Lester, 2006).

Divergent views exist on the societal mechanisms that lead to unsustainable growth and what should be addressed to deal with these (Hahn et al., 2018). It is possible to identify two primary ways of looking at environmental issues (Edén et al., 2000). Economic growth and environmental management can be reconciled by integrating environmental issues into existing institutional arrangements and methods of thinking, according to the concept known as ecological modernity (Gough *et al.*, 2008; Hajer, 2020; Rees, Wackernagel, & Testemale, 1996).). It is claimed that environmental issues come from severe cultural problems that can only be resolved by dramatic changes in our economic systems and production, distribution, and exchange practices. It is predicated on the premise that we must alter our conceptions of reality and our relationship with the natural world (Falkheden, 2000; Porritt, 2006), but thoughts such as this challenge some of the fundamental assumptions of the Western development paradigm.

The elusiveness of the notion of sustainable development makes it appealing (Gray, 2010; Brandon et al., 2017) and it is this elusiveness that helps to achieve broad agreement or at least a minimal commitment to a general understanding of change. However, the concept's usefulness diminishes when applied to more precise macroeconomic, political, or social developments (Cuthill, 2009).

Each region's unique environment dictates how sustainable development should be interpreted and operationalised to achieve its full potential. Although sustainable development has been around since the 1970s, advanced countries' sustainability models only consider global economic expansion, urbanisation, and industrialisation. Resource consumption is under more significant strain because of today's lifestyle, and there is overconsumption of resources worldwide (Farley & Costanza, 2010). In an ecologically constrained society, the idea of consuming more is problematic (Wackernagel & Rees, 1996). There are global imbalances in the supply and demand of commodities and services. Trade and consumption have gone global, making it more difficult for countries to balance these competing demands on the economy, social order, and the environment. Increasing social and cultural connections due to globalisation have resulted in exchanging social and cultural ideas (Gough et al., 2008), and man's impact on the environment has been shaped, resulting in issues like climate change. To

ensure that the people of the globe can live sustainably, all stakeholders must participate in the process of sustainable development.

4.2.3 The sustainable development process

The sustainable development process (SDP) provides cities and neighbourhoods with a framework for progressing towards sustainable development so that efforts can be channelled towards what is being done worldwide. There are three factors used as the metric of continuous growth, namely economic efficiency, social fairness, and environmental management, and they are ranked in the same order. Research has shown that many of the present methods published in the literature for estimating an environmentally sustainable development process adhere to basic sustainability principles.

Although numerous mantras describe sustainable development, each country has its own unique method that incorporates its demographic, cultural, political, and economic aspects to achieve long-term progress (Barlow et al., 2007; World Bank, 1992). Contrarily, the wealth and diversity of a country's resources may make it difficult to determine precisely how the so-called Local Agenda 21 processes of sustainable development are to be implemented (US Coordination Centre for the UN Conference on Environment and Development [UNCED], 1992). Every stakeholder must participate in the SDP process, and individuals, neighbourhoods, communities, local and municipal governments, non-profit organisations, and donor agencies are all stakeholders. Figure 4.3 illustrates the four-part breakdown of the sustainable development process. The objectives of the sustainable development process are outlined in the first section. The second portion demonstrates that local-scale quality criterion is required for a modelled SDP. A variety of evaluating tools are required to monitor the process in the third section, and the fourth and final section addresses the approach in local contexts.

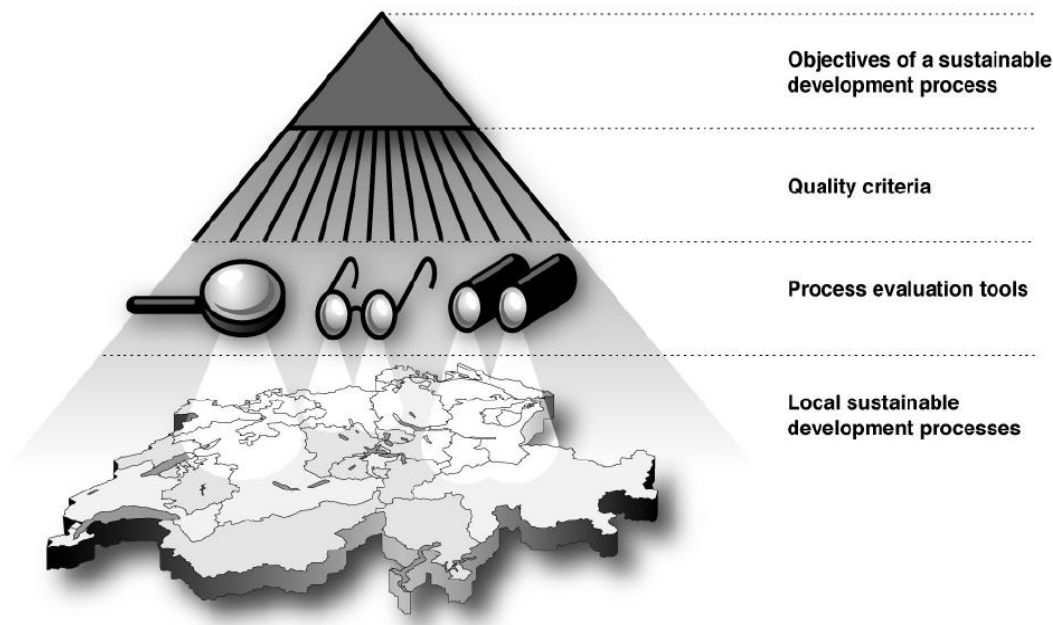


Figure 4.3: The Sustainable Development Process

Source: Federal Office for Spatial Development (2005)

4.2.3.1 The objectives of the sustainable development process

To be traditional, an SDP should allow all neighbourhoods to meet their current generational needs sufficiently without draining the resources that future generations will need for their demands. The Brundtland Commission report emphasises sustainable development as a critical goal. For this reason, the emphasis is on environmental competence, social equity, and conservation to foster growth while preserving natural reserves and considering how important it is for individuals to feel equally represented economically. The SDP should be a top priority at the municipal level to merge the economic and political processes to achieve sustainable development (Weiland, 2006).

All stakeholders must determine how and to what extent the local ecosystem will benefit future generations. The stakeholders include government at the local level, community-based organisations (CBOs), non-government organisations (NGOs), the community, donor agencies, and individuals. Figure 4.4 depicts the connection between long-term sustainability and short-term goals.



Figure 4.4: Sustainable Development Process at the Local Level

Source: Conoco and Phillips (2012)

4.2.3.2 Quality criterion for the sustainable development process

With Agenda 21, the local community is considered an equal partner with the global society to pursue sustainable development. The tagline, "we are all in this together" emphasises that the effects of events in one area of the world can be felt by people in other parts of the world (Hart & Nolan, 1999). There must be harmony between time and place to prevent unsustainable forces from spreading across time and space. This means that to achieve a long-term sustainable development process, there must be a fair distribution of nature's resources per capita between present and future generations. As a result, it is essential to consider the global characteristics required for sustainable development, including:

- i. Resolve environmental distress and socio-economic growth by decreasing the utilisation of nature's wealth while enhancing the welfare of the citizens.
- ii. Utilise a compact community growth method to consume as little space as possible and produce transportation that uses clean energy (biofuel) at the lowest rate.
- iii. Methodically use an efficient, economical, and green energy policy.
- iv. Adopt adequate measures to incorporate the local context, identify local capabilities, and allow local experts to participate.
- v. Promote citizens' participation, encourage individuals to take liability for their surroundings, and enhance recognition of the local settings.

- vi. Strengthen societal composition and encourage fresh ideas and partnerships among all the stakeholders, including politicians, civil society, NGOs, and citizens, to enhance the strength of collective accountability.
- vii. Encourage and apply the theory of egalitarianism that promotes gender equality.
- viii. Reinforce local economic systems (connecting trade and government, instituting inter-sectoral collaborations to create new employment prospects, and localising content).

4.2.4 Types of sustainable development indicators

Agenda 21 (UNCED, 1992), a United Nations initiative, was established to address the pressing issues of our day and prepare humanity for the challenges of the next century. It presents a worldwide agreement on growth and environmental cooperation at its highest level. There is a need to increase the flow of new and additional cash from advanced countries to the Third World in Africa and Asia to alleviate the growth in spending for their efforts to limit global environmental concerns and accelerate growth. Each country must develop its indicators for monitoring sustainability, according to Agenda 21's Chapter 40 (the Rio Declaration). As a result, the Commission on Sustainable Development (CSD) was formed. The UN established the CSD in 1995 to provide policymakers with easy-to-understand metrics (Verma & Raghubanshi, 2018). The sustainable development initiatives (SDIs), methodology, and training on sustainable development issues are the responsibility of the CSD.

As stated in this document, the Johannesburg Implementation Plan, there needs to be *“further work on indicators of sustainable development by countries at the national level, including the integration of gender aspects, voluntarily, in line with national conditions and priorities”* (UNDP, 2002, p. 12).

SDIs are essential tools to evaluate advancements in the direction of sustainable development. There are several indicators of sustainable development, namely economic, social, and environmental indicators. Many intergovernmental organisations, NGOs, and countries' governments have inaugurated SDI programmes since 2005.

4.2.4.1 Genuine progress indicator (GPI)

A system of sustainable well-being genuine progress indicators (GPIs) is required to evaluate and organise the total wealth of communities and countries. Using the GPI as an accounting tool, a society's well-being, economy, and natural environment are evaluated. An assessment

of the well-being or sustainability of the countries' SD plans is implied when examining the minimum social benefits available in the countries (Asheim, 2000), however, several people criticise the GPI as an SDI metric. This is because the GPI aims to address inequality, but it does not measure political or gender disparity.

4.2.4.2 *Environmental sustainability index (ESI)*

Yale and Columbia Universities collaborated in 2002 to create the environmental sustainability index (ESI), a report commissioned by the World Economic Forum. It was the first time that a country's environmental sustainability performance was evaluated using the ESI's 76-factor system. Ecological indicators are used to assess the sustainability of a given environment using 21 variables. A set of ESI values is assigned to each of the 20 primary gauge groups. Environmental and human development and economic well-being benchmarks are summarised in the ESI.

Additionally, the ESI components provide a foundation for ecological decision-making based on the data (Esty & Porter, 2005; Morse, 2005). The ESI thus serves as an instrument to achieve the goals of a sustainable environment. Responsibility for more extensive worldwide strategies for reducing starvation and improving education and health care throughout the global population is assigned by the Millennium Declaration and the MDGs (Krajnc & Glavič, 2005) Table 4.1 shows the ESI components.

Table 4.1 Environmental Sustainability Index Components

Component		Logic
Environmental Systems		A nation can be environmentally sustainable so that its vital environmental systems are maintained at healthy levels and improve rather than deteriorate.
Reducing Environmental Stresses		A nation can be environmentally sustainable when the ecosystem level of pressure is lower and does not constitute a threat to ecological arrangements.
Reducing Human Vulnerability		A nation can be environmentally sustainable to a high degree for the populace. The societal order is not vulnerable to environmental disturbances that affect fundamental human well-being; becoming less vulnerable is a sign that a society is on a track to greater sustainability.
Social and Institutional Capacity		A nation can be environmentally sustainable to a high degree by putting in place institutions and a whole communal system that require expertise, methodologies, and strategies to enhance efficiency in managing the environmental needs.

Global Stewardship	A nation can be environmentally sustainable by uniting with neighbouring countries to manage their regional ecological challenges to reduce the impact of such challenges across borders to reduce environmental hazards collectively.

Source: Adapted from Esty et al. (2006)

4.2.4.3 Environmental performance index (EPI)

When the pilot environmental performance index was initially published in 2002, the EPI assumed that a nation's environmental laws and programmes were comparable to other countries. It aims to complement the MDGs of the United Nations (Esty et al., 2006). The EPI's assessment of policy performance examines the environmental pressures on human health and the strength and resilience of the natural populations in each country. The EPI is provided to policymakers and citizens as an additional outcome-oriented indicator to the ESI. Environmental scientists also use it as a more accurate metric for gauging sustainability.

Air quality and its effect on human health are direct evaluations to be carried out in countries/districts, while indirect calculations present the additional anticipated impacts of policy growth by tracking interconnected indices such as birth rates and environmental health (Esty et al., 2006). The EPI is calculated for each nation's indices and its relative worth is based on the difference between what the EPI is and what ought to be found in the assessment outcome and according to the guidelines' aim. As a result of the EPIs being merged into policies, an estimated score can be calculated for each country's environmental health and ecosystem vitality using the allotted values. The overall EPI score is calculated by comparing subjective and objective data. The application of principal component analysis calculates the EPI. Figure 4.5 depicts the EPI's components.

Cumulative indicators such as the EPI can measure the various dimensions of sustainable development. Instead of considering each indicator separately, the EPI uses a combination to provide greater consistency. In addition to ensuring the EPI's simplicity and dependability, assessing its theoretical and methodological character and approximating its impact on a country's sustainability ranking serves a dual purpose: it allows decision-makers to obtain more precise and significant remarks, which are associated with their decision-making strategy (Organisation for Economic Cooperation and Development [OECD] et al., 2008; Dosio, Paruolo & Rojas, 2012, 2012; Saisana et al., 2005; Saisana et al., 2011; Saisana & d'Hombres, 2008).

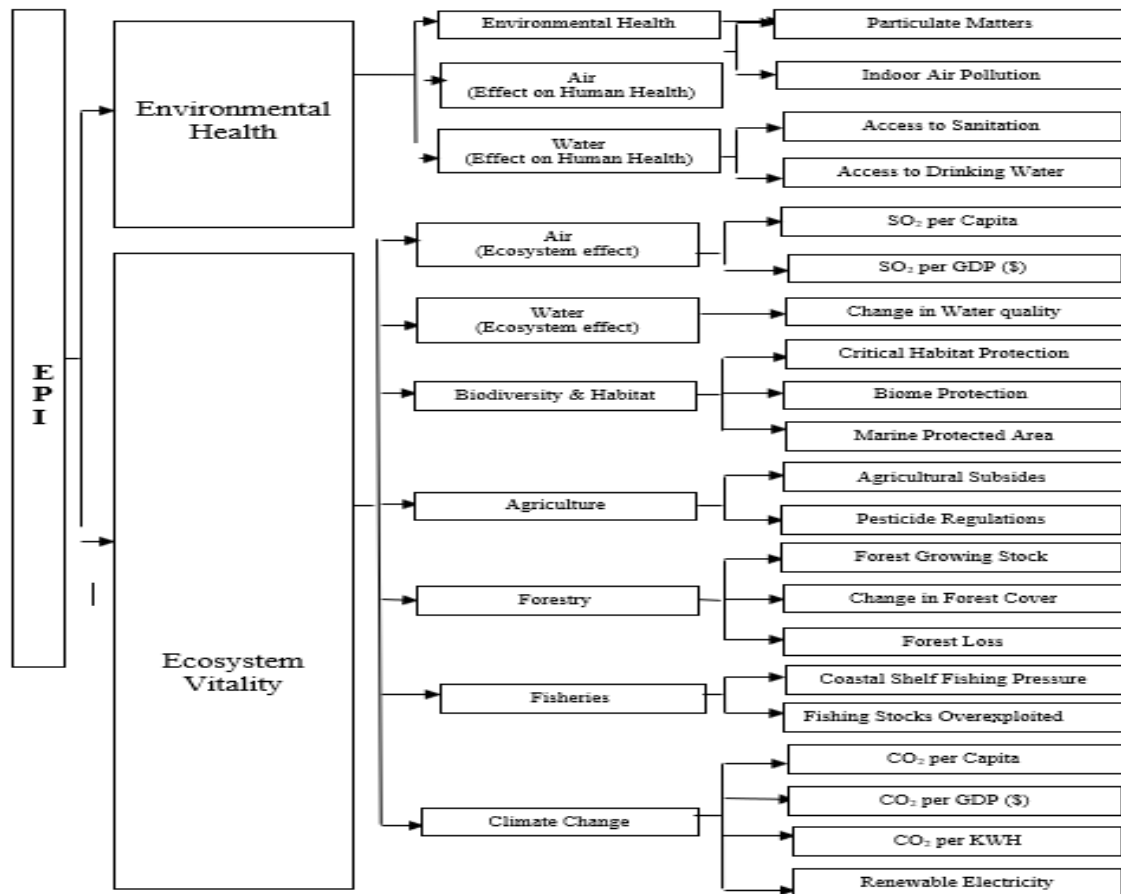


Figure 4.5: Environmental Performance Index Framework

Source: Adapted from Emerson et al. (2012)

4.2.4.4 Well-being/stress index (WSI)

The WSI tracks social improvement growth using human and ecosystem well-being measures to determine the effects of stress on well-being and define developing social inclinations. Communities, regions, and nations can use the WSI to assess how well their citizens are informed about environmental boundaries and how that affects their well-being (Droste *et al.*, 2016). Stakeholders can act quickly and effectively due to the early warning signs, unsustainable lifestyles, and rising social movements and the challenges they provide.

The WSI is a percentage of societal well-being, separated into two stages. The ESI is calculated by subtracting the ecosystem well-being index aggregate from 100. The human well-being index (HWI), calibrated using the ESI, is used in the second step. The WSI is determined by the criteria used to calculate the well-being of nations, as seen in the hypothetical example below. In other words, if the WSI score is 1.0, then both environmental stress and human well-

being are at their maximum. Ecosystem stress is more significant than human well-being if the WSI is less than 1.0. According to this, the higher the score, the more sustainable the product was United Nations and World Economic Forum [UNWEF] 2002).

There is a correlation between the well-being index and the elements that promote human development. As a result of the stress index, the indicator may look at human well-being holistically rather than just as a conducive system. Table 4.2 depicts the five stages of the well-being index's development. According to the data, a city's happiness index ranges from good (8.0) to bad (1.0) and (0.5). Poor cities are dreadful, whereas the best cities are good places to live. Cities with a high level of well-being, such as low chronic disease frequencies and high life expectancy rates and attributes, tend to show much distinctiveness. Compared to a city with good well-being, a poor one demonstrates the exact opposite; however, poor cities can transform into fair ones with good governance in the future.

Table 4.2: United Nations Well-Being Index Ratings

Band	The Top Point on the Scale	The Ratio of Human Well-Being to Ecosystem Stress
Good	100	8.0
OK	80	4.0
Medium	60	2.0
Poor	40	1.0
Bad	20	0.5
Base	0	0.0

Source: Prescott-Allen (2001)

4.2.4.5 Ecological footprint (EF)

Wackernagel and Rees (1996) popularised the EF in the 1990s with their work. Existing technology cannot sequester waste generated by the current consumption patterns without the EF; the geographic location of the ecologically productive land. The environmental impact results from human consumption of finite resources around the world. This footprint is the sum of all the areas required to produce and use these limited resources sustainably (Wackernagel & Rees, 1996). Carrying capacity, defined by ecologists as the population that a specific area can support eternally without severely affecting the environment's ability to support the future generation, is a well-established concept.

Over time, EF has become a critical tool for estimating human desires in the natural environment. The EF is computed by calculating the amount of the earth's surface and the sea

area that the people needed to produce the natural flow they utilise and waste generated within the existing innovation (Clinton et al., 2018). Efficient ecosystems (EF) evaluates humankind's ecological footprint by considering the land and water needed to sustain the human populations and process its waste. The amount of land surface needed includes arable land, pastureland, forest land, marine land, deregulated land, energy land used for transportation, and material form alteration land for the sequestration of waste and humankind's CO₂ release that emanates from burning fossil fuels and natural gas (Bastianoni et al., 2007; Passeri, et al., 2013; Kitzes et al., 2009; Lenzen et al., 2005; Rees, 2001; Wackernagel et al., 2005; Wackernagel et al., 2006).

4.2.4.6 Human development index (HDI)

The United Nations Development Programme (UNDP) has been calculating and presenting the Human Development Index (HDI) to the globe every year since 1990. Mahbubul Haq, Pakistan's Finance Minister, and Amartya Sen, an Indian economist, first proposed the notion. The HDI provides an alternative approach to assessing a nation's progress in development compared to the GDP per capita. Using the HDI, the UNDP provides an annual report on a country's residents' well-being. To understand the impact of global progress, well-being, and environmental management on a country's citizens' welfare as they relate to the HDI, the Human Development Report (HDR) represents the strategy and method of arresting governments' interests at all levels, and the interests of CBOs, NGOs, and multinationals as values of sustainability that are primarily centred on the growth of alternatives to poverty.

The HDI measures a country's consistent progress in three critical areas of human development: life expectancy at birth, literacy rates, and living standards (GDP). Indexes are assigned to each of the criteria. The life expectancy, education, and GDP indicators can all be calculated according to a standard. Adding the lowest (-0) and most significant (+1) values from the three measurements yields an overall score (1). In this way, the whole HDI is calculated in just one dimension. The HDR calculates a country's progress by combining numerous measures explaining a person's life quality, such as life expectancy, educational attainment, and income, into a single HDI. As a first step, the HDI sets out to create an independent metric that can be used to assess both social and economic progress. The HDI can be gauged from the lowest and the maximum measurements. The use of this gauge implies a benchmark. An evaluation of performance provides a snapshot of where each country stands concerning the standards. The score can range from 0 to 1. The lowest HDI is indicated with a value of 0. (a nation with a

high level of poverty). A score of 1 denotes a country with a greater HDI and a higher standard of living for its citizens.

For its review, the HDI analyses statistics such as the yearly HDI, which positions countries based on a composite evaluation of health, education, and income. Besides the HDI, there are two other indicators: the gender inequality index (GII) and the multidimensional poverty index (MPI). The HDI computation considers various indices, such as environmental, trade, technological, and other measures of human development.

4.2.5 Summary

The idea of sustainable development was first given priority globally in 1972 at the UNCED conference in Stockholm, Sweden. It was well defined and the global community accepted the idea so that there would be a measure to determine how sustainable the world is. This idea stems from the fact that social and economic development must align with environmental development, and the notion is that the environment is separate from the economic boom. Both socio-economic development and the environment must be compatible and have mutual benefits. The concept of sustainable development was the United Nations Conference's cardinal objective on environment and development held in Rio de Janeiro in 1992. Sustainable development is seen as a solution to the problems of environmental degradation.

Sustainable development implies discovering a pleasing manner of life for all within the planet's capacity. As cities turn into the main centres of habitation, it is essential to examine whether a sustainable relationship exists between cities and planet earth. All urban centres have enjoyed prosperity simultaneously and annihilated the physical environment for their survival. Sustainable development is recognised to be an idea rather than environmental conservation. The sustainable development idea has several elements such as social, economic, cultural, and ecological facets. Also, it includes the notion of fairness among people in the present day and future generations. Sustainability entrenches environmental consideration in economic policymaking by linking ecological protection to economic development. Sustainability will satisfy the current population and unborn generation's needs, aspirations, and requirements. The measurement of sustainable development is known as the sustainable development indicator, and there are many types of SDIs, but the most important to this research is the EF because of its applicability at the micro-level.

4.3 The Concept of Urban Liveability

The term "liveability" has become a key planning idea. Everywhere you look, "liveability" is used to describe long-term goals in policy and community development activities at all levels of government. Transportation, community development, resilience, and numerous other planning subdisciplines use "liveability." It is also employed in many other planning-related sectors (e.g., subjective well-being and quality of life research).

The phrase "liveability" is frequently used in plans, but the idea has a variety of meanings. A slew of concepts and properties have emerged in trying to pin down precisely what it means. However, most references to "liveability" do not attempt to define the concept. Rather, the term's use provides hints to its underlying meanings. Although specific usages can be mutually incompatible or contradictory, understanding how liveability is used gives planners and communities insight into what liveability means to them.

Capitanio (2017); Kashef (2016); and Valcárcel-Aguilar et al. (2018) have emphasised the necessity of liveability concepts to modify the built environment concerning socio-economic values. Shabanzadeh et al. (2019) state that the factors used to evaluate a city's liveability depend on the individual characteristics, needs, and expectations. It is also said by Giap *et al.* (2014, p.176) that liveability as “... *a place-based notion generally refers to the features of the home, neighbourhood, or city that contribute to quality of life and well-being*”.

Liveability is a broad term that encompasses several interrelated challenges, all of which are grounded by a standard set of principles, namely accessibility, equity, and participation. People's well-being in a city is closely linked to their access to transportation, communication, water, sanitation, food, clean air, cheap housing, fulfilling employment, and open green spaces and parks. City liveability is measured by people's ability and access to participate in the decision-making process for their requirements.

4.3.1 Definitions of liveability and a liveable city

An urban system that promotes the physical, social, and mental well-being and personal growth of its population is "liveable". It is all about creating aesthetically pleasing urban areas that serve as a conduit for disseminating religious and cultural values. Equality, decency, accessibility, friendliness, participation, and empowerment are some of the guiding concepts

of this subject matter. People-friendly cities have always included those social groupings whose idea of a liveable city is one in which these aspects have been kept or restored. Some of them include "*relationships between streets and buildings... building to building... trees to seasons to adornment to events to other people,*" as Smithson et al. (2013) once put it.

Ma's (2016) "*A way to teach liveable city*" describes a liveable city as one where people can lead healthy lives and have access to various modes of transportation, including walking, bicycling, public transit, and, in some instances, private automobiles. For a city to be liveable, it must be accessible to all. For this to be true, a liveable city must be appealing and worthwhile, safe for children and the elderly, not just those who earn money there before moving on to live elsewhere. Children and the elderly require easy access to green spaces where they can play, interact, and converse with each other without having to travel long distances. A liveable city is a city that everyone can enjoy.

Mandhar and Watt's (2011) "*The city as a family*" describes a liveable city is a bridge that connects the past with the present, honouring both our ancestors and those who have not yet been born (our posterity). A liveable city honours its history by preserving historical landmarks and architectural details for urban planning. It is not enough to make a city liveable; it is also vital to protect the environment for future generations. In other words, to be a "sustainable city", a city must be able to meet the demands of its current residents without compromising the ability of future generations to do the same. Both social and physical factors must work together in a liveable city to ensure the well-being and progress of the community as a whole and its citizens. A liveable city is where common spaces are the centres of social life and the entire community's foci. A liveable city must be built up or restored as a continuous network – from the central areas to the more distant settlements where pedestrian paths and bicycle paths bind together all the social quality sites and the community life.

Casellati's (1997) "*The nature of liveability*" asserts that there are two sides to the coin of liveability. One of them is a person's ability to earn a living. The other is ecological sustainability. Jobs close to decent housing, pay in line with the cost of rent, and access to the services needed to maintain a healthy environment are essential to a person's ability to earn a living. Livelihoods must also be able to withstand the passage of time. There is no solution if the city's ecology is steadily and irrevocably degraded due to the residents' search for jobs and houses. As a result of environmental degradation, residents are obliged to give up their right to

clean water and clean air in exchange for a better standard of living. To be liveable, a city must balance the needs of its wealthy and less wealthy residents while also protecting the environment's quality.

The concept of liveability was first introduced in the 1950s. With the help of the Electors' Action Movement (TEAM), the term liveability became a potent language tool in Vancouver (Kaal, 2011; Ley, 1990). In 1981, Donald Appleyard published "*Liveable streets*", a book that introduced planners and urban designers to "liveability" regarding streetscapes and mobility. As a result of the Gore/Clinton Liveability Agenda, a framework for coordinating and adding billions of dollars in funding for "new tools and resources to preserve green space, ease traffic congestion, and pursue regional 'smart growth strategies', usage of the term 'liveability' in planning-related media increased dramatically. Since their initial Community Evaluation Guideline in 2000, the American Association of Retired Persons [AARP] has provided communities with tools and recommendations on liveability. There is little difference between the AARP's definition of "liveability" in 2005 and what it is today. Affordable and appropriate housing, community support services, and adequate transportation are all part of what it means to live in a liveable neighbourhood, according to the Harvard Joint Centre for Housing Studies (AARP, 2005).

In 2009, the Partnership for Sustainable Communities (PSC), a cooperation between the US Department of Housing and Urban Development (HUD), the US Department of Transportation (DOT), and the US Environmental Protection Agency (EPA), acquired substantial popularity as a set of guiding principles (PSC & Gough, 2015). The PSC's six liveability principles are utilised to evaluate award applications for the sustainable communities grant programme.

4.3.2 The principles of liveability

i. Provide more transportation choices

Develop safe, reliable, and economical transportation choices to decrease household transportation costs, reduce our nation's dependence on foreign oil, improve air quality, reduce greenhouse gas emissions, and promote public health.

ii. Promote equitable, affordable housing

Expand location- and energy-efficient housing choices for people of all ages, incomes, races, and ethnicities to increase mobility and lower the combined cost of housing and transportation.

iii. Enhance economic competitiveness

Improve economic competitiveness through reliable and timely access to employment centres, educational opportunities, services, and other basic needs by workers, and expanded business access to markets.

iv. Support existing communities

Target federal funding toward living communities through transit-oriented, mixed-use development and land recycling to increase community revitalisation and the efficiency of public works investments and safeguard rural landscapes.

v. Coordinate and leverage federal policies and investment. Align national policies and funding to remove barriers to collaboration, leverage funding, and increase the accountability and effectiveness of all government levels to plan for future growth, including making smart energy choices such as locally generated renewable energy.

vi. Value communities and neighbourhoods

Enhance all communities' unique characteristics by investing in healthy, safe, and walkable rural, urban, or suburban areas (PSC & Gough, 2015).

In describing the state of current practice on liveability, Young and Hermanson (2013) found that the PSC definition has been adopted by several community planning organisations and is used in academic research. "Liveability" has long been a guiding principle for the investment and decision-making that define the city's social, economic, physical, and biological environments (Benzeval et al., 1995; Hills, 1995; Pacione, 1982; 2003). They believe that the ability to live can be determined by fundamental or unchanging qualities, many of which remain consistent over time and populations.

For a city to be considered "inhabitable" or "fit for human habitation," two things must be in harmony. One of these concerns the characteristics of the population that demand goods and services, such as housing, electricity, water and food, waste management and assimilation, health and public safety, education and entertainment, social participation, economic contributions, innovation, and much more. This is just a small sampling. Liveability is determined by considering the wants and needs of persons who already live in urban areas or may do so in the future. Since these needs and desires are most apparent in regions of

deteriorating infrastructure, decreasing economic prosperity, and growing social discontent (Midgley & Livermore, 1998; Waste, 1998), attention has historically been paid to those areas where the provision of services has been inadequate and where, as a result, people have suffered.

The city's physical and biological qualities of its built infrastructure and ecosystems, which offer the commodities and services that people in the city rely on for their lives and livelihoods, make up the second component of its liveability score. They derive from urban green spaces and water bodies, which give recreational opportunities and economic benefits. They also help regulate the local climate, improve air quality, and prevent flooding. Long-term viability is inextricably tied to environmental sustainability, even if high quality living conditions are only experienced temporarily and degrade the ecosystem's structure and function. Thus, the biophysical environment sets the limits on the ability of metropolitan people to prosper, and the urban populations' stress on infrastructure and ecosystems shapes these limitations in complex ways (Bizikova, Robinson & Cohen, 2007).

It took a full year for the Greater Vancouver Regional District (GVRD) developers to look beyond their priorities, computer models, liveability measures, and programme plans and ask the people to establish living standards. The year was 1972, and the GVRD's planning had shifted its focus to the liveability notion, although no one knew what it meant. What were the characteristics of a liveable city? What were the features that made a city liveable? As they tried to come up with an answer, the planners realised that they needed to engage the public to come up with a definition of liveability. It was not easy to persuade the politicians or the Planning Department personnel that involving the public in improving the quality of life would be beneficial. As a result, a liveable region strategic plan was developed; more in-depth than planners or residents expected.

4.4 The Concept of Inclusive Physical Development

The 2030 Agenda is based on the idea that everyone should be able to enjoy the fruits of economic growth and have a basic level of well-being. As a result, the United Nations has established the 17 Sustainable Development Goals (SDGs), which aim to alleviate extreme deprivation such as extreme poverty and hunger while promoting a healthy lifestyle, equal access to education and health care, and a modern way of life and knowledge. The challenge

of achieving this objective necessitates an institutional framework to ensure execution. There are many ways in which the institutional framework aims to alleviate poverty and ensure that everyone has equal access to justice.

When effectively translated into action, the goals and targets reflect vital social inclusion processes and are correctly benchmarked. Social inclusion spans a broader range of issues than those addressed by the sustainable development objectives. No single global goal-setting agenda can fully address the many elements of exclusion to truly address and promote inclusion in all facets, because the norms, beliefs, and approaches to social inclusion are shaped by each location's history, culture, and institutions. Even if the country-specific and developing character of social exclusion concerns and ways to inclusion are recognised, some argue that attaining a society for all must adhere to general principles.

A former French Secretary of State for Social Action, René Lenoir (1974), coined the terms "social inclusion and exclusion" to describe the situation of "the mentally and physically disabled, suicidal people, elderly invalids," "abused children," "drug addicts," "single parents," "multi-problem households", and other "social misfits".

4.4.1 Social inclusion

Social inclusion is *“the process of improving the terms for individuals and groups to take part in society”* and *“the process of improving the ability, opportunity, and dignity of people, disadvantaged based on their identity, to take part in society”* (Rao & Sanyal, 2010, pp. 3-4).

“Social inclusion is a process that ensures that those at risk of poverty and social exclusion gain the opportunities and resources necessary to participate fully in economic, social, political, and cultural life and enjoy a standard of living that is considered normal in the society they live in. It ensures that they have greater participation in decision-making, which affects their lives and access to their fundamental rights” (Atkinson et al., 2002 p. 9).

Many definitions of social exclusion include a lack of engagement in society, even if there is no universally agreed-upon criteria or standard for social exclusion. People who cannot fully engage in economic, social, political, and cultural life and the processes that contribute to and sustain such a state are considered a social exclusion. Material resources, such as money, work,

land, and housing or necessary services such as education and health care, limit participation when unavailable to those who need them most. Also, when people are denied the right to speak up or engage with each other, their participation is hampered, as is the respect and dignity they deserve. As a result, social exclusion includes material deprivation, loss of agency or influence over crucial decisions, and emotions of alienation and inadequacy. Social exclusion has been based on various factors in practically every country over the years, including but not limited to age, sex, handicap, race, ethnicity, religion, immigration status, financial level, residency, sexual orientation, and gender identity (Papadopoulos & Tsakloglou, 2008).

Concerns about social exclusion have sparked initiatives to increase social inclusion. It is defined as ensuring that those marginalised by age, gender, disability, ethnicity, origin, religion, or economic status have better opportunities, access to services, a voice, and respect for their rights in the face of discrimination. Social inclusion is a process and a goal at the same time. Social inclusion may be achieved by removing barriers to engagement in society and implementing active inclusionary efforts to encourage such involvement (Donnelly & Coakley, 2002; Shortall, 2008; Scharlach, & Lehning, 2013). Socio-economic inclusion is a more purposeful process of welcoming and supporting all people and advocating for greater social equality.

We must remember that encouraging social inclusion may or may not improve people's ability to live peacefully together, and cohesive civilisations may reject specific groups of people (Norton & De Haan, 2012). The terms "social inclusion" and "social integration" are sometimes used interchangeably. However, they do not necessarily mean the same thing. A more cohesive society can be achieved by increasing social integration and inclusion. Even though this research investigates the metrics relevant to social cohesiveness and social integration, its primary focus is on eradicating social exclusion and increasing social inclusion.

4.4.2 Elements of exclusion and inclusion

For two reasons, the term "social inclusion" refers explicitly to marginalised people because of their age, gender, physical or mental handicap, race, ethnicity, nationality, or place of birth. Although anyone may be in danger of social exclusion, certain features or attributes increase the likelihood of this. Identities or group affiliations can be linked to these. Identities can be classified in two ways, according to Kabeer (1997). There are groups of people that accept their

standard membership, have shared views and values and behave in collective ways. Such group identities include those based on caste, ethnicity, and religion, to name a few. In contrast, the other refers to persons defined by similar qualities rather than shared values and ways of life. Apart from the nature of the persecution they suffer, these groups' members do not necessarily know one another. Examples of socially excluded groups include street children, those with leprosy or AIDS, and undocumented immigrants.

It is also important to note that the 2030 Agenda for Sustainable Development's target 10.2 emphasises that all people should be included *"irrespective of age, sex, disability; race; ethnicity; origin; religion; or economic or another status"* to empower and promote the inclusion of all people in society (Asogwa & Ezeibe, 2020). The SDGs specifically list the factors contributing to disadvantages. Even if it is not exhaustive, the list does highlight several characteristics that have historically placed individuals at the greatest danger of being excluded from specific social groups.

The term "social inclusion" encompasses the process of broadening one's opportunities for social interaction. Discriminatory attitudes and behaviours and specific policies and institutions must be addressed as part of social inclusion. Policies and institutions can either increase or decrease social exclusion by establishing "rules of engagement" and determining who gets what and how much of what. Although they are not the primary cause, discriminatory attitudes and behaviours exacerbate exclusion. Discrimination by law or society may prevent people living in remote places from participating fully in social, cultural, or political life. As a result of social exclusion, segregation is likely when discrimination prevents people from fully participating in society's institutions and benefits, such as equal access to products, services, justice, and culture. Instead, they can only contribute negatively to the community (Hickey & Du Toit, 2013).

4.4.3 The challenge of measuring social exclusion and inclusion

Hickey and Du Toit (2013) have a thorough grasp of the criteria used to identify those who are excluded and the methods necessary to advance them, as well as the ability to assess the impact of the inclusion efforts made and, in the end, to ensure that no one is left behind. The measurement of social isolation, on the other hand, involves significant difficulties. Many spheres of life are off-limits to those unable or unwilling to participate (social, economic,

political, civic, and spatial). The importance of each domain varies by country and locale and by a person's position in the life cycle. Social exclusion and social inclusion are both multidimensional and context-dependent ideas. Hence, this indicates that both concepts are multifaceted.

Because of this, it is a significant problem to translate them into a limited collection of indicators. In this sense, monitoring and analysis begin with national standards and definitions for measuring and measurement units. However, a limited range of observable properties that apply to all countries is required for global monitoring and analysis. It is also necessary to consider the subjective views of individuals and social groupings to accurately identify who is being left behind. It is impossible to ignore the perspectives of individuals who have experienced or are in danger of experiencing exclusion (United Nations, 2010). Personal safety, the amount of prejudice, and involvement in political and social life are all important aspects of inclusion and exclusion that must be considered. As a result, measuring exclusion necessitates a compromise between theoretical and empirical factors (Hendrix, 2010).

Because social exclusion has many facets, data used to assess it typically originates from various sources. Many nations have national population censuses and some internationally standardised surveys available, such as labour force surveys, demographic and health surveys, multiple indicator cluster surveys, living standard measurement surveys, and selected opinion polls. The problem is that none of these resources can be relied on to provide a global picture of social exclusion and inclusion. Changes in exclusion indicators are being analysed over time, leading to new issues. Some data sources are only available at a single moment in time, and even between censuses or surveys of the same sort, there are concerns of comparability. Qualitative evidence, such as participatory evaluations and in-depth interviews should accompany quantitative data wherever available, even if cross-country assessments cannot adequately measure the numerous dimensions of exclusion. The exclusion and inclusion experience cannot be reduced to a simple statistical model.

Individual characteristics and combinations that raise the likelihood of being marginalised or excluded should be studied empirically. When conducting individual-level social exclusion and inclusion research is difficult, most studies pre-select (group) some of the established criteria that are empirically proven to increase the likelihood that an individual will be excluded, most often based on their age, sex or ethnicity, income, and nationality. An essential social analytical

tool, grouping can miss new forms of exclusion and is limited in its ability to explore intersecting disparities when using aggregate-level approaches based on old criteria. There is an “*inclination to partition the social world into deep, quasi-natural categories*” Brubaker (2009, p. 5) states, but cautions that it is important to remember that statistical groups or groupings are not always factual entities with a typical agency or ordinary functions.

While working on the Post-2015 Development Agenda in 2013, the High-Level Panel of Eminent Persons on the Data Revolution called for a "data revolution" to increase the quality of statistics and data available to citizens and governments (Stanley & Stanley, 2017). However, digital technology has brought both unprecedented opportunities and risks, the Independent Expert Advisory Group on the Data Revolution for Sustainable Development (IEAG) noted in the UN Secretary-General's report a year later (Independent Expert Advisory Group on a Data Revolution for Sustainable Development, [USGSI] 2014). To cite one of the concerns raised by the group; the data revolution is expected to create new disparities between those who have access to and use data and those who do not.

Data investments in monitoring the MDGs have contributed to increased knowledge of poverty and human development during the past two decades, and it is evident that additional work is required to ensure that many people are tallied, and that the entire population grouping is statistically invisible. Some of these holes are being filled by non-profit organisations (NPOs), academia, and businesses increasingly collecting and analysing the data, and assessing if and how increasing data availability benefits individuals left behind. Data generation typically responds to society's need for information and aids in policymaking and participation, even when used to discriminate and hurt.

Objective and subjective exclusion indicators gathered from existing sources should be disaggregated based on age and gender, ethnicity and race, economic level, place of residence, birth, and/or nationality. Considering that everyone's risk of exclusion is based on the mix of their traits and that many people belong to a disadvantaged category, data should be able to assess the combined influence of these variables. However, household surveys designed to be nationally representative sometimes exclude tiny groups, such as ethnic minorities, limiting the ability to conduct an elemental decomposition analysis.

Additional difficulties in quantifying social exclusion include the definitions of nationality and migrant, ethnic, and disability status vary across nations. People in institutions like jails, hospitals, refugee camps, and nomadic and pastoralist populations are often left out of household surveys because of their high risk of exclusion. Many polls also only look at people within a specific age range. Therefore, they cannot collect data on those who fall outside of that range. Many urban slum communities, remote locations, households with single parents, older people with small children, large families caring for foster children, orphans who are not related to the adults in the home, and households in which children are cared for by neighbours and relatives are underrepresented in household surveys (Carr-Hill, 2013).

Censuses do not intentionally ignore homeless people or any of these categories, but they are typically undercounted due to the difficulty in contacting them. Consequently, it is impossible to provide an accurate global estimate of the number of homeless persons. According to national figures, there are a great many people living on the streets, even in wealthy countries. Nearly 600,000 individuals were homeless in the US on a single night in January 2014 (Ross & Pelletiere, 2014)). In 2012, there were 141,000 homeless persons in France (Petit, et al. 2019). Carr-Hill (2013) predicted that household surveys in developing countries could leave out as many as 300 million to 350 million persons most at risk of social exclusion and extreme poverty because of omissions and under-enumeration.

This study examines three sets of indicators: those that measure access to opportunities, such as education, health services, and infrastructure; those that measure access to employment and income; and those that measure participation in political, civic, and cultural life. These three sets of indicators are based on a review of the empirical literature. When examining exclusion, the study takes a comparative approach, interpreting differences in these indicators across various socio-economic groups. Specifically, the study explores how education and health affect access to resources and political involvement across different populations. The study also examines discrimination as a critical driver of exclusion in all of these aspects.

The choice of indicators is typically dictated by the availability of data in studies of social exclusion. This study's indicators were chosen because the underlying data was readily available and comparable across countries (Labonté et al., 2011). In carrying out a global analysis, specific indicators are needed. Many cross-country comparisons rely on data from a few countries and focus on specific features of exclusion that can be illustrated visually.

When possible, the analysis makes use of data from national population censuses. In addition to these survey data, the World Values Survey Association (WVSA) and the United States Agency for International Development (USAID) support household surveys, such as the Demographic and Health Surveys (DHS) conducted in Stockholm. Despite their concentration on reproductive health issues, the DHS surveys contain much information about the socio-economic status of reproductive-age individuals and provide a comprehensive picture of this demographic. A cross-country analysis is a good source of information because of its coverage, consistency, and comparability. More than 90 countries' representative samples can be found in the WVS. As the largest non-commercial source of knowledge about human values and beliefs, they span the globe. Surveys of public opinion and surveys of personal values are essential tools for determining the extent to which specific interpersonal characteristics and attitudes contribute to exclusion (Barge & Gehlbach, 2012).

In a departure from the conventional terms, "social inclusion" and "social exclusion," the term "inclusive development" was coined in the twenty-first century, and several educational and policy publications have incorporated it. There are a variety of concepts in several fields that can be traced back to its origin. Even though some see inclusive development as simply making sure that economic growth and social well-being are balanced, others define inclusive development as focusing instead on social well-being and preserving nature's ecosystem services by redefining policy goals, especially in the Anthropocene context (Pouw & Gupta, 2017).

It was the social justice movements and academic studies of the 1990s that gave rise to the term "inclusive development" (Gupta et al., 2015), which emphasises the involvement (De Haan & Maxwell, 2017) human rights, and social demands of the world's most marginalised individuals and communities (Pouw & Gupta, 2017). In addition to this, the poorest and most marginalised people in society are those who are most dependent on natural resources like land, water, fish, and forests (Djoudi & Brockhaus, 2011) as well as those who are most vulnerable to the effects of climate change (Mendelsohn et al., 2006), land resource grabbing (Davis et al., 2014), and the risk of resource depletion. Because of this, the notion of environmental inclusivity has been expanded to include all aspects of the environment, which is a huge concern that is compounded by the human need for more resources.

The third issue is that some researchers and policymakers see inclusive development as a way of patronising the poor; however, others argue that it is more about empowering the poor by giving them rights, creating equal opportunities, and ensuring redistributive justice, all of which necessitate addressing the political processes that lead to the concentration of power. As a result, inclusive development promotes social, environmental, and relational well-being rather than growth (Gupta et al., 2015; Pouw & McGregor, 2014). Ecological and social inclusivity are more important than economic inclusiveness, according to Gupta et al. (2015), who argue that this is the most important aspect of inclusive development.

In the UN Global Sustainable Development Report 2015, the term "inclusive" appears 52 times (Un-Habitat, 2015). When balancing social, economic, and environmental challenges, social justice and environmental advocates try to shift that centre of gravity toward those aims (Gupta & Vegelin, 2016). Societal inequity, it is argued, diminishes one's options.

4.4.4 Inclusion criteria for indicators

According to Kennedy & McLoughlin (2022) four criteria are used to evaluate the inclusion of indicators for the measurement of inclusion and to decide on their eligibility for inclusion. They are

significant in terms of the quality of life, health, and well-being in urban regions:

- i. Is the indicator measurable and specific?
- ii. Are there adequate levels and scales at which the indicator can be assessed to allow for comparisons between individuals and between cities?
- iii. Is the metric important to urban planning strategy in the city?

4.5 The Environmental Awareness Concept

Because of our existing way of life's detrimental effects on the environment, we must devote more time and resources to studying human environmental behaviour and the social interactions that surround it (Rodrigo, 2006; Mabey, 2004; Olsson et al., 2004; Sosa et al., 2008). Incorporating the environment in economic and social development plans necessitates monitoring the environmental quality and the public's understanding of environmental issues. To establish public programmes and regulations that encourage involvement, it is vital to research what residents of a specific community know, believe, and feel about their

surroundings (Hart, 2013). Community members must be asked about their attitudes and values regarding the quality of life and the solution to environmental issues (Kos et al., 2003).

In the 1960s and 1970s, the environmental movement was born in the US, with ecological issues and disasters at the heart of this movement. In the US, ecological activism has developed into a diverse action and environmentalism is not a single movement in the country today. Environmentalism cuts across all levels of government, including the local, state, and federal levels. Environmental advocacy has become more widespread in the US over the past five decades, and the business, arts, media, education, and health care sectors are all impacted.

Several well-publicised events in the 1960s and 1970s helped catalyse the modern American environmental movement. Bikini Atoll's nuclear testing, oil spills off the coast of California, and pesticides and other chemicals were all on the public's minds. For many Americans, the polluted waters of the Great Lakes were an early symbol for environmental activism. Damage was caused to thousands of homes and businesses by a fire sparked by pollutants in Lake Erie and its tributaries (Johnson & Govatski, 2013). A media sensation, the "*Lake Erie Fire*" helped bring environmental issues to the forefront of people's minds. Songwriter Randy Newman was inspired to write, "*Burn On*" by thoughts of a canal which was very dirty and became combustible (Gold, 2012).

Americans began to care more and more about the environment throughout the 1960s and 1970s. Preserving natural resources has always been an essential environmental priority, but environmental calamities such as the oil spills, lake fires, and other incidents sparked a renewed interest in preserving America's wilderness and natural landscapes. The subject of the book, "*Silent Spring*" was that Dichlorodiphenyltrichloroethane (DDT) and other insecticides had a devastating effect on animal populations, notably birds. Another kind of bird that was affected by the usage of DDT was the nation's national bird, the bald eagle. The reduction in the birds' population size was caused by pesticide thinning their eggshells. The plight of the national bird drew the media and the public's attention due to its dwindling numbers, and in response to this concern, legislation such as the Endangered Species Act was enacted (Knick & Connelly, 2011).

A further environmental worry was the effect of environmental deterioration on the human population, and there was a rise in public awareness of the dangers posed by environmental

degradation. Air and water pollution were two of the most pressing environmental issues. The *Clean Water Act of 1972* is the cornerstone of the US's water policy. This law governs water quality and how contaminants are discharged into the water supply. The goal of the *Clean Air Act of 1970* was to reduce air pollution. Air quality standards are one of the essential components of the law since they allow the US's Environmental Protection Agency (EPA) to protect the public's health and welfare (Currie & Walker, 2019).).

4.5.1 The supporting principles of environmental awareness

The general understanding and conditions discussed in the preceding section have provided more clarity of purpose and direction. The list below contains the 15 guiding principles of environmental awareness, collected from a variety of sources. They are sorted into five imperfect but helpful categories. They are included to stimulate thought as well as to provide advice.

Societal needs

- Produce nothing that will require future generations to maintain vigilance (Sustainability Report [Morelli, 2011]).
- Design and deliver products and services that contribute to a more sustainable economy (Suzuki et al., 2010)
- Support local employment (Southampton City Council, 2006).
- Support fair trade (Williams, 2011).
- Review the environmental attributes of raw materials and make environmental sustainability an essential requirement in selecting ingredients for new products and services (Global Sustainability Principles [Conley & Williams, 2011]).

Preservation of biodiversity

- Select raw materials that maintain the biodiversity of natural resources (Global Sustainability Principles [Rasche & Waddock, 2014]).
- Use environmentally responsible and sustainable energy sources and invest in improving energy efficiency (Global Sustainability Principles [Rasche & Waddock, 2014]).

Regenerative capacity

- Keep harvest rates of renewable resource inputs within the regenerative capacities of the natural systems that generate them (Goodland & Daly, 1996).
- Keep depletion rates of non-renewable resource inputs below the rate at which renewable substitutes developed (Goodland & Daly, 1996).

Reuse and recycle

- Design for re-usability and recyclability (Sustainable Living 101 [Heywood 2019]).
- Design (or redesign, as appropriate) manufacturing and business processes as closed-loop systems, reducing emissions and waste to zero (Robinson, 2004).

Constraints of non-renewable resources and waste generation

- The scale (population x consumption per capita x technology) of the human economic sub-system should be limited to a level that, if not optimal, is at least within the carrying capacity and therefore sustainable (Goodland & Daly, 1996).
- Keep waste emissions within the assimilative capacity of receiving ecosystems without unacceptable degradation of its future waste absorptive capacity or other vital ecological services (Goodland & Daly, 1996).
- Develop transportation criteria that prioritise low-impact transportation modes (Jayakaran et al., 2020).
- Approach all product development and product management decisions with full consideration of their environmental impacts throughout their life cycle (Jayakaran et al., 2020).

4.5.2 Environmental awareness and sustainable development

People in many developing countries have realised that environmental issues are no longer a luxury; only wealthy nations can afford and understand the long-term costs of ignoring ecological conservation. Progress is being made in emerging countries toward resolving both the vast ecological deficits built up over the years and the necessity for some form of regulation of the current and future growth (Csutora & Móznér, 2012; EPA, 2010; Initiative, 2009).

Since these initiatives, many developing countries already have environmental legislative frameworks, and several have even implemented market mechanisms to improve their ecological quality (Herr et al., 2019; EPA, 2010; Molina et al., 2010). Despite this though, the environmental situation in these countries continues to deteriorate (Butler & Oluoch-Kosura, 2006). Institutional weaknesses, political and economic instability, and a lack of participation in decision-making are among these countries' most significant problems, as is a lack of environmental protection laws and policies. The current environmental policy thus cannot be sustained (Crotty 2009; Crotty & Hall 2011).

Environmental studies have shown a steady rise in people's concerns about the quality of the environment. An analysis of the US population's interest in environmental matters has demonstrated that even though there have been fluctuations, there has been a consistent interest in environmental issues (EPA, 2010). The emergence of "environmental attitudes" is used to describe this development. According to surveys conducted across countries, environmental worries are rising worldwide (UNEP, 2010), and researchers have discovered virtually no difference in ecological quality concerns between industrialised and developing countries (Crotty & Hall, 2012).

Additional evidence suggests that social factors influence environmental sentiments (Dobson, 2007). Several studies have found a correlation between environmental concerns and social traits, in that individual characteristics such as social position and political ideology correlate directly with ecological problems (Fransson & Gärling, 1999). In other investigations, the decision-making system was examined to determine the relationship between environmental attitudes and behaviours. Both Fishbein and Ajzen's Attitude and Action Model and Schwartz' Norm-activation Model revealed shared elements that drive action, despite their variances (Han, 2014). Individual attitudes and the attitudes and reactions of "others" have substantially impacted environmental action decisions.

Public knowledge and pro-environmental initiatives are essential (Csutora, 2012). Disenfranchised decision-making has found that "others" play an important and influential role in encouraging environmentally friendly behaviour (Kopnina, 2012). This shows that a widespread mobilisation of people is necessary for policy success. The Tietenberg-De Young information tool is critical in this situation (Tang & Zhan, 2008). To them, information can serve as a powerful tool for both strengthening their legal and economic leverage with

environmental authorities at all levels and motivating people to take action in support of the environment by educating them about the problem, explaining how ecological damage is caused, and connecting the dots between the two.

A commitment to environmental stewardship may not always result in benefits for the environment, however (Csutora, 2012; Wirth et al., 2014). According to research, people who think they are ecologically aware and even those who appear to act in an environmentally responsible manner have the same environmental impact as other customers (Wirth et al., 2014). There has never been any thought of using public awareness to advance environmental policies (Sauve, 2005). Environmentalists must have this instrument because of its importance and influence (Rest, 2002). All of the global environmental changes implemented since Agenda 21 (Kveton et al., 2014) point to the need for a path forward that will lead to changes in individual circumstances, including the growing role of citizen engagement in global agendas, the emergence of global environmental problems requiring a systemic solution, the rapid growth of information technology, and the globalisation of the economy and its effect on the environment. However, ecological awareness studies in underdeveloped nations are scarce and lack a policy-oriented perspective. Empirical research on environmental awareness in developing countries must first gather relevant data; second, demonstrate that the approach is legitimate; and third, incorporate its findings into environmental policy-making processes (UNEP, 2010).

Although Nigerians are concerned about the state of the environment, this concern is not matched by any action or priority (Ogunbode, 2013). Few attempts have explained why Nigerians are not doing more to protect the environment (Okpala, 2012). Western environmental thought mostly neglects Nigeria's sustainable development status (Oldfield & Shaw, 2002). In addition, studies on environmental awareness in developing countries have concentrated more on formal education and less on raising public awareness, knowledge, or acting in the face of ecological threats (Blinnikov & Lindsey, 2010; Kasimov et al., 2005; Pavlova, 2009; Verbitskaya et al., 2002). Understanding environmental consciousness among Nigerians is essential if the country's 170 million people are to develop sustainably (Bostrom et al., 2006; NPC, 2011).

Environmental education, environmental awareness, and long-term development are thought to go hand-in-hand (Holt & Barkemeyer, 2012). Sustainable growth's influence on

environmental education began in the mid-1980s, and Sauvé (2005) said that the idea of sustainable growth gradually became a dominant stance. As a "pre-requisite" for sustainable progress, education has also been referred to as "*solving the issues of human survival and prosperity in the future*" (Kasimov et al., 2005, p. 49; Kopnina, 2011). Furthermore, Finger and Verlann (1995) argue that the quality of life on our planet will continue to worsen unless we learn our way out of this predicament.

It is also worth noting that most environmental education literature offers a negative image, citing issues like teaching's poor reputation and outdated, high-priced textbooks (Blinnikov & Lindsey, 2010; Kasimov et al., 2005; Pavlova, 2009; Verbitskaya et al., 2002). Studies are studying non-formal environmental education or narratives. Qualitative procedures that involve people outside of formal education are conspicuously lacking (Jickling & Wals 2008). There may be new insights into the relationship between environmental knowledge and sustainable development in countries that are in transition (Kasimov et al., 2005; Mabogunje, 2002), given the increased tensions between economic growth and environmental management in these contexts (Kasimov et al., 2005; Mabogunje, 2002; Oldfield & Shaw, 2002). The lack of ecological consciousness or knowledge among the Nigerian population has been attributed to a lack of education (Ebong, 1994; Mabogunje, 2002).

4.6 The Concept of Urban Governance

Development literature progressively includes themes of governance and good governance in its discussions. An essential aspect of governance is redefining what it means to rule in the modern era. Governmental systems are developed to manage the interaction between government and society, defined in terms of specific principles acknowledged as mutually interdependent. Since the mid-1990s, the good governance theme has dominated international development. Governance is a broad and inclusive term, and the achievement of "good governance" is predicated on enhancements to almost all sectors of the public sector (Grindle 2004).

After decades of neoliberal dominance, a renewed focus on the state's role in development emerged in the mid-'90s, which was a significant shift in approach. To put it simply, this approach to state involvement in development was driven by substantial scepticism about the state's ability to play an influential role (Haas, 2004). The structural adjustment programmes

that urged the rollback of the state in developing nations had primarily failed by the mid-1990s. Policymakers realised that the East Asian 'tigers' fast growth was primarily due to the state's active industrial and financial policies, which encouraged the growth of markets. According to Hout and Robison's (2009, p6), analysis of donor governance strategy, the early 1990s were marked by a "*limited perspective of governance that stressed technical methods to increase government effectiveness and create a legal foundation for market-based development*".

Later in the 1990s, a new phase emerged that emphasised the organisation of political and social life and the engagement and inclusion of society. Since the World Bank's founding in 1944, it has avoided politics and focused on the technical components of governance, according to Hout and Robison (2009). According to some, "*The World Development Report: The State in a Changing World*" published in 1997 was the beginning of the end of the state as we know it today. "Stateless development" and "Development without an effective state is impossible" are two assertions made in the report (Guhan, 1998). The government has a particular role in delivering public goods that support economic and social growth, and this study argues that the persistence of market failures strengthens the economic arguments in favour of government intervention in sustainable development.

Policymakers have focused increasingly on the political and economic features of governance changes since the turn of this century, highlighting the connection between these aspects of governance and the process of development (Hout & Robison, 2009). These authors have identified the "emerging now" phase as one in which people become increasingly conscious of how important it is to address the issues of power, politics, and social conflict to improve development results.

Development agencies have difficulty, however, in turning this analysis into policy, despite the Department for International Development (DFID) being critical in pushing this more nuanced approach to governance analysis (Hout & Robison, 2009). The "common good" or "public interest" can be used as a justification for political action by members of the political community (Healey, 1997). Governmental systems are developed to manage the interaction between government and society, defined in terms of specific principles acknowledged as mutually interdependent. Globalisation has altered power arrangements around the world, as most governance theorists believe, and this has directly impacted the evolution of government.

To a large extent, the concept's appeal is due to four interrelated developments. New institutionalism and economic/political regulation, along with an increased role for civil society, are all a response to the inadequacies of the narrower term "government", and societal participation is essential to the success of the governance system's implementation. People's engagement in decision-making is the only way to attain all of these ideas and aspects, and as a result of this participation, the meaning and context of citizenship have been fundamentally altered. Arif et al. (2018) emphasise developing new substantive constants and variables based on global ideals and local values and norms.

Researchers in rich and developing countries have investigated how good governance can help advance economic and social progress. Werlin (2003) argues that the differences between developed and developing countries in relation to economic development must be due to governance concerns rather than resource issues. Governance can be considered a vital instrument in rethinking macro-micro interactions (Hyden, 2002). Working with a wide range of organisations is essential for the goal of promoting the achievement of better government, including those that set the rules of engagement for economic and political interactions, decide on public problems and allocate the appropriate resources to deal with them, and those that run the administrative systems that deliver the goods or services, or employ human resources for government bureaucracy. Changes in the political structure, representation of interests, and open participation in policymaking are all examples of good governance (Grindle, 2004).

International aid organisations have recently emphasised the need for good governance, both as a desired objective and as a means to generate more economic growth, to contribute to development. According to a recent DFID governance paper, the struggle against poverty cannot be achieved without excellent, or at the very least, good enough governance. The most crucial aspect of deciding whether or not successful development occurs is whether or not states are effective - whether or not they can prevent violent conflict, fulfil human rights commitments, assist enterprises in growing, and provide the public services needed to their population (Robertson et al., 2007). There is a strong correlation between poor governance and poor economic growth and increased well-being in emerging countries and states (Clark & Senik, 2011). As a result, international aid organisations are devoting significant resources towards efforts to improve governance. The Commission for Africa (2005) report and the promotion of a more responsive government are essential pillars of the need to get governance

structures right and increase policy formulation and execution capacity, particularly in Africa and the Middle East (Moore, 2001).

It is critical for donors to address governance issues since the way in which money provided to assist taxpayers is spent is directly linked to the effectiveness of the country's government, both as a tool and as a goal in and of itself. Aid donors and receivers, and intellectuals and policymakers alike have recognised that poor governance is a common problem in much of the Global South, and donors must address this issue in order to deploy development aid effectively (Moore, 2002). As Collier (2007) states, aid initiatives are more likely to fail in nations with poor governance and defective policies.

CHAPTER FIVE

REVIEW OF RELEVANT LITERATURE

5.1 Introduction

The literature review chapter is purposely crafted to examine city development and the various experiences from other parts of the world. The chapter defines cities and their characteristics; city development and infrastructure; the role of infrastructure in city development; the infrastructure and city development nexus; urban infrastructure and city development; the Urban Governance Framework in Nigeria; the stakeholders in city governance in Nigeria; the roles of the urban governance stakeholders in the provision of infrastructure in Nigeria; and cities and city development in Nigeria.

This chapter also considers cities and sustainable development; cities and urban liveability; cities and inclusive development; and development control and planning standards in Nigeria; drawing useful lessons for city development in Nigeria. The chapter also presents the structure of city development in the context of the developed and the developing world. Under this section are sub-sections which review city development in the United States of America and the Republic of Ghana. The study leverages on these countries' city experiences, these countries' relationships with Nigeria's city development in terms of governance and economy, and Nigeria's lessons learned from the city development in these countries.

5.2 Urban Infrastructure

Infrastructure refers to the critical systems and services that an urban area or country or organisation needs to function correctly. For a whole nation, especially its urban areas, it includes all the physical systems such as the road and railway networks, utilities, sewage, water, telephone lines, cell towers, air control towers, and bridges, plus services including law enforcement, emergency services, health care, and education. These infrastructure systems, which require significant initial investments, are essential for enabling productivity in an economy. Most projects are either funded entirely or subsidised. The term, "Urban Infrastructure", is one that engineers, urban and country planners, and policymakers use to describe the essential facilities, services, and organisational structures for all cities and communities.

The prefix "infra" means "below", and these elements are often underground, like natural gas and water supply systems. In current environments, infrastructure refers to any facility we expect but do not think about. We take it for granted because it works for us in the background (Tarzia, 2011).

Urban infrastructure can include:

- Road & railway systems, tunnels, and bridges.
- Mass-transit systems, including buses, subways (underground trains), and elevated trains.
- Energy-generating facilities include power stations, wind farms, and hydroelectric plants.
- The national power grid, with electrical power lines and connections.
- Telephone cables and mobile phone towers.
- Reservoirs and dams.
- Pumping stations and levees.
- Ports, airports, waterways, and canals.
- Hurricane barriers.
- Fire-fighting equipment and personnel.
- Health services, hospitals, clinics, and emergency response systems.
- Education, including schools, colleges, universities, and other adult education facilities.
- Police stations and prisons.
- Waste removal and sanitation facilities.

5.2.1 Meaning of infrastructure

In the paper – "*Infrastructure for the 21st Century*" – the US National Research Council sought to clarify the meaning of "public works infrastructure" with the following comment:

... Both specific functional modes – highways, streets, roads, and bridges; mass transit; airports and airways; water supply and water resources; wastewater management; solid waste treatment and disposal; electric power generation and transmission; telecommunications; and hazardous waste management – and the combined system these modal elements comprise (US National Research Council, 1981, p. 271).

Understanding infrastructure transcends public works facilities and the operating procedures and management practices. Infrastructure planner also develops policies that interact with societal demand and the physical world to facilitate the transport of people and goods; the provision of clean water for drinking; safe disposal of waste products; and energy and information flow. In Keynesian economics, the term “infrastructure” referred only to public assets that facilitated production – it did not include private assets. In post-Keynesian times, however, the term has become more and more popular. Its meaning has also widened and today includes the internal framework in any technology system or business organisation (Hubbard, 2009).

Hard infrastructure refers to the large physical networks and facilities we need for a modern industrial nation to function, including bridges, roads, railways, and power plants (Uddin, 2013). Soft infrastructure includes all the institutions we need to maintain the economy, health, and cultural and social standards, such as education, finance, health systems, law enforcement, emergency services, and government (Adenugba, 2013).

5.3 Urban Land Use

Urban land use is the surface usage of all developed and open land at any site, at a given time and space (Zhu, 2014). According to the UNFAO concept, land use denotes the human activities directly related to land, exploiting its resources, or impacting them (Ferner, 2018). In such context, the emphasis lies on the function and purpose of the land use, and reference is made to “the management of land to suit human needs” (Briassoulis, 2020).

As Jasbir et al. (2005, pp. 5-28) put it, urban land use is the "*cumulative effect of the historical events, economic pressures, interactions with the natural environment, and social values*", and the notion of land use planning, for example, is automatically a part of urban land use. Existing land use should be distinguished from future prospective uses. Residential, transit, institutional and public buildings, open space, recreational land, and industrial and commercial land are the six major land-use groupings in urban settings.

5.3.1 Residential land use

This is where people live, and it includes low (houses), medium (townhouses), and high density (apartment buildings) structures for residential habitation. This land use takes up 50 per cent of the land in cities.

The **residential density** (number of housing units/hectare) is affected by the cost of the land, and the age of the neighbourhood (older neighbourhoods have higher densities than the emerging ones).

5.3.2 Transportation land use

This land use takes up 33 per cent of the land in urban areas. There are three types of transportation land use – vehicles, travel paths, and terminal facilities. Vehicles include both private and public vehicles for transportation. Private vehicles range from bicycles to motorbikes to cars and trucks. Public vehicles include mass-transit systems such as buses, subways, or light rail lines. Mass-rapid transit is far more economical and practical for transporting large numbers of people. Travel paths include expressways, arterial roads (main city roads such as Kennedy Road and Dixie Road), and local roads. Terminal facilities include parking lots, train stations, airports, and bus stations.

5.3.3 Commercial land use

This land use takes up only five per cent of urban areas but is very important to local economies. This land is used for the buying and selling of products/goods (plazas, shopping malls), banks, and anything classified as “business”. The five main types of commercial land use are local convenience stores, neighbourhood plazas, community shopping malls, regional shopping malls, and the central business district (CBD).

There are three levels of products

Low order products – daily, or almost daily, convenience store items such as candy bars, milk, lottery tickets, and newspapers.

Medium order products – products purchased less often, including CDs, clothes, and sporting goods.

High order products – are expensive, niche market items, including for example, TVs, rock climbing gear, and bicycles.

5.3.4 Industrial land use

This land use takes up about 6 per cent of the developed land in urban areas, and is used for factories, warehousing, and shipping products.

5.3.5 Institutional and Public land

This land use takes up 10 per cent of the urban land and it is used for institutional and public facilities like schools, hospitals, government offices, churches, and mosques.

Open space and recreational land take up about 7 per cent of this land use, and includes parks, playgrounds, playing fields, golf courses, and sports arenas.

5.4 Urban Governance Framework

The government (local, state, and federal) and stakeholders deciding how to plan, finance, and manage urban areas is known as urban governance. Allocating social and material resources and political authority are at the heart of this process. Political institutions, the government's capacity to make and implement choices, and the extent to which these decisions acknowledge and address the concerns of the poor all play a significant role in this process. There are numerous economic and social institutions and relationships under this umbrella: labour markets, goods, and services; home and kinship bonds; essential infrastructure, land, services, and public safety; and so on (Devas et al., 2004, p. 1). The opportunity to participate in and reap the benefits of city life is often a significant divide between those living in poverty and those who are better off in terms of social, economic, and political prospects (especially decision-making). There are two types of urban governance, according to Slack and Côté (2014), and this type of governance has different functions:

- It plays a critical role in shaping urban regions' physical and social character;
- It influences the quantity and quality of the local services and the efficiency of service delivery;
- It determines the sharing of costs and distribution of resources among different groups; and
- It affects residents' ability to access local government and engage in decision-making, influencing local government accountability and responsiveness to citizens' demands.

Everything in a city is driven by the interdependence of many different players and institutions that make up the urban governance structure. The government plays an essential role in managing urban transitions and establishing and maintaining strategic partnerships with and among key stakeholders (ESCAP, 2015). However, while municipal administrations play a significant role in determining the lives of the urban poor, they have little authority over many other aspects of their lives. Instead, the daily experiences of urban residents are determined by the market and private firms, federal-state agencies, and the collective voluntary actions of civil society.

5.4.1 The relevance of urban governance

This century's most pressing issue is the management of cities and urban growth. If well-managed, cities may be engines of growth, providing residents with more work possibilities, and better health care, housing, safety, and social development. Cities can also help the federal government expand by generating more revenue, maintaining political stability, and aiding post-conflict peace-making. Unfortunately, cities that have been inadequately planned, administered, and controlled have become hubs of poverty. Sub-Saharan Africa and South Asia are the areas where the problem is most serious. Local administration, planning systems, infrastructure, and urban financing are all under increasing strain due to the growing population of metropolitan areas (Bhatkal & Lucci, 2015). According to many planners and corporations, population growth outpaces their capacity to offer adequate housing, infrastructure, and employment opportunities (Kline and Moretti, 2014), and there has been an increase in crime, slums, the informal economy, and social unrest due to these factors.

Economic opportunities, supporting social networks, and more access to land, infrastructure, and services can improve the well-being of the urban poor. Urban governance, i.e., local political processes (both informal and formal), the influence of civil society organisations (CSOs) representing the poor, and the ability of city governments to respond, all have a crucial role in whether and how these resources are made available to the poor (Devas et al., 2004). Local democratic institutions and processes, resources, and the poor's ability to organise and voice demands all play a role in the outcome.

People who live in poverty are more likely to be affected by ineffective urban government, negatively impacting their ability to earn money. While the architecture of city-level political

systems includes checks and balances between the executive and legislative branches and periodic elections, broader participation is needed to ensure that choices are made following the interests of the poor.

A metropolitan area's full potential can only be realised if various stakeholders are held accountable for their actions (Fox & Goodfellow, 2016). City governments confront severe capacity limits and lack of vision to meet urban growth, and thus need improved information/data on poverty, the environment & services. Three main messages emerge that emphasise the importance of urban governance:

- Cities' scales and high population densities enable economic and social interaction to occur more frequently and effectively. This creates the potential for cities to be productive and offer inhabitants a better quality of life.
- Key issues surrounding land, transport, public finance, and regulation are addressed with good urban governance to unlock this potential. Making the city work requires investment in residential, commercial, and industrial structures supported by effective land markets, appropriate law, good public services, adequate public finance, and transparent and accountable city-level political systems.
- Harnessing urbanisation requires smart policy, hard work (i.e., effective urban governance), and an understanding of the long-term implications of governance decisions.

5.4.2 Elements of effective urban governance

No single model of urban governance is generally applicable, and institutions and decision-making processes are shaped somewhat by the local context and history of the area in which they operate. Nevertheless, the city-federal government interaction, municipal competence, private sector involvement, and political processes and institutions all play a part in efficient urban governance. Problematic urban regions necessitate visible and robust leadership. Nigeria's most prestigious cities and city-regions look to have higher potential to deliver a coherent city vision, mobilise stakeholders' coalitions, and give greater responsibility to residents through directly elected local government chairmen.

Several techniques have been created to deal with the politicised nature of development. Political economy analysis, problem-driven iterative adaption, flexible and adaptable

programming, and political settlements analysis are all examples of these. Supporting local solutions to problems that are defined locally is a critical part of ensuring that changes and policies are more effective when people and communities see them as legitimate (Booth & Unsworth, 2014).

5.4.3 The city-federal government interface

Academics and donors widely agree (Andrew & Doloreux, 2012; Parnell & Simon, 2014; Keller & Hartmann, 2020; UN-Habitat, 2015) that good urban governance requires a federal government structure that connects the city to the broader regional and national development. For city-level initiatives to succeed, the federal government must support them. There is a wide variation in the roles and responsibilities of local governments among countries and between cities. Governments divide responsibilities among the government divisions at the federal national level, designate geographical jurisdictions, organise elections, devise internal management systems, and implement procedures for holding officials accountable.

Federal policies promote concrete actions, which aid in balancing and equitably directing urbanisation and growth. An urban vision must be articulated by building national frameworks that outline how resources and institutions should be distributed in the city (Parnell & Simon, 2014, p. 238). Neither a federalised nor defederalized model is a one-stop shop (ESCAP, 2015), as the development of institutional structures in various federal and city contexts should be considered. Following are some possibilities for balancing the attention on cities and nations:

- The federal government accelerates the development and competitiveness of secondary and tertiary cities to rebalance economies and minimise regional disparities.
- The government promotes less competitive cities' growth and achieves connectivity and collaboration. Imbalances affect national unity and stability – for example, the development of some urban regions over others increases tensions where cities represent different ethnic populations.
- In polycentric regions, the government ensures that cities develop complementary rather than competing specialisations within their federal systems. To be (more) internationally competitive, cities in each region work together in clusters.

Cities and the federal government have been rebalanced through the defederalization of tasks to state governments, making urban government more sensitive to local circumstances and

actors (Shepherd & Karuppusamy, 2021). Democratic reform, participation, empowerment, urban development, fiscal and economic development, and accountability are all favourably linked to defederalization (Smoke, 2003). An institutional framework must be delegated tasks, including revenue generation and decision-making, for dynamic, responsible, and responsive local leadership to arise (Blair, 2000; Crook et al., 1998).

Work between federal, regional, and local governments must be maintained. Unfortunately, these relationships are frequently marked by a lack of trust. Control by the federal government and accountability at the regional and municipal levels are significant sources of friction (Rao et al., 2014), so accountability and coordination procedures must be in place to guarantee that federal, regional, and local ties are balanced and harmonious. Whether defederalization has been good or bad is difficult to say. Defederalization and the creation of efficient urban governance have been hampered in many circumstances by insufficient legal frameworks and institutional and financial capabilities (UN-Habitat, 2015). Although many federal governments claim to be devoted to defederalization, their actions may be affected by the degree to which their right to govern is contested. This is influenced by the following:

- Concern regarding the development of autonomous opposition power bases;
- Concern that local decisions undermine federal policy aims; and
- Concern regarding inadequate local administrative capacity (Devas et al., 2004).

5.4.4 Municipal capacity

Local governments are confronted with issues that their structures, processes, and capacities are sometimes unable to address as urbanisation and defederalization increase. The need for urban services and infrastructure has increased due to rapid urbanisation. In addition, federal policies and legislation are increasingly devolving planning and fiscal authority to local governments, allowing them to better respond to the needs and desires of their constituents. The efficiency of local government is dependent on the resources, talents, structures, and management processes that are readily available on the ground in the community. However, local governments frequently lack adequate planning, regulatory control, financial resources, personnel, and service delivery capabilities (Machohé, 2011).

5.4.5 Planning and regulation

As a result of planning, urban communities can improve their quality of life and their ability to alleviate poverty. It improves health and well-being, makes it easier for people to access services and amenities, and creates more economic opportunities for the people who live in those areas. Planning and urban change are shaped by the formal and informal actors who play a part in governance, which establishes the legal and administrative framework (Kunen, et al., 2015). Lack of up-to-date mapping in many developing nations like Nigeria, poor development control and enforcement authorities, outdated planning processes, and a lack of public knowledge of or compliance with land-use regulation make effective formal planning difficult. As a result, cities frequently grow in ways that exclude the majority of their citizens. Deregulation, free-market policies, globalisation, and deregulation have shifted power to the private sector.

So much urban growth occurs in Nigeria because of a lack of control and oversight. Due to “unplanned development”, the cost of retrofitting infrastructure and the cost of water, roadways, and sewerage in low-density layouts has increased significantly. The city's low-income residents pay a significant price for illegal access to land and services, while the government misses out on tax money. Planning for informal housing zones in many cities does not always consider the city's overall plan, and it is difficult for community-based organisations (CBOs) to impact the planning process since they are not strong enough. Planning and regulation also often lack the measures needed for improving or redeveloping informal housing areas to minimise the impact on existing dwellings and economic activity.

A greater emphasis on technical professionalism has neglected planning's social objectives. The poor are excluded from the planning and decision-making processes necessary to ensure that cities address their unique needs, and poor people in cities have a legitimate stake in city development, according to Patel et al. (2013, p. 31). Planners and city residents must work together to ensure that their plans are fair, and they must be held accountable for their actions at every stage of the planning process.

Potentially major urban concerns can be addressed by urban planning, but these concerns are being undercut by the dominant market worldview, inadequate capability, and a lack of

attention to the interests of the poor. There are a slew of issues and possibilities that urban planners are already battling.

- Urban planning facilitates more transparent development decisions and pro-poor service provision. Where control is weak, governments should proceed selectively through problem-oriented planning that acknowledges informal processes.
- Participation by poor communities is essential for their empowerment. However, transformative development processes depend on collaborative decision-making and the equalisation of differential power relations.
- Strategy planning is based on national development objectives that do not consider local issues. While metropolitan plans channel urban growth, housing development, and significant infrastructure, local programmes identify potential development sites and protected areas.
- Development regulations state that development must be authorised federally through transparent and accountable decisions. These are unrealistic when most urban building is informal. In these contexts, development control should focus on priority areas (e.g., identifying land for housing or ensuring environmental protection).
- Action planning leads to several innovations that redefine the potential for urban intervention. These include urban design and new spatial forms, participatory planning, and land regularisation and upgrading.
- Planning for megacities poses challenges for vertical and horizontal policy coordination. The strategy should focus on critical metropolitan functions such as transport infrastructure, solid waste disposal, trunk sewerage, and water provision.

5.4.6 Urban finance

There are a variety of ways in which local governments raise money. The federal government's transfer payments are the most significant on a per-person basis, although they are inconsistent. Capital expenditures can be financed by local borrowing by state and local governments. Rather than relying solely on grant money, borrowing money helps close the infrastructure gap by putting current costs on the back burner. Unfortunately, control over local governments is limited or non-existent. There is a need for a robust defederalization framework and a mature and liquid domestic credit and capital market, typically lacking in emerging nations. Local governments are also a source of revenue for their jurisdictions. The three primary locally generated revenue sources are property taxes, company taxes, and user fees. Property taxes

have a vital role to play in maximising revenue and encouraging optimal use of property, but a lack of current address records and mapping, an insufficient workforce, and political opposition have contributed to their underutilisation in several places.

Land taxes, on the other hand, ensure that land is not left to deteriorate. Cities in developed and developing countries continue to generate significantly different local capital and cities that have solid fiscal databases, billing and collection capacities, communication programmes, and taxation benefits are able to generate more revenue than those that do not have the same. Cities that do not have the same solid systems and capacities must learn the following:

- i. How to increase their revenue collection to finance redistribution and public services; and
- ii. How to design their tax policy to strengthen economic growth incentives

Increasing revenue collection, distribution of the revenue, and improving service provision has traditionally been the focus of discussions about taxation, and the function of taxation in bettering government has piqued public interest in recent years. Taxation is an essential component of government responsiveness and accountability to achieve sustainable development. According to Pinskaya et al. (2016), most developing countries rely on sub-federal governments' land assets for financing. Sub-federal governments have access to property in various ways, and land is generally their most valuable asset. When it comes to housing and other services, local governments impact the land markets significantly (Fischel, 2005). When it comes to capital land financing, the most obvious example of revenue generation is from direct land sales. Auctions and other open methods of selling land can have far-reaching consequences (e.g., reducing the scope for corruption). Property pooling methods used for regional economic development are another option for turning public land rights into cash or infrastructure. Land is often a crucial public contribution to infrastructure-building public-private partnerships (PPPs), but the unstable nature of land assets and the excessive reliance on land asset financing can pose risks to federal capital budgets, warn Grimsey and Lewis (2017).

The need for a robust budgetary framework is consequently imperative. According to research, many local governments lack the necessary abilities to raise or manage local funds, so all urban development projects should incorporate help from sub-federal agencies to build their capability (Sood et al., 2012). Such help includes improving the capacity to increase local

revenue streams (particularly property taxes), financial management, debt absorption, debt management, and project development and implementation to demonstrate creditworthiness and facilitate access to financial markets. Capacity building must also construct the legal procedures and regulatory frameworks required to allow market capital to flow to sectors involved in urban development. Efforts are being made to strengthen the utility providers' financial viability and creditworthiness. Additionally, the establishment of reasonable regulations and performance standards, improved financial management systems, and the preparation of capital investment plans and bankable projects require technical support (Sood et al., 2012).

5.4.7 Human and administrative capacity

To ensure inclusive and sustainable urban development, facilitating responsible governance systems and promoting balanced multi-stakeholder participation and capable local government is essential (Sorensen & Okata, 2011). Unfortunately, the local governments' human and administrative capacity has not kept up with social, economic, or physical transformations (Rola et al., 2015).

UN-Habitat (2016) says that urban governance requires better capacity at all levels of government and for those involved in the process. It is important to emphasise that urban government capacity building considers institutional powers, individuals' technical and professional skills, and local leadership abilities. Enhancing urban planning, budgeting, public asset management, digital age governance, data collection, and collaboration with other stakeholders has been emphasised (UN-Habitat, 2016). Overall governance procedures and rules that assure accountability for performance and transparency in decision-making, along with the participation of key stakeholders, are needed to achieve this. Examples of low capacity in human and administrative capabilities include:

- Complicated and unclear organisational structures.
- Unclear delegation of tasks between managing authorities and intermediate bodies.
- Insufficient capacity and power within coordinating bodies to fulfil their roles.
- Weak governance arrangements to hold managers accountable for performance, control corruption, and avoid undue political influence over project selection and staff appointments.

- High staff turnover rates and a lack of appropriately qualified and experienced staff, often due to patronage systems.
- The insufficient administrative capacity of local governments and significantly smaller local authorities.
- Lack of expertise, leading to compliance issues with complex federal and inter-federal regulations, e.g., public procurement, aid, and environmental legislation.
- Limited analytical and programming capacity, including insufficient capacity (and political backing) to deliver result-oriented strategies.

5.4.8 Service delivery

Governments in large cities are responsible for providing adequate, affordable, and high-quality vital services. Residents' health and well-being are directly linked to services (water, sanitation, and waste management) in metropolitan areas. However, urbanisation's rapid pace and scale have compounded the problem of delivery in many developing nations, where coordination, governance, financing, and ability are all constrained. Regulating, facilitating, and partnering with other parties and institutions are essential responsibilities of governments. Local governments are given resources by the federal government to carry out the federal government's policies. Even if the supply of critical services is privatised, the state and municipal governments are usually responsible for providing these services. The whole spectrum of arrangements by which governments and other stakeholders work together to install, deliver, and manage services is covered by urban governance of vital services.

Infrastructure provision and maintenance; environmental management; development control; land-use management; community liaison; land leases and sales; and policy development fall under the local governments' purview. Cities with higher resources are assigned these responsibilities. The state government frequently assumes these responsibilities in smaller municipalities. Structure and patterns of defederalization are crucial to a local authority's ability to oversee service delivery, and incoherent defederalization often contributes to low service levels. When it comes to market and public policies, the urban poor are at a distinct disadvantage. This leaves them no choice except to rely on expensive and risky services.

Even though it may seem like it, providing essential services is more than just a technological undertaking. As a result of the political and governance framework, resources are allocated in

a way that has little to do with the lack of resources (Devas et al., 2004). On the list are inadequate federal policy frameworks and city governments' lack of responsiveness, multiple regulations, the inability of poor people to have their voices listened to, and the lack of transparency in municipal decision-making. CBOs and NGOs are also lacking in their ability to help express the needs of poor people and ensure that services are delivered. In light of the reasons outlined above, citizens are more likely to use informal methods to get their hands-on essential services. A proliferation of parallel systems and informality has taken hold in many metropolitan areas. In addition to the structural and operational concerns listed above, there are several more typical issues:

- **Multiple and overlapping structures and actors:** The presence of many different service providers creates a challenge for policy coherence, oversight, and monitoring.
- **Lack of information/data:** This undermines planning and management of service delivery. Urban stakeholders improve data collection to facilitate decision-making in service delivery and justify decisions. CSOs and NGOs can play a role here.
- **Low levels of community participation:** Service providers and localities need to understand what communities want, their priorities, and acceptable fees. Further, urban authorities need to create more awareness of local governments' role through education and communication exercises. These initiatives include radio programmes, city newsletters, websites, social media, and civil society actors' workshops.
- **Inadequate revenue sources:** Many urban areas rely heavily on monetary transfers from the federal government, but these payments are inconsistent.
- **Lack of adequate knowledge of local government issues:** Many countries in the Global South have initiated reforms to defederalize responsibility to urban areas and democratise decision-making. These initiatives are still developing and require prolonged and consistent support from federal governments and inter-federal agencies (Mulholland et al., 2018).

Many issues degrade the quality of life and decrease public confidence in local government, including inadequate service levels, interruptions, and insufficient coverage (Jones et al., 2014). The government does not necessarily have to provide all needed services, but it ensures that the poor access appropriate services through better governance. Working with service providers (public or private), small-scale merchants, civil society organisations, and low-income residents are part of this process. Furthermore, because service delivery involves

several different government departments and authorities, close cooperation among them is essential. Women are often expected to fill in the gaps left by cities when meeting the needs of city residents, particularly the impoverished (Tacoli, 2012). There are already many demands on women's time and stress levels, such as long-distance travel to different sites, waiting in queues, and competition for scarce resources, and this adds to the list (Brouder & Sweetman, 2015; Chant, 2013).

5.4.9 The role of the private sector

The private sector is a vital participant in urban and economic development since it is a significant source of federal revenue and the primary employer and job provider. In the developing world, the private sector employs about 90 per cent of the workforce, provides essential goods and services, generates tax revenues, and efficiently moves capital. In addition, the private sector plan to focus most of their future growth in metropolitan areas (Venables, 2015, p. 5). It is becoming increasingly popular to take advantage of urbanisation's advantages and avoid its drawbacks. A vital role for the private sector in urban governance is to influence whether urban areas grow inclusively and sustainably and how poverty reduction, exclusion, and instability are impacted (Haider, 2014; Hameed & Mixon, 2013; MacSweeney, 2008). The involvement of the private sector in urban government and coordination with locals are two of the many benefits of interactive planning and decision-making processes.

When working with the private sector, municipalities can strengthen their ability to govern their cities by fostering partnerships and local economic development (LED) strategies that combine local resources and ideas to stimulate the local economy, allowing it to respond innovatively to federal and global economic changes. Pieterse (2000) provides insight into what is required for effective LED schemes, for example, laying out how the locality will be illuminated:

- Infrastructure and services must be built and maintained.
- Existing firms should be marketed and expanded.
- The local economy has to be improved.
- Vulnerable populations must be assisted to enter the workforce by developing their human capital.

- Community businesses and co-operatives must be promoted, and regional exchanges and informal finance systems are all excellent ways to aid in the development of neighbourhoods.
- Increase the number of small, micro, and medium-sized businesses (SMME) by implementing both supply-side (training) and demand-side (space and facilities) strategies (reforms to procurement policy to ensure access to contracts for SMMEs).
- Encourage monetary infusions into the city, as there is an explicit LED strategy that links long-term economic growth difficulties with the immediate concerns of unemployment and income inequality.

Local governments involve groups and businesses in city-wide strategic planning procedures to strengthen relationships with local and international private sector interests. As a result of this, the city's long-term claims are bolstered. PPPs (public-private partnerships) are examples of a formalised relationship between the local government and organised enterprises. Additionally, the private sector collaborates to provide managerial and technical training and assistance to municipalities to strengthen the strategic management of urban regions (Pieterse, 2000).

An estimated 80 per cent of poor people's income comes from the unorganised sector. By reducing laws that hinder the informal sector, city-wide development programmes help enterprises with the capacity to grow (UN-Habitat, 2015a). Programmes balance the two objectives: maximising the potential of informal companies to create jobs and alleviate poverty while ensuring that the required social protections and laws are in place (UN-Habitat, 2015a). Pieterse (2000, p. 32) suggests the following as a thorough method for dealing with unregistered businesses:

- The formal banking industry, the government, and non-profit organisations must play a role in supporting financial and credit regulations.
- Bartering and local trade systems must be supported as this helps keep them going.
- As markets flourish, supply-side initiatives are necessary, such as the creation of incubators enabling informal entrepreneurs to establish their enterprises with some degree of protection.
- Home-based businesses must be considered in the planning and implementation of infrastructural initiatives.

- Procurement policies must be streamlined, so that established and new enterprises can collaborate more effectively.

PPPs, as previously mentioned, are a systematic strategy for interacting with the formal private sector. Contracts between a private firm and the government, where the private enterprise assumes the risk and management responsibilities and remuneration is connected to performance, are public-private partnerships (Mohale, 2017). PPPs can have a significant impact on infrastructure development, building, maintenance, and service provision by enlisting the help of the private sector. Using the resources and experience of the private sector, PPPs allow governments to acquire and deploy public infrastructure, including service offerings (Delmon, 2021).

Many economies with limited public resources have set themselves the objective of improving and expanding their infrastructure (Dang & Pheng, 2015). According to Castells-Quintana (2017), urban concentration's growth-enhancing advantages are determined by the quality of the city's infrastructure. Rapid urban population growth can be accommodated, and strong economic growth can be maintained in countries with good urban infrastructure (Turok & McGranahan, 2013). Social inclusion, economic opportunities, and quality of life are all influenced by the quality of a city's infrastructure (housing, power, roadways, public transportation, water, sanitation, waste management, telecommunications, hospitals, and schools) (Carvalho et al., 2018).

Global infrastructure investment will cost \$71 trillion by 2030, according to zu Ermgassen et al. (2019). Emerging economies are going to need a lot of this investment. According to the African Infrastructure Development Programme, annual capital investment and maintenance costs will reach \$93 billion by 2020. There is currently a \$48 billion shortage, and PPPs have been identified as a way to cover the shortfall (Loxley, 2013).). Extending services to underserved or unorganised communities, establishing safer workplaces, advocating for non-discriminatory hiring practices, making it easier for the poor to obtain credit, and increasing investments in affordable housing are all possible through collaboration with the private sector. Partnerships with the residents of informal settlements, non-governmental organisations, and the local government should be actively pursued by the business sector. As a result of these cooperative endeavours, inhabitants of informal settlements can be informed, educated, and

empowered to take an active role in programme development. The poorest families in the country can be helped with micro-finance (Franceys & Wietz, 2003).

Successful partnerships necessitate both a thriving private sector and a local government that is competent and authoritative, all driven by a shared economic interest (Devas et al., 2004). Policymakers must be well-versed in PPP objectives and the local context to recognise the advantages and limitations of PPPs (Phang, 2009). There must be a detailed examination of long-term development goals and risk allocation. Legal frameworks governing tendering, contracts, and oversight are poor or unimplemented in many locations, inhibiting domestic and foreign company investment, so this must be improved upon. Pre-feasibility studies and high technical skills and negotiation abilities are required to establish PPPs, but this has proven challenging in practice (UN-Habitat, 2016). Federal and municipal governments frequently lack the essential knowledge and competence to compete on an equal footing with private sector providers of public services.

Public policy and development objectives can be achieved by allowing the private sector to participate in urban planning and policymaking (Coelho et al., 2022; Ahmed et al., 2018) and local governments must look at ways to encourage the corporate sector to get involved in the public sector. Legal and regulatory reform is also needed to foster more sustainable economic growth and boost the private sector's effect (Anyanwu, 2014).

To achieve their financial (e.g., fiscal defederalization, issuing local bonds) and non-financial commitments, local governments must also investigate arrangements other than PPPs to improve service provision through better management of operating systems; reduce distribution and transmission costs; reducing water and electricity theft by informal network providers; combat corruption; and promote e-governance. Rather than competing against the private sector, specific governmental instruments and activities must complement, coordinate, and collaborate with the sector.

PPPs and privatisation weaken public control and contribute to urban fragmentation and rising inequality, especially in terms of access to land and services. However, the private sector has emerged as an essential player in delivering large-scale land development and infrastructure in many financially distressed cities when they are under-managed (UNESCAP & UN-Habitat, 2015). While privatisation has increased the quality of many urban residents' services, Fox and

Goodfellow (2016) point out that it has also brought about price rises that have disappointed them. They point out that advances brought about by privatisation have sometimes come at the expense of universal coverage, leaving low-income communities out.

5.4.10 Political systems and institutions

Local institutions and their interests have a significant role in determining whether cities are managed in a sustainable, inclusive, and pro-poor manner. Interactions between citizens and the state are framed by these institutions, which impact collective decision-making on resource allocation and the provision of local public services (Baptista et al., 2020). Electoral processes, the functions and responsibilities of the executive and legislature, the organisation of political representation (through political parties), and the state's responsibilities and monitoring are all influenced by the state's formal political institutions (Avis, 2019). These institutions and processes (e.g., constitutions, laws, and customs) regulate the political, social, and economic interactions. Resources are also distributed and spent according to these rules.

Informal and customary political systems, conventions, and rules exist within and/or alongside these formal structures (Lauth, 2015). There appears to be a distinction between formal and informal political systems; old and modern, and democratic and nondemocratic. However, these systems do overlap and interrelate, and understanding these systems and institutions necessitates a focus on three key elements:

Firstly, there is the political context. An urban actor's ability to take advantage of the socio-political public space that is available to them (including the impoverished) is discussed here. The federal and regional institutions and laws that control political behaviour, political culture, and the character of the national system are all included in this definition. In urban politics, formal institutions and procedures are established and implemented, and it is essential to understand the many players in the political process as well as the underlying dynamics that underlie their actions.

UN-Habitat (2016) reports a lack of political involvement and inclusiveness in many metropolitan areas. There is a disconnect between federal development plans and local demands, and collective decision-making has failed to bridge that gulf. It is not uncommon for people with impairments or minorities to be excluded from decision-making. In addition, place

of residence, ethnicity, class, and religion all have a role in citizens being excluded (i.e., those in informal settlements or peri-urban areas fall outside the defined administrative responsibility of the city government) (UN-Habitat, 2016).

Negotiation and distributional conflicts over policy, products, and services are increasingly being studied in metropolitan settings from a political, economic, and social perspective (Hawkins, 2010; Jones et al., 2014; Muggah, 2012). The political economy of urban government institutions and how local power hierarchies influence the distribution and allocation of resources must be understood. Urban decision-making is affected by several political and economic restrictions, as Carter & Lubinsky, (2015) outline:

- Urbanisation and environmental change are just two of many intertwined factors affecting the political economy of cities, but there is also conflict and fragility within the federal political settlement to contend with.
- There is a lack of policy consistency, as well as fragmentation of institutions, the proliferation of service providers, and the influence of informal political incentives in the governance framework.
- The urban poor in America have the political capability to alter electoral dynamics, engage in clientelism, and affect the elite takeover of services and decision-making processes.

Non-governmental organisations (NGOs) and community organisations (COOs) taking advantage of low-income residents in informal settlements, political market defects, policy incoherence, and barriers to collective action are all factors that affect service delivery. Urbanisation, social and economic inequality, the legacy of military conflict, political authoritarianism, and harsh police all contribute to war and bloodshed. Also, discrimination against women and girls as well as the marginalisation of rural migrants, immigrants from other countries, and residents of informal settlements make them vulnerable.

Because of the variety of individuals involved in different decision-making levels, there is a need for network-based governance rather than a hierarchical approach (Jordan, 2008). There has been a shift in urban management in some areas due to the changing roles of private and public players and new forms of political engagement (if only temporarily). An important factor in aligning and resolving conflicting interests has been the function of institutions and

ideas that underpin them. Even when parties have similar goals, a lack of agreement on a single vision has hampered cooperation in many metropolitan settings. Urban governance is undermined by a lack of capability and legitimacy of the government agencies, unsatisfactory performance and accountability procedures, and the immaturity of political institutions.

Increasing responsiveness and improving service delivery can best be achieved in many cities at the state or local government level. Accordingly, as with higher governmental levels, a local government's ability to be representative and effective depends on its legislative basis, its authorities and resources, its representation of its constituents, and the nature of its leadership. Elections are the foundation of democratic representation, but novel democratic practices, such as direct, deliberative, or participatory democracy, can also occur here. An urban governance structure must promote citizen empowerment through the use of a rights-based approach (i.e., direct democracy provisions) to establish democratic systems and institutions that work for the people. It must also facilitate bottom-up accountability by measuring the government's performance in the role of facilitator of a network of providers for citizens acting as governors.

5.5 Cities and City Development in Nigeria

5.5.1 Definition of a city

Cities are commonly referred to as "urban centres" and they originally appeared in Mesopotamia, Asia, and the Americas. They considered agriculture and the economic scale they invented (Vallino et al., 2020). There are no official city boundaries in an urban region; instead, it is a landmass that has been constantly developed within the confines of a labour market. It is an area of human habitation with a high population density and built environment infrastructure, classified as an urban area. King (2020) defines a city as an inhabited location of greater size, population, or importance than a small town or hamlet. According to Sumasgutner et al. (2019), however, the concept of a city appears to be more complicated than first thought.

The city is an enclave within an enclave. It depicts a highly populated, finite place where people and their institutions interact, generating and distributing economic resources, services, and other values. A distributional mechanism makes sense because of this. Racial, ethnic, occupational, religious, and ideological diversity abound throughout the city, and the

disparities are a source of both cooperation and contention. Neighbourhoods, communities, and urban zones have been identified as city divisions (Ayedun et al., 2011).

A city is defined as "*the urban agglomeration or metropolitan area it keeps together*" in the Hot Spots 2025 study by the Economist Intelligence Unit (Zhang & Grydehøj, 2021) without any relation to administration or functionality. A city's public transportation system, commuter habits, population density, or even fan support for the city's sports clubs may all play a role in its cohesiveness. When it comes to defining cities, Fahmi et al., (2014) relies on an urban settlement's stringent administrative bounds. Looking at New York and Paris as examples, there are 20 districts in Paris and 5 boroughs in New York City. This definition utilising administrative boundaries can be considered more precise; however, it deviates significantly from the definitions using traditional metropolitan patterns. Metropolitan agglomerations like Paris and New York extend far beyond the boundaries of their respective governments.

5.5.2 City expansion

There is an ever-increasing impact of rapid urbanisation on society as a whole. According to most estimates, most of the world's population now lives in urban regions for the first time. An estimated 55 per cent of the global population (or around 3.8 billion people) resided in urban areas in 2014 (Avis, 2019). Global urbanisation is expected to rise to 68 per cent by 2050, according to the 2018 Revision of World Urbanisation Prospects (Ritchie & Roser, 2018), so many countries will see significant increases in their future urban populations. Between 2018 and 2050, India, China, and Nigeria are expected to account for 35 per cent of the world's projected urban population growth. India, China, and Nigeria are expected to see population increases of at least 416 million urban residents each year by 2050 (Avis, 2019).

Urban centres in Nigeria are classified according to the country's population density and statutory or administrative requirements. Nigeria uses a population threshold of 20,000 people to identify an urban centre, and all state and local government area headquarters have traditionally been considered urban centres (Fox et al., 2018).

On a national scale, the most extensive urban spatial expansion in Nigeria is concentrated around four urban areas (Bloch et al., 2015):

- There is a northern conurbation centred around Kano that has a north-south axis running from Katsina to Zaria, and an east-west axis running roughly from Funtua to Hadejia;
- An emergent central conurbation runs from Abuja in the South-West to Jos in the North-East;
- A South-Western conurbation stretches from Lagos in the south to Ilorin in the north and to Akure in the east; and
- A South-Eastern conurbation within a roughly square zone encompassing Benin City, Port Harcourt, Calabar, and Enugu.

Natural urban growth is a major (perhaps dominant) factor in Nigeria's rapid urban population growth and development, as population growth is driven by reducing mortality and persistently high fertility.

5.5.3 City expansion in Nigeria

Nigeria's urbanisation patterns, trends, and characteristics are noteworthy (Aliyu & Amadu, 2017). There has been a tremendous increase in the population of Nigeria's towns and cities, with an annual urban growth rate of more than two per cent (UNDESA, 2019). Nigerian cities have overgrown due to this fast expansion, often unplanned and unregulated (Cities Alliance, 2007). Overcrowding, air pollution, and heat stress result from Nigeria's haphazard use of urban space and its consequent intensity (Tozer & Klenk, 2019; Gandy, 2006).

In most cases, urban growth is restricted to the outskirts of existing settlements, and a continual reinterpretation of the urban border occurs as the land cover grows (Bloch et al., 2015). This regularly redraws the line between what is considered “urban” and “rural”, blurring the distinction between the three pillars of city life: growth, development, and governance. There appears to be an inconsistency between Nigerian municipalities' present administrative and institutional boundaries and the size of the built fabric's land cover, according to Bloch et al. (2015). There is a tendency for urban growth to spread beyond the boundaries of a single local government area (LGA) or even a single federal state. For Nigeria's current urbanisation dynamics and urban expansion to be addressed, state governments must play a vital role in strategic spatial planning as this falls within their constitutional tasks and powers (Bloch et al., 2015).

If a town in Nigeria has a population of 20,000 or more, it is considered urban. This is an unusually high number of people compared to many other countries (Ofem, 2012). Over the last half-century, urban Nigerians have seen a dramatic rise in their numbers. The growth rate is expected to continue for the foreseeable future, and it is unclear how rapidly it will do so, but it is estimated that the urban population of Nigeria will more than double in the next 30 years, according to UNDESA (2019). Nigeria's urban population increase has brought with it many built-up areas and new and distinct 'urban' towns (Bloch et al., 2015).

Urban centres are classified according to Nigeria's population density and statutory or administrative requirements. A threshold population of 20,000 people is used in Nigeria to define an urban centre, and all state and local government area headquarters have traditionally been considered as urban centres, as stated (Turok & Parnell, 2009). Urbanisation is taking hold in Nigeria due to a variety of circumstances, but there have been health crises among city residents, particularly the urban poor, resulting from this. A systematic search of English language literature published between 1960 and 2015 was carried out, revealing that urbanisation is accelerating at an unprecedented rate, with some places like Lagos experiencing an annual growth rate of 5.8 per cent (Jiboye, 2011).

Despite and because of Nigeria's rapid urbanisation, the country's urban health problems are exacerbated by inadequate water supply, squalor and shanty communities, inadequate sanitation and solid waste management, disease outbreaks, and an ineffective transportation system because of a lack of infrastructure (Jiboye, 2011). Urbanisation has the potential to alleviate hardship and human suffering, but it can also worsen poverty and squalor if it is not managed correctly. Several laws need to be changed to make low-density communities eligible for federal assistance. To make our cities more liveable and healthier, we need a multi-sectoral approach backed by political will and urban regeneration initiatives.

Forty Nigerian cities had populations ranging from 300,000 to one million in 2018, nine cities with populations of one to five million people, and only one city with ten million or more. In 2018, URBANET announced that by the year 2030, Nigeria's eight most populous cities will have grown even more significantly. The population of Lagos, Nigeria's most populated metropolis, is expected to nearly double in the next ten years to 20 million people. Three more cities will see a near-tripling of their populations over this period. Nigeria is already home to five of the continent's thirty largest urban areas, making it a significant player in African

urbanisation. However, by 2037, when Nigeria's urban population has doubled, it will play an even more critical role. Almost one million new housing units must be produced each year to meet this demand (Ayele & Tarekegn, 2020).

5.6 Cities and Sustainable Development

It is no secret that population growth and internal migration drive rapid urbanisation in developing countries. Achieving the SDGs will be substantially impacted by how urbanisation processes are managed and the types of jobs that internal migrants can obtain. The idea of sustainable development is to meet the requirements of the present without jeopardising the ability of future generations to meet their own. Local and regional governments must pay close attention to this to be accomplished in a more urbanised world (van Erp et al., 2016).

The Sustainable Development Agenda 2030, signed in 2015 and supported by its 17 SDGs, as explained by Georgios et al. (2019), emphasises cities as crucial stakeholders for actively growing towards more sustainability. SDG 11, "*Making cities and human settlements inclusive, safe, resilient, and sustainable*," reflects this trend, as does the fact that urban living is becoming increasingly crucial in sustainability discussions. To strike a balance between the requirements of the present and those of future generations, we must accept that metropolitan areas will dominate the future. Applying sustainability targets, cities are increasingly being considered the drivers of sustainable development. They are also the "*key to achieving sustainable development and climate change*" (Fanzo, 2019, pp. 159-174). Thus, cities provide a wide range of difficulties and opportunities, and transforming cities to be more sustainable is a topic brought up in this context.

When it comes to cities' paths to sustainable urban development, the term "sustainable urban pathways" (or 'USTs') refers to the non-linear representations of the complex interactions and repercussions of many different activities. In 2015, the United Nations approved the SDGs and the 2030 Sustainable Development Agenda (SDA) to alter the world, but it is unclear how cities can fulfil these obligations and meet the high expectations that they have been set. The Local Agenda 21 procedures or climate-related projects can teach us two things: Because they are not legally enforceable, the SDGs may help cities to accomplish their sustainability goals as countries take ownership of and execute them at a national and municipal level. SDG implementation in towns, however, presents numerous obstacles due to the notion that views

the economic, social, and environmental components of sustainable development as being more linked, which is essential and in line with the policy framework of integrated sustainable urban development.

5.6.1 Planning of the sustainable growth and development approach in Nigeria

The government's commitment to eradicate poverty, enhance the livelihoods of its citizens, and ensure the sustainable development of urban centres and the country for the benefit of present and future generations has led to some strategic policies designed to stimulate the sustainable growth of the urban centres and the nation. Some of the strategies being adopted to tackle sustainable urban growth and development in recent times by Nigeria's government include:

5.6.1.1 Provision of adequate and affordable housing

The housing crisis in Nigeria is based on quantity and efficiency. There is a noticeable difference between supply and demand, and the difficulty arising from the problem of mobilising sufficient funds into the National Housing Fund has made it impossible to increase the housing stock appreciably. Other issues associated with housing supply in the country include inadequate access to land, the security of the tenure, the non-availability of cheap building materials, poorly developed local building materials, and poor infrastructure on land for housing development.

5.6.1.2 Ensuring environmental sustainability

Current approaches to environmental planning and management in Nigeria are grossly deficient in citizen engagement, even though there are appreciable provisions in the current legislation for environmental planning, land use regulation, and building design and communication routes to achieve financial security, convenience, beauty, and the involvement of local people in decision-making (Akinmoladu & Oduwaye, 2000).

5.6.1.3 Good governance and enhanced urban development

The government realises that good governance is fundamental to national development and that sustainable urban growth and development cannot be achieved on its own without sustainable peace and democracy. Therefore, strong emphasis must be placed on ensuring a stable political environment, sustenance of democratic principles, and a government geared toward improving

its citizens' living conditions. Several anti-corruption measures have been put in place by the government. These include the Anti-Corruption Act, the Corrupt Practices and other Related Offences Commission, the Code of Conduct Bureau, the Public Complaints Commission, and the Economic and Financial Crimes Commission (EFCC). These measures have gone a long way to promoting good urban governance and development.

5.6.1.4 Poverty reduction and economic empowerment strategies

Poverty eradication, one of the indispensable requirements for sustainable urban growth and development, is presently one of Nigeria's most significant challenges. The extent and magnitude of poverty in the world have risen over the past few years, to such an extent that the country is now one of the 25 poorest countries globally (both human and natural). Most citizens are poor due to massive under and outright unemployment, uncontrolled inflation, governance inundated with greed and corruption, the nonexistence of economic opportunities for the poor due to the erratic power supply, and the lack of accessibility to land and capital for the average Nigerians.

5.6.1.5 International cooperation for development

Cooperative efforts that have benefited Nigerians have charted new paths for long-term prosperity and development for the country. The government has agreed to implement integrated development strategies to promote growth throughout the country, rather than just in the cities, after realising that more people may choose to live in urban areas than in rural ones. This must be avoided if the country's growth is to be maintained.

This century's most significant urban challenge, according to Nnaemeka-Okeke (2016), is the rapid growth of many cities and the extent to which this growth contributes to climate change. It appears that urban planning has not been able to overcome these issues. More than a billion people live in cities, becoming increasingly vulnerable to rising sea levels and coastal floods, and other climate-related risks like storm surges. The global population is getting increasingly urbanised, and the rate at which city populations increase and the rate at which countries urbanise is a good indicator of the pace of social and economic transformation (Donk, 2006). In 2006, half of the world's population lived in cities, up from one-third in 1976 (Tibajuka, 2006). Cities worldwide are expected to house two-thirds of six billion people by 2050, the target year for the MDGs (UN-Habitat, 2006).

As these cities have grown, questions have been about their long-term viability. Several major African cities' physical and living conditions are quickly deteriorating, especially those in Nigeria. Destruction manifests itself in increased traffic congestion, flooding, erosion, and the deterioration of infrastructure in slums, urban sprawl, and squatters' settlements. Urban sprawl continues to draw the attention of both national and international entities but attempts to resolve these problems have so far yielded few fruitful outcomes.

5.7 Cities and Urban Liveability

5.7.1 The origin of urban liveability

The concept of "liveability" has become an essential part of planning. All levels of government are increasingly using the term "liveability" to describe long-term objectives. Liveability has been implemented into a wide range of planning contexts, including transportation, community development, and resilience, to name just a few. There are many other uses for it, some of which are close to planning, and studies on subjective well-being and the quality of life (Mouratidis, 2021).

The word "liveability" is frequently used in plans, but the idea has a variety of meanings. As a result of attempts to define the word, various topics and qualities have emerged. Most references to liveability do not attempt to explain the concept; rather the term's use provides hints to its underlying meanings. Understanding how liveability is used can offer insights into what liveability means to planners and communities, even if the services are mutually incompatible or contradictory.

The current form of the term "liveability" was coined in the 1950s. The Electors' Action Movement (TEAM) in Vancouver popularised the term "liveability" as a potent theoretical tactic (Kaal, 2011; Ley, 1990). Planning and urban design professionals were introduced to liveability in 1981 when Donald Appleyard published "*Liveable Streets*", a book about streetscapes and mobility. As a result of the Gore/Clinton Liveability Agenda, which organised and added billions of dollars in funding for new "*tools and services to conserve green space, alleviate traffic congestion, and pursue regional smart growth strategies*", the term "liveability" became increasingly prevalent in planning-related media (Edwards & Haines, 2007).

A new version of the AARP's guide, published in 2005, gave a definition of liveability that is essentially unchanged to this day. Housing that is affordable and appropriate and community amenities that promote inhabitants' participation in the local economy are only some elements that make a community liveable (AARP, 2005). In 2009, the guiding principles set up by the Partnership for Sustainable Communities (PSC), a then new collaboration between the US Department of Housing and Urban Development (HUD), the US Department of Transportation (DOT), and the US Environmental Protection Agency (EPA), gained significant traction in the United States (Curtis & Gough, 2018).

5.7.2 Defining 'liveability' in the built environment

The term "liveability" and the spelling of the word "liveability" have yet to be agreed upon despite several attempts to achieve liveability and the term's widespread use. The British prefer the spelling "liveable," whereas Americans prefer the spelling "livable", which is gaining acceptance around the world (Orlova et al., 2017). As a noun, "liveability" denotes "the ability to live" (Sagot, 2017). Another way to describe it is to say that something is "fit or suitable or acceptable to live in or with", and it may also be stated as "can be lived" or "liveable" (Ahmed et al., 2019).

When it comes down to it, what makes a location "liveable" varies significantly from place to place based on the local values and contexts, such as the regional economic, social, and cultural norms, and personal preferences and desires (Pandey et al., 2014). Thus, "living" in the United States refers to "quality of life" and "well-being," whereas "living" in the United Kingdom refers to "cleanliness, protection, and the nature of the plants in the area". Figure 5.1 shows how the relationship between environmental and personal qualities affects a person's potential to live a fulfilling life. When we better understand how people feel about living in a location, we can better define "liveability" and determine how to measure it.

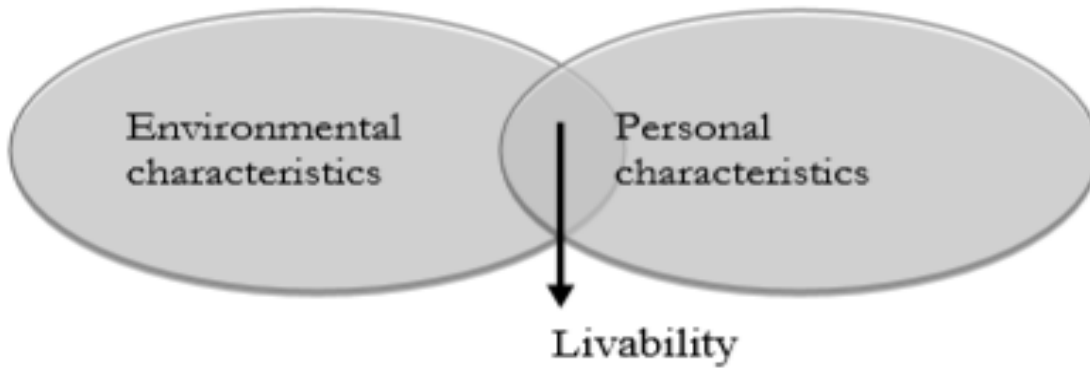


Figure 5.1: The Behaviour-Related Function of Liveability

Source: Pacione (1990)

Many scholars believe that the term "liveability" refers to the subjective perceptions and interpretations of the people who live in a place and that it includes concepts like "vitality" and a "feeling of belonging". These words are strongly associated with liveability; however, they are not an alternate phrase for it. Other individuals simultaneously influence the accessibility and desirability of public areas in the vicinity (Bosselmann et al., 2008).

Despite this distinction, the first empirical approach to vitality, called liveability, has taken place in the social sciences and humanities sectors, according to the words of Kordjazi et al. (2014). Both "liveliness" and "vitality" have been used interchangeably to describe "the condition of being when you are full of life and energy" (Webster, 2018). In popular literature, the term "vitality" refers to the quality of being alive and vibrant, and this association between the word's "vitality" and "liveliness" dates back to the early 1900s. Regarding urban "vitality", you talk about varied public domain activities and how cities adapt to different behavioural bases. The adjectives "vitality", "alive", and "sense of belonging" are not synonyms for "liveability" but rather criteria that must be met in any living environment. They are incorrectly substituted for the term "liveability" because they are utilised in conjunction with the behavioural foundations discussed by Pacione (1990), which is essential to grasp the concept of liveability.

5.7.3 A comprehensive understanding of liveability

Ahmed et al. (2019) believe that there is a single silver-bullet answer to the building of liveable cities, despite the numerous attempts to define the concept of "liveability". An entire city is

considered a "city collection" since it contains a wide range of things, including a high standard of living.

5.7.4 Liveability and related concepts

Sustainability, well-being, contentment with one's lot in life, and happiness are all synonyms for "liveability". These are only a few examples of the countless possibilities, and because of this, the term "liveability" became ambiguous. There are so many alternative meanings that it has become an expression that can be used in various contexts, i.e., there is a wide range of uses for the term (Ahmed et al., 2021). The term "liveability" involves more than simply reflecting the place and its living conditions; it reflects the people who live there and what they think of it. Quality of life, well-being, and happiness with life are all adjectives that belong under this umbrella phrase. As a result, understanding the relationship between viability and other concepts, seeing areas of contradiction, and integrating different ideas are more important than ever (Gough, 2015).

5.7.5 Principles of liveability

To minimise family transportation costs, there is a need to reduce the country's reliance on fossil fuel, improve air quality, reduce greenhouse gas emissions, promote public health, and develop safe, dependable, and cost-effective transportation solutions. To lessen our dependence on fossil fuel, we should explore solutions which promote alternative and renewable energy sources to drive our daily activities and improve economy.

Housing affordability and equity: Increase housing options for people of all ages, incomes, races, and ethnicities, to promote mobility and reduce the cost of housing and transportation.

To improve the economy's competitiveness: Employers and workers alike benefit from increased market accessibility, as well as better access to job centres, educational opportunities, and other necessities.

Preserve the existence of existing organisations: Land recycling and mixed-use developments can help rejuvenate existing communities and increase the efficacy of public works investments while protecting rural landscapes.

Remove obstacles to collaboration, leverage funds, improve accountability, and increase the effectiveness of all levels of government in planning for future growth through the adoption of innovative energy choices such as locally generated renewable power. Remove barriers to federal spending and policy initiatives.

Health, safety, and walkability should be prioritised in all communities, regardless of whether they are rural, urban, or suburban. It has been found that the PSC definition had been adopted by many community planning organisations and is being utilised in academic studies to describe the current state of practice on liveability. Organisations and researchers use the PSC's six guiding principles explicitly and implicitly. Sources examined frequently referenced and used the federal government's definition of "liveability", suggesting that national policy impacts the discourse of "liveability".

5.8 Cities and Inclusive Development

5.8.1 The origin of inclusive development

Economic growth and income disparity have been debated for a very long time, and most economists use the Kuznets Economic Model (1955). As the economy grows and wages keep pace with those in other areas, new, high-paying jobs are created for just a few people, reducing inequality for this few. The Trickle-Down Theory of Development and the assumption that growth is the first step in alleviating poverty have been linked to this growth-induced imbalance (Kakwani & Pernia, 2000; Kanbur, 2000). The outcomes of studies on inequality conflict with the core assumption of the Kuznets curve, and therefore Kuznets Economic Model has been replaced with a complex theory that growth may be achieved differently and with a wide range of income distributions (Kanbur, 2000; Ranieri & Ramos, 2013; Yin, 2004). Policy choices made by governments as part of national development goals have, unfortunately, instead resulted in increased inequality, according to Yin (2004).

Many people are concerned that economic growth has exacerbated inequality rather than aiding the poorest among us. Piketty & Saez, (2014) is a well-known economist who underlined the long-term increase in inequality controlled by capital returns and growth rate, in his seminal work. According to Piketty (2014), a lack of growth leads to a rise in inequality since capitalists will outperform workers in pay, and it is not strange to read about a similar story in a modern economy. According to estimates from the Brookings Institution, the average male full-time

worker in the United States now earns less than he did in 1973. Wessel (2015) noted that income inequality in the United Kingdom has decreased significantly since 2008, and the OECD expects this to persist over the long term (Hood & Waters, 2017; OECD, 2011).

Even though growth can have a positive impact on low-income people, according to the distributional effects of growth literature (Ravallion, 2015), the relationship between change and poverty depends on the type of growth, such as its sectoral composition and the local context, such as the starting level of inequality (Ferreira, 2010). A better understanding of how different types of "growth" have other implications on poverty and the income structure led to new concepts that sought to relate growth with distribution. In 1974, the World Bank published "*Redistribution with Growth*", which argued forcefully to include distributional issues in future policy discussions (Ahluwalia et al., 1974). People with low incomes suggested that instead of using the GDP, that "distributional weights" be used to indicate a more accurate estimation of increased revenue.

"Pro-poor growth," defined as the difference between a drop-in poverty associated with any growth phase and a poverty reduction had growth been equally distributed, was the most critical concept in these talks (Kakwani & Pernia, 2000). The second goal of the literature on pro-poor growth was to respond to Washington's consensus policies that increased inequality but had little impact on poverty (Bakker & Messerli, 2017; O'Connell & Shoff, 2014). The first objective was to devise new metrics for directing policies toward reducing poverty. Pro-poor growth was a policy move that ensured that the poor were helped, but not at the expense of economic growth. At some point in the late 1990s, the term "pro-poor growth" began to gain popularity in development circles, and by 2004, nearly everyone was using it.

Despite its widespread acceptance, the Theory of Pro-Poor Growth came under fire from several quarters. Its execution was complex because of the varying meanings used by different actors: academics used precise statistical language while policymakers had alternative notions in mind (Lopez, 2004). However, a lack of attention was paid to those with incomes over a certain poverty level. "Inclusive growth" became the dominant term in international development in the late 2000s (Grimm et al., 2015), and Ravallion (2004) argued that enthusiasm for pro-poor growth had peaked, and the focus had shifted instead to "inclusive growth". Governments and countries in the Global South quickly accepted the idea, and it

spread to cities and regions worldwide. By 2011, anti-poverty policies' geographies were more jumbled up than ever before (Peck, 2011).

5.8.2 Defining inclusive development

There is no single agreed-upon definition of inclusive development because of the extensive range of actors who use the word. According to an early World Bank definition, “speed and pattern” are important considerations when discussing inclusive growth, and in reports, both appear to be significant. This new approach to economic growth, according to the Organisation for Economic Cooperation and Development (OECD), strives to raise living standards and distribute more fairly the advantages of rising prosperity. These two elements of speed and pattern are the starting point for most definitions, however extra factors have been added to expand on them (Rauniyar & Kanbur, 2010).

McCawley (2017) included social welfare in its definition of inclusive development, which reads as follows: *"... High, sustainable economic growth to create and expand economic opportunities, broader access to these opportunities, and social security networks to prevent extreme privation"*. To emphasise inclusive development as a necessity and to claim that inclusive development will increase total economic production is a common feature of many institutional definitions. Several critical aspects of inclusive urban development are shown in Figure 5.2.

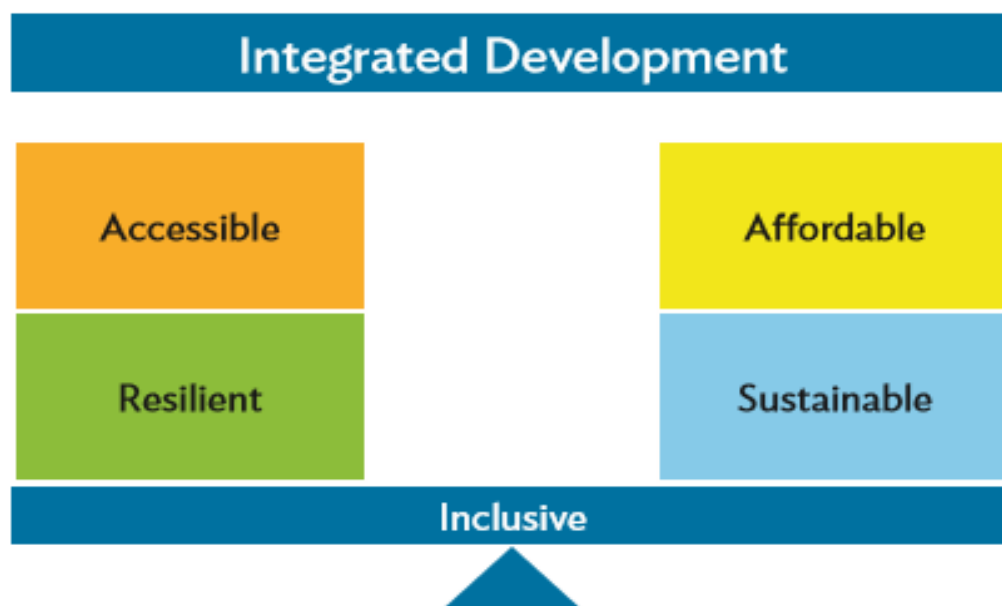


Figure 5.2: Critical Aspects of Inclusive Urban Development

Source: Asian Development Bank (2017)

Samans et al. (2015) state that there is no inherent trade-off in economic policymaking between enhancing social inclusion and economic growth and competitiveness. Pro-growth and pro-equity positions can coexist. As a result, inclusive development contends that improving equity efficiency will also enhance the system's overall efficiency (Ranieri & Ramos, 2013). Khan (2017) defines inclusive development as allowing as many people as possible to participate in and profit from the advancement of society.

5.8.3 Methods for making cities more inclusive

"Inclusive growth" is a trendy new term in urban and regional policy, and two distinct developments have aided its increase in popularity. First, there is a significant concern about income disparity's extent and its potential consequences (Cavanaugh & Breau, 2018). China's economic expansion has likely reduced global inequality over the preceding three decades. There is still a widening divide between the wealthy and those who are not, with the rich making more money while others who are less fortunate are not making any more money (Bain et al., 2014; Benner & Pastor, 2015; Summers & Balls, 2015). There has been a long-term trend of increasing inequality in the United States, Britain, and Sweden, where the average male full-time worker has gotten less in real terms in 2014 than he did in 1973 (Stand & Rising, 2011). The UK's decision to exit the EU and Donald Trump's becoming president of the United States have been attributed to rising inequality, according to some (Anttiroiko, 2018; Lee et al., 2018; Muller et al., 2018).

5.8.3.1 Reinforcing approaches to inclusive cities by connecting the dots

For many low-income families, the cost of necessities like housing and services can be prohibitive. However, the most disadvantaged must access high-quality occupations and chances (to accumulate assets and wealth) to be included in the community. To truly make an impact, Bergeron (2003) recommends a multifaceted approach that goes beyond traditional brick-and-mortar projects and considers all three dimensions of inclusive interventions, which are the spatial dimension of access to land, housing, and infrastructure; rights and responsibilities in a democratic society; and economic tenets require that everyone in the economy have equal access to opportunities.

Space, society, and the economy are all interwoven and interdependent. Due to their interdependence, interventions in any three aspects will affect the others. For example, more

people will take advantage of work and professional opportunities if affordable transportation is available. As a result of better economic possibilities for the excluded, people who have been left behind will be able to access more housing and services. Increased access to shelter, services, and opportunities will lead to more participation in development and decision-making.

So, the web of interconnected forces can reinforce itself. If these forces work against them, people are imprisoned in a stigmatised zone of poverty and marginalisation. They can alleviate their marginalisation by working in the other direction.

5.8.3.2 Diverse stakeholders must work together to create inclusive cities

"Inclusion" is the mantra of nearly every international organisation. The federal government has taken notice of the problem in various nations and is actively pursuing federal inclusion in urban regions. Increasing the diversity of a city's population is another goal of some local administrations. Activists from NGOs and communities have impacted several situations at the national and local levels. Because of their ability to work directly with residents, civil society organisations play an essential role in creating inclusive cities.

5.8.3.3 The commitment of the international community to inclusive growth

Thus, international organisations play an essential role in promoting public awareness and persuading government leaders to act. The World Bank's plans to eradicate extreme poverty while promoting shared prosperity aim to create a society where everyone, not just the wealthy, has a say and is empowered. Ethnic minorities and indigenous peoples are encouraged to participate in decision-making (Hossain, 2013), and the participation of both national and sub-national governments is significant.

Governments increasingly focus on urban challenges regarding how quickly cities contribute to the national GDP and how rapid urbanisation extends across countries. While promoting urban economic growth, many federal governments have promoted inclusive urban development.

5.8.3.4 Community-based organisations (CBOs) are strategic partners

The inclusion plan relies heavily on the efforts of communities. First, efforts to help communities were geared to benefit the people. As a result, there has been a shift in how the communities and their organisations are engaged. There is now an understanding that communities need to be considered as partners and included in the planning and implementation processes. Instead of treating them as passive recipients, they should be put in the driving seat.

5.8.3.5 The private sector is increasingly providing shelter and essential services

When it comes to solving the country's economic growth problems and improving people's lives, the private sector has a distinct advantage. It has proven possible to involve the private sector in providing services through public-private partnerships (PPPs). With PPPs, private businesses can help implement, finance, and maintain infrastructure services for the poor, resulting in significant cost savings and efficiency advantages.

5.9 The Roots of Nigerian Development Management

During colonial times, the Town Improvement Ordinance was published in Nigeria in 1863 as the first attempt to regulate the physical growth of towns and cities. The colonial government of Lagos enacted this ordinance to control the city's development, however, the legislation proved largely unsuccessful as even with the law in force, Lagos's sanitation worsened. As early as 1904, the Northern and Southern protectorate's colonial administrations were attempting to regulate the growth of a few major cities. Some of these cities were commercial and governmental centres with significant numbers of Europeans (Salet et al., 2015)

The Cantonment Proclamation created "European and African" quarters (Obialo, 1982). European quarters were reserved for colonial administrators, while the "African" quarters were meant for the indigenous population and were characterised by squalor and overcrowding. Even though the 1904 Cantonment Proclamation was a one-sided effort to create an organised physical environment for the colonial overlords, it can be inferred that it was the first town planning law. The Town and Country Planning Ordinance, No. 9 of 1914, was passed in 1914 when the Northern and Southern Protectorates were merged. This ordinance gave the government the authority to acquire land for public use without occupying it. There were several reasons for the ordinance, but its principal purpose was to address the issue of public

access to land that was privately owned. In 1914, Nigeria became the first African country to enact eminent domain law (Akpan, 2005).

Rural-urban migration took on a new guise as the economic and social standing of both the old and new cities rose. To keep Nigerian cities from becoming chaotic, it became necessary to instil orderliness in their physical development patterns. As a result of this single cause, the 1917 Road and Township Ordinance No. 20 was enacted. The ordinance addressed these issues by dividing townships and urban districts into first, second, and third-class townships and regulating offensive traders, property acquisition, building code regulations, open space, and traffic (Oduola, 2021; Agbola & Jinadu, 1997). To carry out town planning efforts in Northern and Southern Nigeria successfully, the colonial government established a separate town planning commission in 1924. Urban growth, planning schemes, and building plans were the committee's primary objectives. Governor Hughes Clifford, who set up the committee, left office and disbanded the committees responsible for urban governance and planning.

The Lagos Town Planning Ordinance of 1928 was enacted in response to the city's unhygienic state due to its unplanned physical development. The Lagos Executive Development Board (LEDB) was established due to the ordinance. Planning and regulating new developments, building and maintaining roads, clearing out the slums on Lagos Island to keep the number of inhabitants to a minimum, and buying and selling land were all essential responsibilities of the board. Lagos was the only city to receive the ordinance. Combined with Britain's establishment of the Town and Country Planning Act in 1932 and Nigeria's stratospheric growth, the two factors led to Nigeria's adoption of the Town and Country Planning Ordinance in 1946. The 1914, 1917, and 1928 Planning Ordinances were viewed as the basis for this ordinance, but it differed from the previous ones in that it expanded spatial planning to the entire country and provided the relevant planning organisations with additional legal authority to put its provisions into action (Home, 2013).

Following independence, the pre-independence development control system was passed down to the new government. Obasanjo's military government issued the Land Use Decree in 1978 to address and alleviate the issue of the lack of property available for public use, particularly in the South, where individual ownership of land was at an all-time high. For the benefit of all Nigerians, the land within the jurisdiction of each state government was held in trust. Absolute land ownership was eliminated, favouring government ownership, which was either presumed

or granted to citizens. As a result of deficiencies in the 1946 Town and Country Planning Ordinance, the Urban and Regional Planning Law of 1992 was enacted. In contrast, the latter emphasises long-term physical development plans at the federal, state, and local levels. A different type of planning was required. Additionally, the various levels of government's roles in physical planning and management were explicitly defined (Porter, 2015).

5.10 The Profile of Nigeria's Development Control

The concept of "development" in the 1917 Town and Country Planners Act includes construction, engineering, mining, and other activities in, on, under, or over land. As stated in Nigeria's 1992 Urban and Regional Planning Decree No. 88 (Federal Government of Nigeria, 1992), development also refers to "*any building, engineering, mining, or other operations in, on, over, or under any land*" and/or "*the making of any environmentally significant change in the use of any property*". In the Nigerian Urban and Regional Planning Degree, "develop" is used in conjunction with "development" (Tacoli, 2003; Watson & Odendaal, 2013).

Controlling or exercising one's influence over one's realm is another term for this. Consequently, "development control" is a phrase that refers to physical planning tools, such as rules, training, and monitoring of materials on land. Even if used with a pessimistic mindset, it can be a valuable tool for strategic planning. One way to ensure that city and rural development plans are implemented correctly is to employ this form of physical planning. Before a project may go forward, a planning agency must accept or reject the application. A system that governs the use of land and buildings on it can prevent or check non-conforming usage (Casadei et al., 2011; Shen et al., 2021).

The United Kingdom's Parliament passed Cap 54 in 1933, creating a framework for development control. Nigeria established a Township Improvement Ordinance (TIO) in 1863, which only applied to the Lagos Colony, but it had a similar effect. This Township Improvement Act aimed to promote public health and sanitation, development control, and public services and facilities. Several changes were made to the Township Ordinance before renaming it the Township Improvement Ordinance. The 1863 Act broadened the definition of "public land acquisition ordinance", which had a more restrictive scope. Between 1863 and 1900, the British colonial administration in Southern Nigeria resulted in British control and

development of the region. Townships and urban districts were established as a result of the 1917 Act (Shinggu & Kadala, 2020).

Additional legislation in 1928 established the Lagos Executive Development Board (LEDB), today known as the Lagos State Development and Property Corporation (LSDPC). The plague outbreak in Lagos triggered this 1928 decree, while the 1917 law regulated the rest of Nigeria. Until 1946, the Lagos Ordinance (1928 Act) was not officially introduced to other country regions. It was used as a powerful working tool for the ministries of land and housing in the country's town planning departments (Chan et al., 2018).

5.10.1 Requirements for the management and control of development

Planning laws vary from state to state, but they are always aimed at helping to guarantee that land use activity is in line with societal ideals while also benefiting the local community. A set of laws to protect or promote the environment is defined as environmental law (Gray, 2011). Decree 88 of 1992, Nigeria's law on urban and regional planning, stipulates in Section 91 that development is defined as "*the building of structures or undertaking of other activities on any land, including cutting down trees and placing free-standing erections used for distribution*" or "*the environmentally significant change in the use of any land*" (Federal Government of Nigeria, 1992).

The law on Ekiti State's urban and regional planning and development (Ekiti State Urban and Regional Planning and Development, Act No. 16 of 2011) defines "development" as any project that takes place on or above a property; or any major change in the use of any property or any action or change in use that fits within the concept of "development," planning approval must be sought first. This means that any development without permission is forbidden (Wahab, 2014).

According to Olufemi (2018) development control is spread by enforcing the approved planning standards and regulations to ensure that development is carried out according to the applicable planning standards and legal requirements. In this instance it is the Urban and Regional Planning Law of 1992 (Federal Government of Nigeria, 1992). There are six distinct sections to the legislation, and these:

- Make sure that all plans are put together and implemented correctly.

- Control the course of development.
- Affect the specific bodies with control over the development.
- Deal with the purchase of and compensation for land.
- Deal with renewal, rehabilitation, and upgrading.
- Deal with appeals lodged against any part of the process.

5.10.2 The tools of development control

There are two instruments or tools often used in the development control process. These are:

- **An enforcement notice:** This is served for any breach of town planning law relating to development without planning permission (approval). It relates to illegal building, engineering, mining, and land use change. This notice may be served either for the demolition of such a building built without approval or for restoring an altered building to its previous condition under section 47(1). Non-compliance with an enforcement order is punishable, though a breach of planning law is not a criminal offense.
- **A stop-work notice:** According to section 53 of the Urban and Regional Planning Decree No. 88 of 1992, a stop-work order can be issued where it appears to the Control Department that:
 - (a) An unauthorised development is being carried out; or
 - (b) Where development does not comply with the development permit issued by the Control Department.

This document is used until a notice of enforcement is issued to the owner, occupier, or holder of the land where the non-compliant activity is taking place. It has an immediate impact on the operation being carried out on the land in question and is typically issued within 21 days of the contravention being noticed. It ceases to be successful if the contravener is not informed of the enforcement within 21 days (Federal Government of Nigeria, 1992).

5.10.3 Problems and constraints of development control

Several authors, including Ogundele et al. (2010), examined the challenges and limitations of development control in depth. Even if they benefit the environment, development control legislation in Nigeria confronts several challenges, as do other rules requiring citizens to adhere

to specific criteria. These authors discovered many obstacles to successful development control in Nigeria.

The lack of a current land use map reflects the current development direction and the vehicles designated for development management. A lack of access to police and law enforcement officers when responding fast to any disobedient growth makes the development control technique ineffective. Physical planning suffers from a lack of investment compared to other sectors of the economy. Accordingly, governments at all three levels misinterpret the development control authorities and agencies (including the Federal Housing Authority [FHA]) as revenue-generating units rather than perceiving urban and regional planning as social services.

The absence of physical planning education programmes offered by the FHA leaves the general public in the dark. This leads to illegal constructions to satisfy their self-interests, without regard for the harmful influence on the surrounding environment. Public support is a requirement for progress that is both efficient and successful and the majority of the population is always ready to support any action once they are made aware of it. There is also incorrect or inadequate monitoring to ensure compliance with approved development permits. Town planning needs to be departmentalised, equipped, and funded appropriately to deal with development control difficulties, according to Ogundele et al. (2010). To restore order will necessitate ongoing monitoring of development every day.

There is also a severe dearth of qualified Town Planners working in the few offices that do exist, which is challenging. For example, Ogundele et al. (2010) found that the FHA's Festac Town Estate/Town Planning section required 15 employees, but the staff size was only 4, with an 11-person shortfall. The Town Planning Unit has been short on human resources despite its annual participation in the qualification process of the prospective town planners from the polytechnics and universities. Registered Urban and Regional Planners are in low supply in this country.

Nigeria's inability to provide adequate utility services has hurt the placement or siting of physical development projects. For example, instead of being positioned in an area with inadequate access, a gas station and shopping centre should be situated in a place where customers have easy access to the national grid and reliable power. Because of this,

development projects can be crammed into inconvenient spots without regard for local zoning regulations. Converting residential buildings into mixed-uses (primarily residential and commercial or residential-institutional) without permission also hinders development control. The amount of land zoned as "mixed-use" demonstrates how often the city's planning regulations are flouted.

Another concern cited by the respondents is the FHA's bribery and corruption when approving a development plan. It has extended to the relevant officials, who accept bribes and pass them as processing fees. Due to this sad occurrence, the area is influenced negatively because it encourages the use of different criteria for approval or denial (Ogundele et al., 2010).

5.11 Case Studies of Urban Development

5.11.1 Urban development in the United States of America (USA)

This section evaluates the urban development, regulations, spatial changes and control in USA and draw a comparison with the situation in Nigeria in terms of areas of comparative advantages and variance. The section looked at the profile of USA-Nigeria Urban development relationships and USA urban development experiences amongst other topical issues related to urban development between both countries.

5.11.1.1 Profiling the Nigeria-USA relationship

Ayam (2008) informs that the United Nations Organisation (UN) recognised and acknowledged Nigeria as an independent state in 1960, signalling the beginning of critical foreign policy developments in Nigeria. During the Cold War, the US and the Soviet Union established diplomatic ties with Nigeria. The US's policy of containment to curb the spread of communism and Nigeria's non-aligned posture in the 1960s shaped the two countries' interactions. So, even during the height of Soviet backing of the Nigerian government during the country's civil war, the two countries maintained a friendly relationship. Because of its prosperity, affluence, and high technological level, Nigeria continues to receive tremendous help from the United States today. According to Gambari (2005):

There are many commonalities between the Nigerian and American populations. We share the same lingo. Our democratic values and traditions are comparable, so we are friends. We are home to the most African-Americans in the world. Nigeria is in desperate need of American expertise and capital. We exchange a lot with each other.

A new administration in either the United States or Nigeria would be powerless to override the seriousness of these issues (Gambari, 2005).

Because of Nigeria's vast natural resources and dense population, the US has benefited from the countries' friendship as well. There has been a shift in the relationship between the two nations since the conclusion of the Cold War. The demand for democratisation in Nigeria, trade, the fight against illegal drugs, and African peacekeeping have all influenced the relationship between the two countries. After the disaster in Somalia, the US decided not to send troops to the continent for peacekeeping purposes, and Nigeria deployed its military to West Africa in response to this decision (Ayam, 2008). Nigeria and the US had a friendly relationship before December 25, 2009 but attempts by a Nigerian to carry out a suicide attack threatened relations between these two countries.

A consequence of this is that the USA has classified Nigeria as a threat to its national security. This action infuriated Nigerians and prompted calls for the Nigerian government to take retaliatory action. The Obama administration issued a forceful policy statement that put Nigeria on the US's Terrorist Watchlist following the incident, and predictably, both the Nigerian government and the people called for the country to be removed from the list immediately (Osaretin & Ajebon, 2012). However, even when relations between Nigeria and the US were at their worst, the country's economic progress was unfettered by political or diplomatic friction. Political ties between the US and Angola also grew tense in 1975, while business ties flourished throughout the same period.

A year after Nigeria's presidential election, sanctions were placed on the country by the US authorities. Despite these sanctions, there was no threat to their business activities, particularly crude oil trading. No matter how much they disagreed, the two countries would not risk jeopardising their economic interests. Since 1960, the relationship between Nigeria and the US has undergone considerable changes, as has the relationship between the US and the Soviet Union. The Kennedy, Carter, and George W. Bush administrations all had periods of improved ties with the Soviet Union, while in contrast, the Ford and Clinton administrations had low-key contact and even outright and antagonistic relations. As Nigerian oil is critical to the US's economy, Nigeria will continue to pursue investment possibilities in the US markets and benefits from their technology (Shepard, 1991).

5.11.1.2 The USA's urban experience

The word "city" has only been used in the United States since the 17th century, according to Bretagnolle et al. (2018). According to historians (Chudacoff, 1981; Greene & Harrington, 1932), Boston, Philadelphia, New York, and Newport, each having a population of over 2,000 persons, were all registered as cities in 1690. As reported in the first census of 1790, 32 cities in the Eastern Seaboard region were heavily dependent on trade with Europe. The construction of canals and railroads in the 1810s and 1830s aided migrations westward and commercial exchanges with North-Eastern ports and Europe (1830 and after). Eastern regions were connected to the burgeoning Ohio during the first industrial revolution and to the wheat producers who used the Mississippi River to export their harvests through these transportation networks. Mexico was a second "urban frontier" for the Spanish, who arrived there in the 16th century (Wade, 1959). The population of San Francisco and Sacramento did not surpass 3,000 until the mid-19th-century gold rush.

There have been four main periods of urban and economic growth in the US: commercial (1690-1840); early manufacturing (1820-1860); industrial (1860-1940); and services (from 1860-1940). A mere quarter of the population was directly involved in maritime transit and commercial transactions. However, all of the cities were seaports, subsidised by the Atlantic trade between Europe, the West Indies, and the Americas throughout the mercantile/commercial period. The cities in Virginia, on the other hand, did not consider their large populations to be residing in cities, or their exports. Virginia's primary export, the tobacco trade, was dominated by British traders rather than natives. As a result, the lack of formalised cities in the Southern US dates back to the colonial era (Bretagnolle et al., 2018).

Factory organisation spread across a wide range of industries, many of which were resource- and energy-intensive, during the second industrial revolution of the late 19th and early 20th centuries. By 1920, US manufacturing production had overtaken agricultural production as the country's primary source of income. Industrialisation was focused on urban regions during the second industrial revolution compared to its predecessor, which took place in rural areas. Manufacturing became more concentrated in a Northern region of the US known as the manufacturing belt between 1860 and 1920, as the industrial revolution spread (Bretagnolle et al., 2018).

Boustan et al. (2013) believe that the US population has shifted from rural areas and smaller towns to larger cities since the country's founding. First century American populations saw limited urbanisation expansion, with an urbanisation rate of less than 10 per cent. Between 1830 and 1930, urbanisation advanced dramatically, with the percentage of people living in cities rising from 30 per cent to 60 per cent. From 1940 to 1970, the urban share increased significantly, and from 1970 to 2010, it grew more slowly, reaching an all-time high of 80 per cent. The proportion of people who live in a metropolitan region closely mirrors the proportion of people who live in cities.

The privatisation, liberalisation, and modernisation of urban planning in the US throughout the 1980s made the country the world's leading power in the newly accepted global view, according to Peters (2012). The country reasoned that American marketing brilliance (called "city marketing") might help sell otherwise tricky products. Renovating Baltimore's waterfront to attract tourists helped that city's struggling economy, and as a result, the project was a huge success. However, it did nothing to help repair the damage done in the neighbourhood surrounding the construction site itself. Downtown malls, conference centres, sports arenas, museums, and galleries have been built as part of the area's revitalisation. It started with governmental funding and support, then moved to private capital and management.

5.11.1.3 Linkages between the USA's cities and the Nigerian scenario

In the 1990s, argue Yazar and Dede (2012), environmental attitudes began to alter in the US when new urbanism and smart growth became regarded as novel concepts in the planning sector. Smart growth aims to make communities more liveable by increasing the environmental quality of life and economic sensitivity. Urbanisation in Africa is considered demographic rather than economic because significant agricultural productivity and industrialisation changes are not driving the process (Songsore, 2008).

Profits from oil production in the 1970s in Nigeria were used to encourage industrialisation and develop modern urban infrastructure, as noted by Bloch et al. (2015). Cities and towns began to see improvements in infrastructure, such as paved streets, roads, and bridges. The new administrative organisation of the country attracted a massive influx of people to towns that were designated as state capitals. In Lagos, this was observed to be taking place. As a result of the work by the German engineering company, "Julius Bergerwork", on Lagos' bridges and

highways in the 1970s, Lagos' physical structure has been permanently altered, and this hints at a permanent transformation into a modern metropolis with an excellent road network, high-rise buildings and contemporary modes of transportation.

In the US there is a distribution of cities of different sizes, with a host of different city functions, regular spatial patterns, and co-evolution of their socio-economic outlines, as demonstrated by Bretagnolle et al. (2009). As a result, cities, and towns have grown incredibly, characterised by the conquest of space and land exceedingly rapidly. When they reach a position of dominance within their territory, they can exert authority over a far larger area than they could previously. With urbanisation rates at just 15 per cent in 1850, the US has gone from being a primarily rural country to a significant economic and cultural powerhouse in just 150 years (urbanisation rate of 94%, higher than in Europe and much the same as Japan, with a maximum city size of around 20 million, while London and Paris only have maximums of 10-12 million). In many small and medium-sized cities, the state capital is housed in a democratic federalist system, which creates an exciting dynamic between political institutions and urban growth. The hierarchical diffusion of new ideas facilitates the concentration of economic power in a small number of major metropolises.

According to Bloch et al. (2015), contemporary Nigerian urban settlements are characterised by a decentralising population and economic activity within low-density metropolitan zones. Nigerian urbanism may be seen in this particular urban setting. Because of the country's large and growing population and rapid urbanisation, Nigeria has reached a new level of urbanisation. The result is poly-nucleated structures that extend beyond single urbanised entities, and this demonstrates the significant interdependence of urban districts. Lagos-Ibadan, Abuja FCT, and its satellite towns, Kano-Katsina-Maradi and Awka-Onitsha-Nnewi are notable examples of this development. The growth of the cities is concentrated in their outskirts. The urban perimeters constantly shift as land cover expands. This regularly redraws the line between what is considered “urban” and “rural”, blurring the distinction between the three pillars of city life: growth, development, and governance.

Central locations were significantly affected by advantages in geography, such as the existence of streams and the proximity to fertile farmland. Although Cronon (1991) refers to this as "second nature", human investments in supportive infrastructure helped keep it going. New York City is an example of a city built around a natural harbour, which provides access to local

and foreign markets. The Hudson and East rivers connected upstate New York with Long Island's agricultural region. These territories maintained a large rural population, which provided a consumer basis for the city's services, thanks to the fertile farming. The rise of New York City was bolstered not just by the city's natural advantages but also by investments in the Erie Canal, which connected upstate New York to the Great Lakes and thereby expanded the city's available market base. However, due to advances in transportation technology, cities in the US no longer enjoy the natural advantages that once defined their positions (Bloch et al., 2005).

Ahmad et al. (2021) report that in Nigeria, the natural growth rate in urban areas is lower than the growth rate in rural areas, which leads to urban growth and expansion through seizure and takeover, migration from rural to urban areas, and the transformation of rural settlements into small metropolitan areas. As a result, urbanisation has surpassed industrialisation in speed. The growth and development of Nigeria's cities have long been a part of its history. Lagos, Ibadan, Kano, Sokoto, Calabar, and Port-Harcourt are just a few of Nigeria's cities whose settlements have existed for millennia. Lagos, Nigeria's colonial capital and the world's largest port, is one of the world's largest cities. To this day, it is the world's economic and cultural hub. Ibadan was founded as a battle camp in the 19th century, making it the largest pre-colonial metropolis in sub-Saharan Africa. Agribusiness and international trade are the lifeblood of the economy. Usman Dan Fodio, a 19th century jihadist leader based in Sokoto, was responsible for spreading Islam to Northern Nigeria's major cities. Oyo, Abeokuta, Ife, Zaria, Katsina, Jos, Bida, Calabar, and Enugu are just a few of Nigeria's main metropolises. Economic, transportation, and political centres have become increasingly important.

Global and domestic trade and natural and human-made advantages have played significant roles in the rise of New York, Los Angeles, and Chicago. Despite Philadelphia's prominence throughout the colonial era, New York overtook it as the leading metropolis by the year 1690. Natural harbours and auction systems for disposing of goods and regular packet ships were responsible for this. The completion of the Erie Canal in the 1820s solidified New York's position as the dominant city in the US. During the second industrial revolution, the value of railroads grew, and Chicago grew as a result. Human-made inventions assisted its development that reduced transaction costs despite Chicago's Great Lakes location (Cronon, 1991). Finally, as trade between the US and Asia increased in the second half of the 20th century, Los Angeles began to rise. In contrast to San Diego, Los Angeles is located on the west coast, far from any

natural harbours. However, the Port infrastructure developed in Los Angeles handles more than 70 per cent of all Pacific Coast maritime traffic (Ducruet & Notteboom, 2012; Erie, 2004).

Kano is the largest Hausa city in Northern Nigeria, according to Aliyu and Amadu (2017). They use it as an essential crossroads for trans-Saharan trade and it is the centre of an agriculturally prosperous region (the Land Pyramids). It is a substantial commercial, industrial, transportation, and administrative centre. In light of the inapplicability of smartphones to improving social ties in overall urban green management, it is possible to argue that Nigerian urban governance contains some elements of smartness that look at the policy thrust of an effective transportation network and traffic management in Lagos, Abuja, and Enugu (Akujobi et al. 2017).

5.11.2 Urban Development in Ghana

This section evaluates the urban development, regulations, spatial changes and control in Ghana and draw a comparison with the situation in Nigeria in terms of areas of comparative advantages and variance. The section looked at the profile of Ghana-Nigeria Urban development relationships and Ghana urban development experiences amongst other topical issues related to urban development between both countries.

5.11.2.1 Profiling the Nigeria – Ghana relationship

According to Otoghile and Obakhedo's (2011) study, Nigeria and Ghana were subjected to British colonial exploitation and dehumanisation. Legal consultations led to the independence of these countries (Idisi & Idise, 1996). After their democratic cycle of military governments, both countries face similar financial and economic challenges, such as widespread poverty and general unhappiness (Goldstone (2011). Nigeria is Africa's largest oil producer and exporter, and it also happens to be its most populous country. However, new research indicates that Ghana has many oil wells and that the country might begin producing and exporting oil in about ten years' time.

At the time of Ghana's independence in 1960, the country's economy was more substantial than Nigeria's. Due to the high value of Ghana's exports of gold and other mineral resources, this was an understandable situation. Despite this though, Nigeria's economy was more solid than that of Ghana at the time. In December 1960, Nigeria's foreign exchange reserves were

estimated at \$172,500,000,000 (Federal Office of Statistics, 1961). From 1960 to 1966, Nigeria-Ghana relations were marred by hostility and distrust, and there were three leading causes for this situation. To begin with, the political elites in Nigeria and Ghana had very distinct outlooks and behaviours. There were many unforeseen twists and turns in Nigeria and Ghana's relationship from 1966 to 1975, after military coups overthrew the two countries' governments (Otoghile & Obakhedu, 2011).

Musiliu Obanikoro, Nigeria's ambassador to Ghana, spoke about the very close ties between the two countries during an interview on TV3 at 10:00 a.m. on October 1, 2010, Nigeria's 50th Independence Day. He announced that a Ghana-Nigeria Commission had just been established in Nigeria, tasked with resolving the issues between the two countries so that they could work together as one. He believed that the entire West African region would be united and integrated if Ghana and Nigeria were able to resolve their differences, he was of the opinion that there would be a ripple effect across West Africa if Ghana and Nigeria worked together to promote peace and togetherness despite their differences (Adeleke, 1995).

5.11.2.2 Ghana's urban experience

National poverty rates are expected to fall as the proportion of the overall population living in cities increases, primarily due to increased economic development linked with urbanisation rather than redistribution, according to Ravallion et al. (2007). A slow but steady decline in poverty in Ghana during the last two decades may only be partly explained by urbanisation, which has caused a shift away from agricultural activities toward urban ones (from 52% of the population in 1991 to 32% in 2006 and 24% in 2013).

According to the findings of Oteng-Ababio and Owusu (2016), urbanisation and economic development appear to be linked in Ghana, based on the higher earnings in Southern Ghana than in the North. Accra and Kumasi serve as examples of fast urbanisation during the early phases of a country's economic development. As rural populations and agriculture dwindle, urban population growth slows in the core areas as urbanisation advances through the intermediate economic development stage. According to Sao (2013) the rise of intermediate-sized cities and suburban rings is becoming more prevalent. People in Ghana are moving to the cities in more significant numbers than elsewhere in Africa. In Ghana, an urban centre is defined as any place with more than 5,000 residents, and most Ghanaians now live in cities or

towns with more than 5,000 residents. Ghana's population is expected to double by 2020 if current trends continue (Kwankye & Cofie, 2015).

As Songso (2009) noted, urbanisation in Africa appears to be a plausible model because it has traditionally occurred without shifting the production system, such as industrialisation and agricultural modernisation, through urbanisation. Because of this fundamental discrepancy, urban life in Africa lags far behind that of other North American and European countries. Migration from rural regions accounted for nearly all urban growth between 1948 and 1960 in Ghana. This does not come as a shock. The new post-independence government's attempts from 1957 onward to undertake considerable urban-industrial development and social infrastructure supply for growth hubs in urban areas coincided with this time. A significant flood of African immigrants arrived, mainly from mining towns and cocoa-producing districts in Southern Ghana.

Located in West Africa, Ghana has an area of 238,537 square kilometres, which is ideal for local economic and physical development. There are ten administrative regions in the country. Studies have shown that Ghana's population is getting increasingly urbanised. Statistics show that the population of Ghana has grown steadily since its first regular census in 1921. Between 2000 and 2010, Ghana's population grew by 30.4 per cent, reaching 24.658.823 people, with an annual inter-census growth rate of 2.5 per cent (Awumbila et al., 2014).

There has been an unprecedented expansion in service jobs in Ghana, which has enhanced the economic benefits of agglomeration and lessened the penalties for land costs or congestion. Living and working in an urban community with better amenities is becoming more desirable. This urban cycle has been a great success since rural areas have been gradually included in the urban orbit. Small and medium-sized villages surrounding big metropolitan centres have grown thanks to transportation advancements; they have become functionally urbanised and serve as essential housing locations for workers in major cities. Elite neighbourhoods in and around Accra (e.g., Trasaaco Valley) have grown in popularity among Ghanaians and ex-pats due to the increased availability of leisure time (Oteng-Ababio & Owusu, 2016).

Approximately 98 per cent of the urban expansion occurred between 1948 and 1960 due to rural-to-urban migration. Considering that the post-war economic boom coincided with the new post-independence government's efforts to conduct considerable urban-industrial

development and supply social infrastructure for the populace starting in 1957, that period is not surprising. During this period, many African migrants migrated to the cocoa-producing districts of Southern Ghana (Benneh et al., 1990).

5.11.2.3 Linkages between Ghana's cities and the Nigerian scenario

The importance of socio-economic development in urbanisation has been underappreciated in Africa thus far. Many of the socioeconomic and environmental changes needed to enhance living standards and protect the environment are not occurring in African cities (Cobbinah et al., 2015). The energy sector's legal and regulatory framework in Ghana focuses more on resolving infrastructure difficulties than does Nigeria's, according to Aladeitan's (2014) analysis of the essential laws in both countries. Although Ghana has yet to overcome the challenges of building its energy infrastructure, the government has made considerable progress. The decrease in the frequency of power outages shows that things are moving in the proper direction. The tremendous success of Ghana's energy sector legislation reform and the independence of Ghana's institutions, including its Energy Commission, when compared to the situation in Nigeria, may have something to do with the differences.

In Nigeria, a policy formulation and information collection body's implementation and compliance powers prove that legislation's substance and the resulting outcomes are linked directly. Both nations' state institutions and their performance indexes were examined to determine whether there was a link between the content of the legislation in each country and the growth of their energy infrastructure. The results showed that Ghana outperformed Nigeria. Urban life in West Africa is now commonly acknowledged as considerably antiquated. In pre-colonial times, a state's development depended on trade and commerce, the foundation of which fostered trade and commercial centres' growth. A period encompassing work with Western Sudan and European coastal trade from the 16th century to the 1850s was studied. Gambaga, Nalerigu, Yendi, and Wa were examples of important interior administrative centres or state capitals. Western Sudanese trade had led to the formation of the Mamprusi, Dagomba, and Wala states. Walewale, Savelugu, Lawra, and Larabanga were all commercial hubs simultaneously. Northern Ghana's north-west and north-eastern regions were home to these centres. Begho, Salaga, and Kumasi were some of the other southern cities. There were significant commercial routes between northern Ghana and the Sudan belt and the forest region to the south, where goods such as gold, kola nuts, and ivory were found, which were brought in from the countryside (Yankson & Bertrand, 2012).

A study by Bloch et al. (2015) found that pre-colonial structures in Nigeria display a similar development pattern to urban regions; this can be corroborated by city walls limited to the north. There was an increase in size. The main mosque and government buildings were always in the cities' centres. There was a dedicated section of town for each type of craft maker in Northern Nigeria, and the roads leading from the perimeter to the cities' cores shaped the cities' physical layouts. The location of the Yoruba battles of the early 19th century, on the other hand, matched the physical pattern of the Western cities in the South-West.

Unlike the Northern cities, war camps had several power centres without a single central palace, and the markets in the war camps frequently assumed key roles. In Ibadan, the best city in the Yoruba nation at the time, each of the city's initial factions had its own designated quarter, which illustrates this point. A Western urban system developed inside the geographical system as a result of European coastal trade. Elmina, Cape Coast, and Accra were the three most important settlements along the coast that were linked to European forts. Fort towns and the interior's raw material suppliers were linked together via a web of smaller towns. Kumasi, the capital of the Asante ethnic group, served as a gateway to Western Sudan from the Northern regions of Ghana (Songsore, 2009).

The colonial economy's development was erratic. There was a distinct difference between the pre-capitalist peasant sectors and regions' "labour reserves" in the export enclaves, and the capitalist sectors and areas merged as capitalist communities. The colonial space's economy developed a simple centre-periphery structure. Gold, diamonds, and manganese were all concentrated in the woodland belt in the centre of the country. In pre-colonial periods, various commercial towns in this generic growth region served as marketing centres or mining towns. Asante's former capital, Kumasi, was at the epicentre of this intricate network. There were also coastal port towns, which played an essential role in importing and exporting goods (Songsore, 2003).

A similar scenario was outlined by Bloch et al. (2015) when Nigeria's post-colonial sectors improved. The colonial system of 'indirect rule' left its impact on urban structure most visibly in the dispersion of Nigeria's cities. The colonial rulers created Government Reserve Areas (GRAs) to house the European population to protect their public health by controlling disease transmission and sanitation. A low-density residential pattern with tree-lined streets and vital infrastructure was used to create these communities. They also had access to excellent

amenities in education, recreation, and religion. The GRAs created an exiled enclave within the existing urban architecture by purposely creating a green belt around them. Thus, colonial cities had different neighbourhoods with distinctive architectural and social characteristics. Although the 'native city' was defined by its high density, it typically lacked infrastructure, services, and amenities compared to the GRAs.

Physical planning in Nigeria was greatly alleviated by the "1975-1980" plan, which included policies relating to the environment and rural development, and established the Federal Ministry of Housing, Urban Development and Environment (Akujobi et al., 2017). After independence, the Federal Government contributed substantially to urban and regional planning by establishing new towns, including Abuja, Onne, Satellite, and Festac.

Early success in responding to foreign demand in Ghana's cocoa-growing and mining regions created dynamics that fuelled additional growth in the region. Accra, Sekondi-Takoradi, and Kumasi already had the infrastructure to accommodate modern manufacturing. Cash crop markets were similarly consolidated. As post-independence growth progressed, the colonial economy's functional organisation was increasingly concentrated in these vital metropolitan centres, which had their primary function in facilitating the colonial economy's functional organisation (Songsore, 2009).

As former British colonies, Nigeria and Ghana share comparative histories, according to Aladeitan (2014), and this had a significant impact on the economies of both countries. Both countries were subjected to the British Common Law as former British colonies, contributing to their low energy levels. Although these rules served as a guide for the colonial-era governments, they may be ineffectual now. The degradation influenced the laws in those countries' energy sectors, and each country has since adopted reform measures to realign their power sectors. When comparing the two countries, it is clear that there is little difference between their respective reform strategies. Both countries emphasise competition, private participation, a transparent licensing system in their separate legislation, and their respective state institutions' role in promoting the reform and ensuring its progress. African countries' political leaders have had to make difficult decisions because of the international community's influence, according to Oyenike (2013). Communism, as a strategy for democratising economic development, has some supporters, capitalism has others, and non-alignment is also a viable option for many people today.

Yankson and Bernard (2012) state that land delivery for housing and urban development has been a concern in Ghana's urbanisation. Among these issues are land use planning and physical development constraints, urban land demand patterns and land delivery systems, institutional and legal arrangements for land development, and the subject of urban and peri-urban land markets. As a result of Ghana's colonial-era local government system, lacklustre urban administration and governance structures have hampered the country's urban growth. Current municipal and metropolitan assemblies have proven to be incapable of providing and managing adequate levels of services and infrastructure in their jurisdictions, and national organisations and the agencies responsible for providing services in them have been unable to function effectively in their jurisdictions.

Nigeria, like Ghana, is beset by problems related to poor governance and a lack of support for urban growth. Due to Nigeria's growing urbanisation and poor industrialisation, Nigeria's economic base has deteriorated during the past few decades. Many people cannot find work because of the growing urban population and the low-paying informal economy. In metropolitan regions, many people are living below the poverty line. Urbanisation in Nigeria will continue beyond the 1990s because of ongoing rural-urban mobility and economic backwardness in the countryside. Planning systems also limit the ability to deal with spatial expansion, according to Bloch et al. (2015).

5.12 Proposed *Hangwurian* City Development Model (City without Ills Model)

Sustainable urban development, urban liveability, environmental awareness, inclusiveness, and urban governance have resulted from the desire for a better urban environment. Human environmental behaviour and social relationships must be examined more closely because of the harmful influence of existing lifestyles on the environment (Corrêa et al., 2006; Mabee, 2004; Olsson et al., 2004; Sosa et al., 2008). Incorporating the environment in economic and social development plans necessitates monitoring the environmental quality and the public's understanding of environmental issues. Literature also asserts that public programmes and policies that encourage involvement require knowledge of what residents of a given community know, think, and feel about their surroundings (Hart, 2013).

Community members must be asked about their attitudes and values regarding their quality of life and the solution to environmental issues (Kos et al., 2003). Raising people's understanding of environmental issues can only be accomplished by applying political will and policy goals successfully. An essential aspect of governance is redefining what it means to rule in the modern era. Governmental systems are developed to manage the interaction between government and society, defined in terms of specific principles acknowledged as mutually interdependent. Governance is a broad and inclusive phrase, and the achievement of "good governance" is predicated on enhancements to nearly all sections of the public sector (Grindle, 2004).

For many policymakers, the political-economic factors of governance reform have taken precedence over other aspects of governance since the beginning of the 21st century (Hout, 2009). Hout and Robison (2009) detect an increased understanding of power, politics, and social conflict in affecting development outcomes and the difficulty in addressing them through existing institutional or governance programmes.

A fabricated assessment of environmental consciousness and urban governance might be detected during the transitional period. Because it is at the centre of the city's growth, it helps to ensure that the city's growth is environmentally friendly, liveable, and inclusive for all residents. This strategy was adopted as part of Agenda 21 at the United Nations Conference on Environment and Development (US Coordination Centre for the UN Conference on Environment and Development, 1992). When sustainable development was first coined in 1992, it was utilised as a political aim across the globe. Understanding the origins of sustainable development requires tracing its roots back to the 1960s' environmental movement and the link between economic growth and environmental degradation.

The human condition is the focus of sustainable development. Unlike many other forms of development, it emphasises economic growth and highlights the significance of balancing economic expansion with environmental protection. There are two dimensions to sustainable development that are considered universally: development (improvement) and sustainability (maintenance or to maintain). When planning sustainable development and making decisions, economic development, environmental protection, and social justice must all be considered (Goodland & Daly, 1996). These three features are regarded as the three pillars of sustainable development. When executed correctly, people's well-being is enhanced as the environment

and resources are protected (in the broadest biophysical and socioeconomic meaning), and future generations will not suffer as a result of the decisions taken. Environmental concerns and economic development through time and space must be linked to sustainable development. It also emphasises its social and ecological dimensions in politics, practice, and research (European Commission, 2002). When looking at the specifics of sustainable development, the quality of the urban environment and social inclusion play an essential role.

The concept of liveability has become an essential part of the planning process. All levels of government are increasingly using the term "liveability" to describe their long-term objectives. It is not just transportation that incorporates liveability; it is a wide range of planning sub-disciplines that have embraced it. It is utilised in many planning-related industries (e.g., subjective well-being and quality of life research). The phrase "liveability" is frequently used in plans, but the idea has a variety of meanings, and as a result of attempts to define the word, a wide variety of topics and qualities have emerged. In general, though, people who use the word "liveability" do not mean it in a technical sense. As a result, information about the term's actual meaning can be gleaned from its common usage. Understanding how liveability is used provides planners and communities with insights into what liveability means to them.

It can be summarised as an urban structure that supports its residents' physical, social, and emotional well-being and personal development. It is all about creating aesthetically pleasing urban areas that serve as a conduit for disseminating religious and cultural values. Equality, decency, accessibility, friendliness, participation, and empowerment are some of the guiding concepts of this subject matter. People-friendly cities have always included those social groupings whose idea of a liveable city is one in which these aspects have been kept or restored. Cities can be judged on three factors: the quality of life, liveable communities, and place shaping.

René Lenoir, the former French Secretary of State for Social Action, first used the term "inclusion and exclusion" in contemporary discourse in 1974 to refer to the situation of specific groups of people – the mentally and physically handicapped, suicidal people, aged invalids, abused children, drug addicts, delinquents, single parents, multi-problem households, marginal and asocial persons and other social misfits (Banerjee, 2016).).

Concerns about social exclusion have sparked initiatives to increase social inclusion. Encouraging social inclusion is a way to improve the lives of those who have been marginalised by their age, sex, disability, race, ethnicity, origin, religion, and economic position. The idea of inclusivity can be thought of in this way. Social inclusion can be achieved by removing barriers to involvement in society and pursuing active inclusionary measures. Socioeconomic inclusion is a more purposeful process of welcoming and embracing all people and advocating for greater social equality.

Beginning in the mid-1990s, a revived interest in the state's role in development marked a significant departure from the neoliberal paradigm that had previously dominated. However, this approach to state involvement in development was followed by substantial scepticism about the state's ability to play an influential role (Batley et al., 2002).

A growing understanding among policymakers in the region was that the rapid growth demonstrated by the East Asian "tigers" was due to the state's aggressive industrial and financial policies. Hout and Robison (1990) identified the first phase of donor governance policy in the early part of the decade, which demonstrated a narrow view of governance that placed emphasis on technocratic measures to improve the government's effectiveness and provide a legal basis for market-based development (Hout & Robison, 2009).

Environmental knowledge and motivation/value as markers of environmental awareness are used to assess the ideological connection between ecological consciousness and urban governance. Population management, family planning, credit facilities, and information flow are amongst many other indicators of urban governance, which, when synthesised effectively, can balance the tide of development flow between sustainable urban development measured on the tripod of economic prosperity, social cohesion, and environmental consideration; urban liveability measured through the quality of life for residents, creating liveable communities; and it has been established through critical analysis of the complex interplay between these concepts that the ability to develop a sustainable consumption pattern for both human and natural resources, improve access to the city and ensure equity within it holds the key to a paradigm shift toward new urban thinking that can bring about a city free of worries and concerns. The *Hangwurian* Model has been suggested for physical and urban development, and Figure 5.3 depicts the path connectivity of this proposed concept.

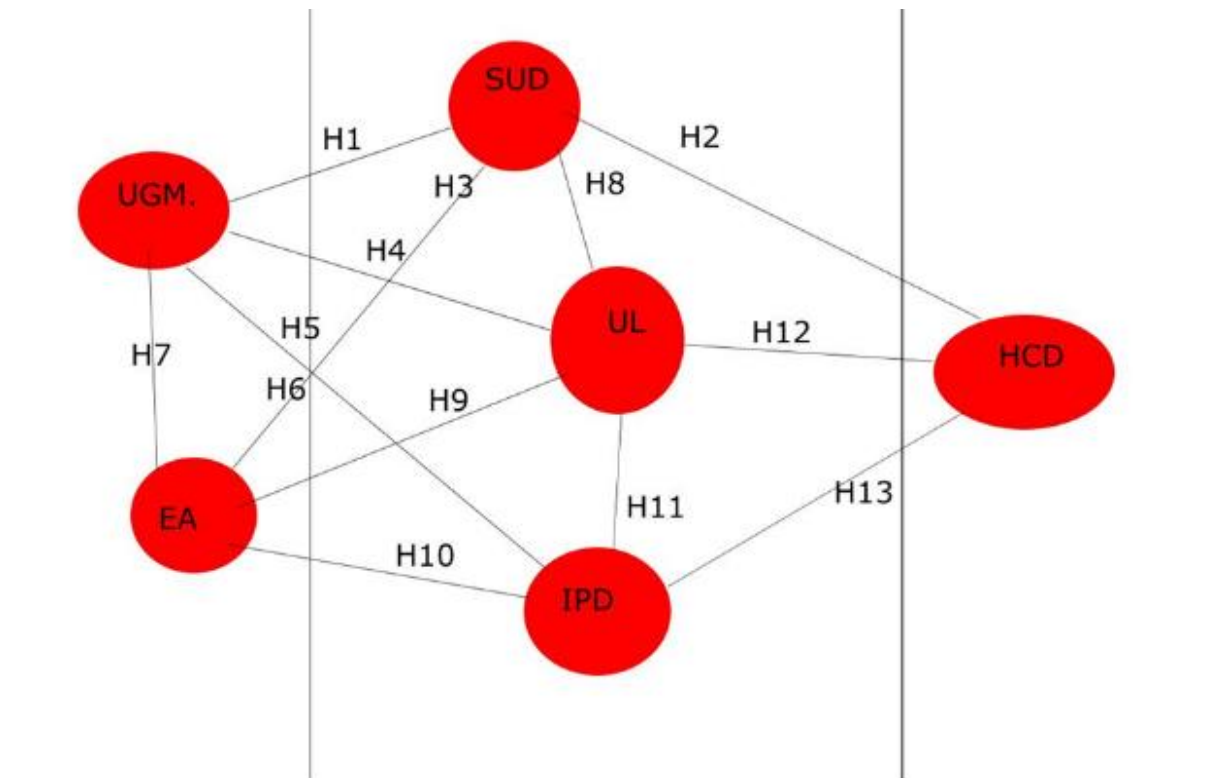


Figure 5.3: *Hangwurian* City Development Path Diagram

Source: Author's Simulation (2021)

This paradigmatic shift is the impetus for the *Hangwurian* City Development Model, which seeks to evolve through three critical indicators of a city without worries. This model is for a city devoid of ills for people of different races and classes, that gives adequate access to the city through concerted placemaking, ensures that equity is assured for all residents within the urban space and does not violate the area as there is a regulated consumption pattern for urban resources in the natural and artificial form.

The notion of a *Hangwurian* city, which is the anglicised version of the Xhosa term, “*Hangwelani*”, is therefore measured using the tripod of the consumption pattern, the access to the city, and equity as indicators. This paradigmatic shift of development focus can help African cities to evolve as city spaces that show value and competitiveness through the policymakers and urban gatekeepers—promoting development at a logical pace of resource availability and enhancing development acceptability, all of which are points of conflict in the African city system.

5.12.1 Evolution of the *Hangwurian* City Development Model indicator

This model for city development draws from five important city development concepts: sustainable urban development; urban liveability; inclusive physical development; urban management and governance; and environmental awareness. These concepts are all evolved to give a strong sense of society and value to the urban system and enhance the quality of urban living for all components of the city system. It is the strength of the interrelatedness of the various indicators and the further links of the indicator variables of these concepts and the theoretical linkages of the concepts that gave rise to the *Hangwurian* city development, drawing from the strengths of the individual concepts and leveraging the weaknesses of each to arrive at a concise model which is ideal for cities in North-Central Nigeria.

5.12.2 Sustainable development indicators

Over the past two decades, enormous amounts of money and effort have been devoted to the creation of sustainable development policies and indicators at the international, national, and local levels. When it comes to indicator initiatives, it's all about how well they're supposed to be able to provide a succinct snapshot of a wide range of environmental, social, and economic trends (Levy, 2012; Rosenström & Palosari, 2000). According to Article 40 of Agenda 21, it is necessary to have trustworthy, easy to use, and current information to improve the quality of decision-making in the area of sustainable development (Rowlands, 1992). Several nations then adopted their own national sustainable development indicator sets, building on the work of the United Nations Commission on Sustainable Development, which launched the first set of indicators in 1995 (Arvis et al., 2013). Several programmes have been launched since then to assess sustainable development at all levels (global, national, and local). A wide range of institutions and organisations have developed sustainable development indicators for a variety of goals, resulting in a large range of indicators.

The concept of sustainable development was formulated in response to a growing awareness that there are several important relationships between processes such as social and economic development, global, regional and local environmental problems, and increases in the population and urban built-up areas (Malkina-Pykh & Pykh, 2002). Land use planning and management are undergoing ongoing evolution around the world. With sustainability as the goal, the use of indicators for urban monitoring and control is becoming more and more in demand (Repetti & Desthieux, 2006). Zhang et al. (2003) completed several researches' works

regarding assessments on eco-cities and put forward a set of indicators to measure sustainable development.

More than 100 indicators related to demographics, standard of living and consumption, production patterns, agriculture, industry, energy, services, transportation, air, water, land and soil, and biodiversity were compiled by the Lebanese Environment and Development Observatory (LEDO) at the Ministry of Environment (MoE) (Nader et al., 2008). It is becoming common to employ indicators in the assessment of urban ecosystems, sustainability, and city administrations, as well as in land use and environmental management (Merkle & Kaupenjohann, 2000; Saeger, 1997).

With the help of indicators, sustainability policies can be guided and monitored, as well as conveyed to a broader audience (Spangenberg et al., 2002). They facilitate a better comprehension of complicated events and give a common reference to numerous stakeholders with various preoccupations (Repetti & Desthieux, 2006), however, their implementation within institutions remains problematic when creating an indicator system for sustainable urban development that is relevant to the demands of its users (Merkle & Kaupenjohann, 2000; OECD, 1997; Repetti & Desthieux, 2006). By looking at indicators from a variety of perspectives, it is possible to assess how well a city is doing in terms of its overall progress toward sustainable urban development (Eurostat, 2007; and Rinne et al., 2011, for example). This is supported by the available literature.

5.12.3 Urban liveability indicators

The use of indicators has become the standard for subjective evaluations of quality of life (Diener, 2000; 2009; Veenhoven et al., 2012) and for subjective measurements of urban liveability (Mouratidis, 2018; Glatzer et al., 2015). Eudaimonia (i.e., self-actualisation and meaning in life), life satisfaction, and effect (also known as emotional/hedonic well-being) are all components of subjective well-being (OECD, 2013; Sirgy, 2012). These are the philosophical distinctions that underlie these three aspects of subjective well-being (Haybron, 2000; Schueller & Seligman, 2010). Evaluations of life satisfaction, evaluations of meaning in life (eudaimonia), and emotional experiences during a specific time frame (effect) are all components of subjective well-being (Dolan & Metcalfe, 2011; Hough et al., 2013; OECD, 2013). As defined by Kovacs Györi et al. (2019, p. 12), liveability can be defined as "*the*

quality of the person-environment relationship or how well the built environment and the available services fulfil the residents' needs and expectations". To be considered liveable, a city must promote the well-being of its citizens (Mouratidis, 2018; Newton, 2012).

The SDGs and the New Urban Agenda necessitate that cities play an important role (Ramirez-Rubio et al., 2019; UN-Habitat, 2016). In order to close the gaps in health gains between regions, these goals provide an operational framework for urbanisation. The SDG 11 goal of creating inclusive, safe, resilient, and sustainable cities is specifically addressed by the SDG 3 goal of health and well-being. Health in All Policies (HiAP) uses a multi-sectoral, health-centred approach to public policy in order to minimise negative health impacts while simultaneously maximising beneficial ones, all in an effort to improve the general health of the population. When it comes to city policies that support public health interventions aimed at achieving the SDGs, HiAP is a necessity (Ramirez-Rubio et al., 2019). As a result, city planning and decision-making should incorporate it.

Many definitions of liveability exist, ranging from *"desires related to contentment of life in a specific location"* (de Chazal, 2010, p.221-240) to a *"behavior-related function of the interaction between environmental and personal characteristics"* (de Chazal, 2010, p. 221-240; Pacione, 1990). Liveable cities are socially inclusive, affordable, accessible, healthy, safe, and resilient to the impacts of climate change. This is the definition we started with in this study. Liveable cities offer a wide range of options for people to live their lives and raise their families to their full potential (Infrastructure Australia, 2010). Beyond the physical environment, social interactions are included in this definition of "liveability" (Hankins & Powers, 2009). Social determinants of health refer to everything from a person's birth and upbringing to their present and future environments and the systems in place to deal with illness (WHO, 2008). Living conditions are reflected in contemporary socioecological models of health, which seek to understand the various levels of influence that influence health behaviours or outcomes (Sallis et al., 2015).). The term "urban liveability" refers to the degree to which a city's "character" and the well-being of its residents, including environmental, economic, and social factors, contribute to its residents' quality of life and well-being.

In the 1950s the concept of liveability was introduced primarily in the field of urban planning. The Electors' Action Movement (TEAM) was the first to use the term "liveability" as a powerful linguistic tool (Kaal, 2011; Ley, 1990). Liveability studies have thus far focused

primarily on the city's social and economic aspects (Lye & Chen, 2010). There is no arguing with the fact that city dwellers are surrounded by nature, but only a healthy and happy natural environment can provide the residents with a good quality of life (Beatley & Newman, 2013). According to some studies, environmental factors have a greater impact on a city's ability to sustain human life. Nature and green spaces should thus be incorporated into every aspect of the residents' lives, according to the caretakers. The concept of “biophilic cities” began to take shape as a result of this thought process (Wilson, 1984). This idea elaborates on the human desire for nature and all of its components, including food and fresh air (Kellert, 2012). As a result, the residents of a biophilic city are surrounded by nature, which provides a clean and joyful life for them (Beatley, 2017).

The term "liveability" is used to describe an "ensemble concept" that has yet to be defined precisely or universally. Various criteria and sub-criteria can be determined in various ways in this multi-dimensional, hierarchical framework (Ghasemi et al., 2018). The concept of "liveability" is a relative one, and its *"precise meaning depends on the place, time, and purpose of the assessment and on the value system of the assessor"*, as stated by the Pacione (2003). Depending on the context, the term "liveability" can be defined in a variety of ways by various studies, organisations, and authorities around the world (Ghasemi et al., 2018). All local communities, regardless of their values, can benefit from a higher level of liveability (Yassin et al., 2019). An urban setting that is "liveable" is one in which the built environment contributes to the well-being of its inhabitants by meeting their most basic needs. To begin, the premise is that cities should have a built environment that promotes healthy and sustainable living rather than one that hinders it, because the urban form and environment are all intertwined with economic values and social sustainability (Ghasemi et al., 2018). Several city development actors on the frontlines of urban development have articulated three important sub-constructs that can be examined as part of the urban liveability construct: quality of life, liveable communities, and place shaping (Aulia, 2016).

5.12.4 Inclusive physical development

Three indicators make up the headline target for reducing poverty and social exclusion. A person is considered at risk of poverty or social exclusion if he or she is severely materially deprived or living in a household with a very low work intensity. For their national targets, member states are free to use any combination of indicators they deem appropriate, even though

the EU target is based on the composite indicator. A Europe-wide monitoring system for social inclusion is strongly linked to the Lisbon era's use of social indicators (Atkinson et al., 2002). Open method coordination on social protection and social inclusion in the 2000s further developed and expanded the Laeken European Council's indicator system (Marlier et al., 2007).

At-risk-of-poverty rates, as well as other measures derived from one single data source (Decancq et al., 2014), were used to develop the Europe 2020 policy goal for combating poverty and social exclusion. Other measures, such as poverty rates, were developed in recent years using data from the Laeken set of indicators (EU-SILC). Guio, et al. (2009) provided the material deprivation indicator, and Ward and Ozdemir (2013) provided the low work intensity indicator. Rather than being a measurement tool representing a clear European social policy agenda, the composite indicator of multidimensional poverty was adopted as the result of political coordination motivated by the differing views and interests of the member states. There was no prior theoretical work on the relationship between low work intensity, material deprivation, and the introduction of the composite indicator.

An intense debate erupted in the scientific community after the composite indicator was introduced, resulting in a large amount of empirical research. Recently published papers by Copeland and Daly (2012); Moulaert, (2013); and Nolan et al. (2011a; 2011b), among others, explore extensively the theoretical and policy implications of delineating one specific European target in the fight against social exclusion as part of an all-encompassing strategy. While the effectiveness of using a single measure of multidimensional poverty is questioned, the inclusion of non-monetary indicators is seen as a step forward in monitoring the poverty target in an expanded Europe (Nolan & Whelan, 2011b; Ravallion, 2011).

Many people are concerned about the choice of additional indicators to measure income poverty and the definition of the composite indicator (Nolan & Whelan, 2011b). Using a dashboard approach, the European Commission has begun tracking the member states' progress toward the headline target (Rogge, 2019). Reports on social processes are based on aggregate EU figures, country profiles, and summary tables. Every one of these analytical tools focuses on results and uses cross-sectional data from the most recent time period possible. The dynamic interrelationship between poverty, severe material deprivation, and low work intensity is also important from a policy perspective. When it comes to making policy decisions, we need to know more about how the three phenomena interact over time.

Individuals' increased social inclusion has been based on four main pillars, each of which has spawned a set of four policy recommendations: a) decrease in financial hardship; b) an improvement in living conditions; c) an expansion of employment opportunities; and d) an improvement in educational opportunities (Atkinson et al., 2002; 2004; Eurostat 2011; Marlier et al., 2003). It's interesting to see that even though employment and education are intertwined, Europe 2020 treats them as separate goals. Resilience, equity/justice, and safety (UN-Habitat, 2016) are the three important sub-constructs from which the indicators of inclusivity emerge.

5.12.5 Environmental awareness

In order to appreciate the significance of investigating Malaysians' environmental consciousness, one must first grasp the broader context of environmental consciousness. Environmental awareness is comprised of three concepts, according to Abidin, (2010) emotion, attitude, and practice of sustainability awareness. The desire to carry out a series of environmentally friendly actions is motivated by psychological and emotional factors. Altin et al. (2014) found that environmental awareness is defined as an individual's knowledge of environmental issues and active participation in organisations dedicated to protecting the environment. Despite this, environmental awareness serves as a catalyst for cultivating positive attitudes and feelings toward environmentally friendly behaviour (Karatekin, 2014). As a result, it is important to measure environmental awareness and concern, as well as the causes and consequences of environmental issues (Karatekin, 2014). The more aware an individual is of environmental issues and their causes, the more likely they are to engage in environmentally conscious behaviour.

Policymakers' efforts to deal with environmental stresses are hampered by a lack of environmental awareness in the face of overwhelming environmental problems, urbanisation, industrialisation, deforestation, rising global temperatures, and degradation of biodiversity (Keles, 2012). The quality of life is consequently disrupted as a result of this (Keles, 2012). Economic, ecological, social, and human factors all play a role in determining one's overall well-being, which means that an individual's quality of life is directly link to the well-being ideals of the individual in a wholistic manner (Keles, 2012; Marans, 2012). The concept of quality of life has always been linked to environmental studies and as a result, policymakers in charge of developing and managing our living environment pay close attention to it (Marans, 2012). Policymakers care about people's well-being, so finding out how environmentally aware

Malaysians are is critical to good policymaking. It is possible for the environmental protection programme to fall far short of expectations if the policy-making process is not supplemented by public environmental awareness. Environmental behaviour is a pre-requisite for combatting environmental disasters (Klößner, 2013). This focuses on the key determinant that shapes human behaviour towards environmentalism. Ostman and Parker (1987, p. 3-9) described environmental behaviour as “*overt and observable actions taken by a person in response to comprehension of environmental issues to which he or she has had an emotional reaction*”.

People's environmental attitudes and values can have a significant impact on their choices and actions, but they aren't the only ones who can make this sort of judgment. Apparently, researchers and policymakers are becoming more aware of the link between poor environmental behaviour and environmental degradation (Klößner, 2013). For this reason, environmental behaviour and the variables that influence it should be assessed, as behavioural patterns affect both the environment's quality and the efficacy of environmental strategy (Singhirunnusorn et al., 2012). Understanding or predicting environmental behaviour can help mitigate environmental perils in social and political contexts because environmental issues have been around for a long time (Harth et al., 2013). Accordingly, policymakers can better understand what they are doing to encourage better environmental behaviour if they can track changes in public attitudes and behaviour (Owens & Drifill, 2008). This is an important step in the process of being included in environmental policy decisions. Rather than the other way around, a shift in attitude can lead to a shift in behaviour. For an environmental policy to be effective, the government must know why and how people engage in environmentally friendly behaviours.

A training programme can help raise environmental awareness, which is measured by one's knowledge of the environment (Meiboudi et al., 2011; Safitri et al., 2019). There is a strong correlation between sustainable development and a high level of environmental sensitivity (Hassan et al., 2010). Students in different grades have different environmental attitudes and behaviours (Hasiloglu et al., 2011), and the knowledge level about the causes and effects of environmental issues is increased through education (Basri, et al., 2012; Meiboudi, et al., 2011; Safitri, et al., 2019; Viorica-Torii, 2013). Environmental consciousness can be broken down into three categories: emotion, attitude, and behaviour (Hassan et al., 2010). In Ahmed and Khatee's (2012) study, people in the surrounding areas were praised and thanked for their efforts to conserve the environment, which inspired them to do even more. In the process of

recycling waste materials, students' creative thinking abilities to produce instruments as well as their environmental awareness levels were raised (Debrah et al., 2021). Thus, if you're looking to measure the performance of urban development statutes, you'll want to look at environmental awareness in terms of motivation, values, and attitudes, and at environmental expertise, knowledge, and abilities (Mei et al., 2016).

5.12.6 Urban management and governance

According to Rhodes (1997), the term "governance" refers to self-organising, inter-organisational networks that are characterised by interdependence, resource exchanges, rules of the game, and significant autonomy from the state. As a result, matching governance very closely with networks is seen as limiting their operationalisation and comparative studies (Cristofoli & Markovic, 2016). Local governments still have the most powerful and important role in governance, according to Stoker (2011), so if one bases the evaluation on the relationship between local governments and the general public, then measuring the level of governance in a particular area seems more palatable. There is some agreement among the many debates and theoretical disagreements, however. According to the majority of definitions, it is critical that the public sector and stakeholders adhere to game rules, and that the public has the ability to participate in decision-making and the quality of the adjustment mechanisms (Kaufmann & Kraay, 2008).

In recent years, some efforts have been made to evaluate the quality of governance and governance-related aspects. Existing indicators of governance are divided into "objective" and "subjective" measures by Williams and Siddique (2008). Objective measures are primarily linked to facts (hard data) about political instability and violence, according to these authors (e.g., the number of coups, demonstrations, riots, political assassinations and strikes for a particular country in a particular year). Objective measures of governance are based on data collected through research or surveys, while subjective measures rely on expert judgment or a combination of indicators (such as the World Bank's Worldwide Governance Indicators [WGIs] or Transparency International's Corruption Perceptions Index) (Charron, 2021).

An indicator's type is determined by what it measures: input/rights/commitment and de jure indicators (commitments and rules); and processes, responsibilities, and de facto indicators (what actions were taken to fulfill the responsibilities and commitments - the results of

commitments. NGOs (such as the World Bank) and for-profit organisations (e.g., the Economist Intelligence Unit) both compile composite indicators commonly used in applied research on the effects of governance. No single indicator (either objective or subjective) can provide an overall measure of governance due to the breadth of the concepts and the inherent unobservability of many of them (Kaufmann & Kraay, 2008, p. 4).

Unobserved components modelling is the most widely used of all composite indicators of governance. Unobserved components modelling is used to standardise the data from a variety of perception-based sources and aggregate these underlying variables into six "dimensions of governance", namely: voice and accountability; political stability; government effectiveness; regulatory quality; rule of law; and corruption control (Kaufmann et al., 2010). The "margins of error" for each country are smaller, the more underlying sources there are. All three of these approaches have their own "dimensions" that can be used to evaluate local governance in a specific area.

According to the Kulenthiran & Stanley (2018, p. 9), *"local governance assessment frameworks are based on normative, value-oriented, prescriptive principles"* and there is no unifying set of criteria to evaluate the quality of governance to date. *"Appropriate governance indicators will: have a theoretical foundation; focus on specific fields of engagement; emphasise outcomes; and control for key contextual differences in comparing countries"*, Andrews et al. (2010, p. 7) write. The "major contextual differences" problem is mitigated when all municipalities in a state have similar regulatory environments and follow the same rules, but this is not always the case.

According to Flood (1999); and Meissner (2016), there are six important constructs that can be used to evaluate the concept of urban management and governance from a theoretical perspective. Population, family planning, credit, the hospital network system, and youth empowerment are all sub-constructs of this framework. The conceptual evolution of the *Hangwurian City Development Model* in terms of linkage of the concepts to the theory which gave rise to this conceptual model and how the constructs and sub-constructs of the model gave rise to the indicators is shown in Figure 5.4.

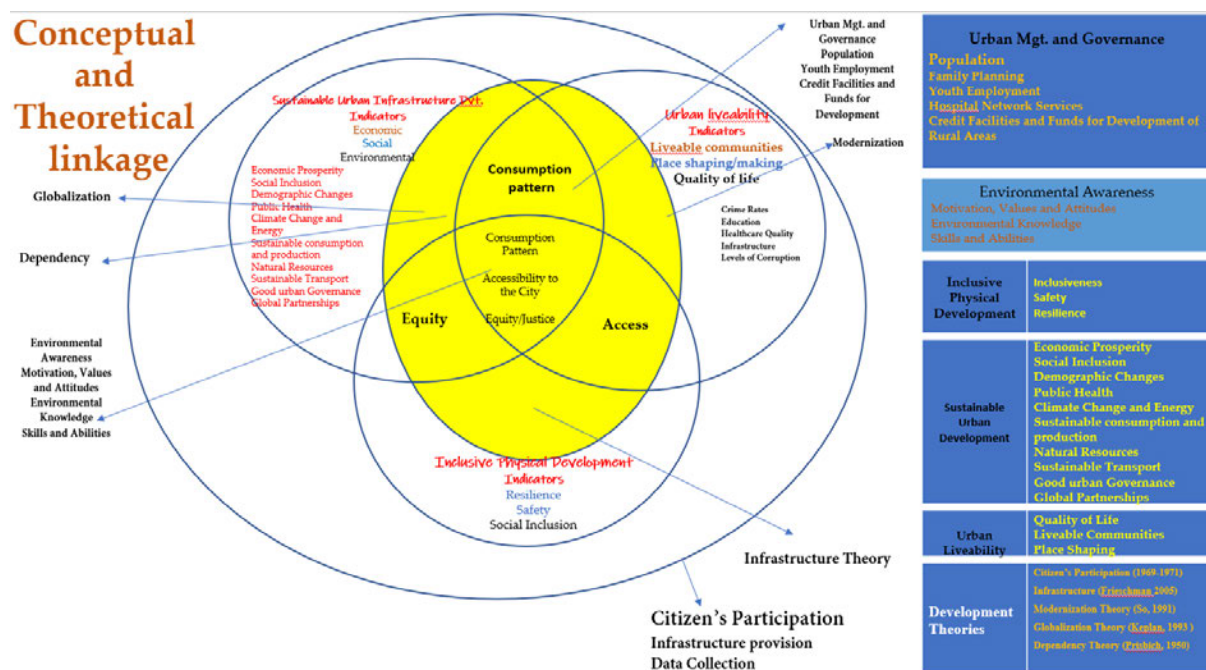


Figure 5.4: Conceptualisation and Evolution of the *Hangwurian Model*

Source: Author's Simulation (2021)

5.13 Conclusion of the Chapter

This chapter reviewed extant literature related to urban development, urban analysis, and development control. The chapter also analysed the various case studies of urban development and countries' development that could be compared with the Nigerian situation. The research looked at the case studies of Ghana in West Africa and the USA. Both of these countries are strongly linked and comparable to Nigeria in terms of their governance structures and development objectives. However, while the Ghanaian models are strongly linked to the Nigerian problem in terms of successes and failures, the American development strides are invariably stepping that both Nigeria and Ghana can leverage to steer themselves out of their current states of poor infrastructure and development deficits that are observable across both countries.

CHAPTER SIX

ESTABLISHING SPATIAL GROWTH AND DEVELOPMENT IN NORTH-CENTRAL NIGERIA

6.1 Introduction

Changes in local climate, hydrogeology, floodplain biogeochemistry, and environmental sustainability are all affected by urbanisation, land use, and land cover (LULC) (Lambin et al., 2001; McGrane, 2016). Globally, the pace of change has accelerated to alarming proportions in recent years, and developing countries are predicted to have the most megacities in the world by 2020, according to World Bank (2007) research.

Cutting down trees, destroying forests, converting them into residential zones, and building roads and other modern infrastructure are all hallmarks of urbanisation (Dewan & Yamaguchi, 2009). The demographic shift from rural to urban areas has brought about these changes (Sahana et al., 2018) and increased the areas' impervious surface coverage. Due to urbanisation, the hydrodynamic framework, floodplain structures, and current groundwater recharge paths are altered (McGrane, 2016). Urbanisation's spatio-temporal dynamics must be studied to protect our environment from degradation and promote sustainability in the future. Due to urbanisation, land use and land cover change can impact natural resources substantially, particularly water, air, and soil quality (Haas & Ban, 2014; Liu et al., 2019). Due to the siltation of drainage channels, deforestation increases the risk of flooding in the watershed. The hydrologic cycle can be influenced by land use and land cover to affect the hydrodynamic state.

6.1.1 General information

This research's general information looked at age, gender, and marital status. The study's age ranges started at 0-18 years and ended at above 46 years. The analysis showed that 2.7 per cent of the sampled residents had an age range of 0-18 years; 22.7 per cent had an age range of 19-25 years; 33.0 per cent had ages of 26-35 years; 21.1 per cent had ages ranging from 36 to 45 years, and 20.1 per cent had an age range above 46 years. This implied that most of the respondents sampled for this research were above the age of consent in Nigeria. The genders of the respondents sampled were also analysed. The findings showed that 61 per cent of the respondents were males and 39 per cent were females, which validated the data as it provided 35 per cent affirmative action (Eagly et al. 1995). The residents in the selected cities' marital

statuses were also investigated, with 35 per cent of the sampled residents being single; 58.50 per cent were married; 1.70 per cent were divorced; 1.50 per cent were separated; and 2.90 per cent were widows/widowers. The analysis of the marital status findings showed that most residents sampled kept close family ties. This data is shown in Table 6.1.

Furthermore, as Nigeria is a multi-ethnic nation, and this multi-ethnicity is reflected in most regions of the country, this called for an evaluation of the ethnicity of the sampled residents. Analysis indicated that 37 per cent of the sampled respondents were of Hausa descent; 12 per cent were Igbos; and 13 per cent were Yorubas. The remaining 37 per cent were other ethnic minorities such as the Rindre, Assakio, Kadara, Nupe, Gbagi, Okun, Igala, and Ebira. They were considered ethnic minorities but were found to play a very significant role in the cities' functions. These residents had household sizes ranging from 2-5-member households (45.4%); to 6-10-member households (40.8%); 11-15-member households (9.5%); 16-20-member households (2.1%) and 21 members and above (2.0%). This analysis implied that the selected cities had densely populated neighbourhoods compared to the average occupancy ratio.

Table 6.1: General Information of the Respondents in Selected Cities in North-Central Nigeria

Age of the Respondents/Household Heads		
Age of Respondents in Years	Frequency	Percentage
0-18	23	2.7%
19-25	191	22.7%
26-35	278	33.0%
36-45	178	21.1%
46 and above	169	20.1%
Total	840	100%
Gender of the Respondents		
Gender	Frequency	Percentage
Male	513	61%
Female	329	39%
Total	840	100%
Marital Status of the Respondents/Residents		
Marital Status	Frequency	Percentage
Single	294	35%
Married	493	58.60%
Divorced	15	1.70%
Separated	13	1.50%
Widows/Widowers	25	2.90%
Total	840	100%
Ethnicity of the Residents/Respondents		
Ethnicity	Frequency	Percentage
Hausa	312	37%
Igbo	101	12%
Yoruba	114	13.50%
Others	312	37%
Total	840	100%
Household Size of the Respondents		
Household Size	Frequency	Percentage
2-5	382	45.4%
6 -10	343	40.8%
11-15	80	9.5%
16-20	18	2.1%
21 and above	17	2.0%
Total	840	100%

Source: Author's Compilation (2021)

6.1.2 Financial capacity and the socio-economic drive of the residents

The financial capacities of the respondents in the selected cities were also appraised in terms of their monthly salaries and other sundry issues. The analysis showed that some residents earned less than ₦5000 per month (4%); some earned ₦6000-₦10000 per month (27.2%); some earned ₦11000-₦20000 per month (17.3%); others earned ₦21000-₦30000 per month (12.7%); some earned ₦31000-₦40000 per month (8.8%); some earned ₦41000-₦50000 per month (11.0%); while others earned above ₦51000 per month (17.20%). This implied that about 61 per cent of the sampled residents in the selected cities earned less than the minimum wage in the country; a wage that was assigned in 2018. Another critical issue was the skill

classification of the residents sampled. The analysis showed that 13 per cent of them were traders; 3.5 per cent were automobile mechanics; 4.1 per cent operated barber's shops; 5.1 per cent were female hairdressers; 3.3 per cent were shoemakers; 20.5 per cent were fashion designers; 1.10 per cent were trained drivers; 2.30 per cent were cake bakers; while 46.70 per cent of the population engaged in other vocations such as food vendors, blacksmiths, and electricians, amongst others.

The family composition of the various households sampled also reflected a strong culture of monogamy and polygamy across the selected cities. The analysis showed that 64.50 per cent were monogamous households; 35.40 per cent were polygamous; while an insignificant 0.01 per cent did not declare the family structure of their home - a decision that the field assistants had to respect. Literacy was also a significant factor in analysing the financial capacity of the residents of the selected cities. The analysis showed that 9.60 per cent just had a primary school education; 38 per cent had a secondary education; and 43.60 per cent had a tertiary education; while 8.40 per cent had no formal education at all. This implied that over 70 per cent of the sampled respondents had secondary and tertiary educational attainment. The residents of the selected cities were observed to have stayed in the cities for a varying number of years. The analysis showed that 29.90 per cent had lived in the selected cities for less than 5 years; 31.50 per cent had residency tenure of 6-10 years; and 38.60 per cent had lived in the cities for over 11 years. This indicated that most of the residents had good knowledge of the evolution of these cities based on the length of time they had lived in the areas. The composition of the residents in terms of their origins was also appraised. The analysis showed that 49 per cent of them were indigenous dwellers, while 50.90 per cent were migrant dwellers. This implied that most of the cities selected were adequately balanced in terms of their cosmopolitan nature. The analysis of the financial capacity of the residents sampled in North-Central Nigeria is shown in Table 6.2.

The position of financial head of the home was also appraised, as shown in the analysis. The analysis showed that 80 per cent of the sampled respondents listed the household's financial head as the father, and 11.70 per cent opined that the financial head was the mother of the house. In comparison, 8.20 per cent noted that the children who were the highest income earners were their home's financial heads. This analysis, therefore, reflected a profoundly patriarchal composition of the families in the selected cities. Another issue of interest was the financial capacity of the selected households in terms of the number of people per habitable room per dwelling. The analysis showed that 41.40 per cent of the sampled respondents noted

that the dwelling ratio was less than 2 people per habitable room; 49.20 per cent had between 3-5 people per habitable room; and 9.30 per cent had more than 5 people per habitable room. This implied that many households in the selected cities were severely overcrowded. Finally, family expenses also reflected several issues regarding what the households spent most of their money on each month in the selected cities. The analysis showed that 34.30 per cent of the household expenses went on education; 5.40 per cent was spent on medical costs; 5.70 per cent was allocated to social expenses; and 54.40 per cent was spent on other miscellaneous and household expenses. This expenditure pattern showed a series of out-of-budget costs or contingency expenses that were not planned for by the households at the start of the month but crept up on them as the respondents went about their daily lives in the cities.

Table 6.2: Financial Capabilities of the Residents in the Selected Cities

Monthly Income		
Average Monthly Income in Naira	Frequency	Percentage
Less than 5000	34	4%
6000-10000	229	27.2%
11000-20000	146	17.3%
21000-30000	107	12.7%
31000-40000	74	8.8%
41000-50000	93	11.0%
51000 and above	145	17.20%
Total	840	100%
Skills Classification		
Kind of Skills	Frequency	Percentage
Trader	108	13%
Mechanic	30	3.5%
Barber	35	4.1%
Hairdresser	43	5.1%
Shoemaker	28	3.3%
Fashion Designer	173	20.5%
Driver	10	1.10%
Cake Baker	20	2.30%
Others	393	46.70%
Total	840	100%
Type of Home of the Residents		
Type of Home	Frequency	Percentage
Monogamous	541	64.50%
Polygamous	297	35.40%
Undeclared	2	0.01%
Total	840	100%
Educational Status		
Highest Educational Level in the Household	Frequency	Percentage
Primary	81	9.60%
Secondary	320	38%
Tertiary	366	43.60%
No Formal Education	71	8.40%
Total	840	100%
Tenure of Residency		
Residency and Length of Tenure	Frequency	Percentage
<5years	250	29.90%
6-10years	264	31.50%

>11years	323	38.60%
Total	840	100%
Type of Household		
Type of household	Frequency	Percentage
Indigenous Dweller	411	49%
Migrant Dweller	427	50.90%
Total	840	100%
Skills of the Household Members		
Family Members Considered Skilled	Frequency	Percentage
Yes	579	69%
No	260	30.90%
Total	840	100%
Household's Financial Head		
Household's Financial Head	Frequency	Percentage
Father	669	80%
Mother	98	11.70%
Children (Highest Income Earner)	69	8.20%
Total	840	100%
Household Dwelling Ratio/Habitable Rooms		
Dwelling Ratio per Room	Frequency	Percentage
<2	346	41.40%
3-5	411	49.20%
>5	78	9.30%
Total	840	100%
Household Expenses		
Household Expenses	Frequency	Percentage
Educational Expenses	288	34.30%
Medical Expenses	46	5.40%
Social Expenses	48	5.70%
Other Miscellaneous and Household Expenses	457	54.40%
Total	840	100%

Source: Author's Compilation (2021)

6.2 Spatial Analysis and Projection of Selected Cities in North-Central Nigeria between 1999 to 2029

Three cities were selected to analyse the land use/land cover changes in the North-Central region of Nigeria. The towns were Minna, Lokoja, and Lafia. They were all afforded equal status as state capitals and seats of government at the state level in accordance with the 1999 constitution of the country.

6.2.1 Spatial analysis and projection of the Minna City Limit in North-Central Nigeria from 1999 to 2029

6.2.1.1 Growth analysis of Minna City in 1999

The City of Minna is a nodal town with significant roads linking North-Western Nigeria to the Federal Capital. The city's railway terminal links Southern and Northern Nigeria and amalgamates two Local Government Areas (LGAs) (Bosso and Chanchaga) and Minna City has served as the state capital since 1976. Changes in the city's status have transformed the city

into a metropolitan area with a growing population and expanding city limits. The city occupied merely 476.4 Ha of land in 1976 (Abd' Razack, 2014) and has grown tremendously as its status changed to that of a state capital. Table 6.3 shows the spatial growth analysis of the city in 1999, with a total built-up area estimated at 5,501.4 Ha (9.3% of the total area of the town). The vegetal cover/bare ground was estimated at 53,764.6 Ha (90.5%) of the city's space in 1999, and 126.0 Ha (0.2%) was made up of water bodies in 1999. This indicated that the city was growing faster, characteristic of urbanisation in Africa. The centralisation of government activities and migration of civil servants led to the city's growth and expansion to a 1177 per cent change from the original size in 1976 (476.4 Ha in 1976 and 5,501.4 Ha in 1999). Figure 6.1 shows the 1999 space occupied by the different landscapes of the city, employing a Global thematic mapper.

Table 6.3: Growth Analysis of Minna City in 1999

Land Cover	Area (Ha)	% Δ
Built-up	5,501.4	9.3
Vegetal Cover/Bare Ground	53,764.6	90.5
Water Bodies	126.0	0.2
Total	59,392.0	100.0

Source: Author's Computation (2021)

As shown in Table 6.3 and captured in Figure 6.1, the total spatial cover of the city was 59,392.0 Ha (excluding the adjoining villages that were parts of the Bosso LGA) and formed the city space identified in 1999. Figure 6.1 shows that the built-up areas were concentrated within the city centre (around Mobil, Sabon Gari, Railway, and Lagos Streets) that formed the core of the city's CBD. The image indicated a higher concentration of buildings and physical development within this city section. The reason was the nodal nature of the area (This was the nodal points of Tegna, Sule, and Bida traffic routes, the railway terminus, and the centre of the commercial activities). The analysis further revealed that the city's development was southward and northward. It followed the route that led to the Federal Capital of Nigeria (Abuja) to the south and northward because of a new airport city development and the air force base.

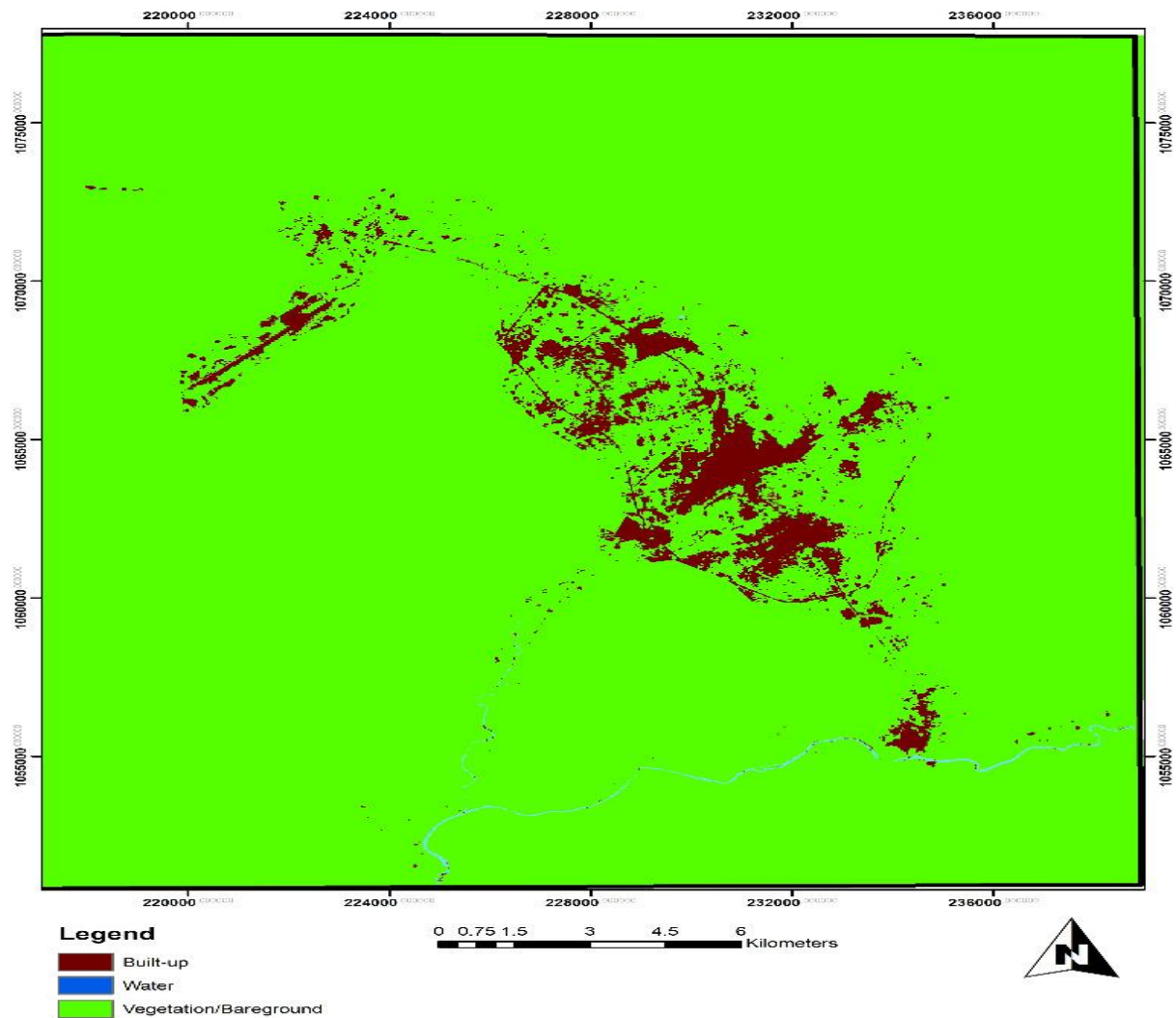


Figure 6.1: Minna City's Spatial Extent in 1999

Source: Global Visualisation (GloVis) Viewer (2021)

6.2.1.2 Growth analysis of Minna City in 2009

The research employed ten years of growth as the level of comparison of the land use changes. The subsequent spatial analysis of the land use changes in the city was conducted using the 2009 Land use/Land cover Global thematic mapper. The study showed that the built-up area increased tremendously from 5,501.4 Ha in 1999 to 8,305.3 Ha in 2009 (an increase of 4.7%). This translated to a 14 per cent increase in the city's total land area, and the vegetal cover/bare ground area decreased to 50,624.4 Ha from 53,754.6 Ha within 10 years. There was a 5.8 per cent decrease in the vegetal cover/bare ground area. The analysis showed that it had shrunk from 90.4 per cent in 1999 to 85.2 per cent of the total land area in 2009. The change in the area of the water bodies was also tremendous. It increased from 126.0 Ha in 1999 to about

462.3 Ha in 2009. The total city space covered by water bodies rose to 0.6 per cent, as shown in Table 6.4.

Table 6.4: Growth Analysis of Minna City in 2009

Land Cover	Area 2009 (Ha)	Area 1999 (Ha)	% Δ in 10 Yrs.	% Δ	Total Area
Built-up	8305.3	5,501.4	2,803.9	4.7	14.0
Vegetal Cover/Bare Ground	50624.4	53,764.6	-3,140.2	-5.3	85.2
Water Bodies	462.3	126.0	337.3	0.6	0.8
Total	59392	59,392.0			

Source: Author's Computation (2021)

Figure 6.2 shows the interpretation of Table 6.5 in space that depicts the spatial spread and extent of the cityscape in 2009. The growth pattern analysis indicated that nearly all of the open areas within the city had been developed into built-up land. The spread pattern was radial as parts of the city developed in all directions, albeit haphazardly. The growth map also shows a severe increase in development around the Maitumbi and Maikunkele axes in the city, which form the northern and north-eastern axes of the town. Also, the south-eastern part of the city witnessed sporadic growth in the areas around the Kpakungu-Gbeganu-Gurara-Bida Roads due to the movement of the Federal University of Technology to its permanent site in 2005.

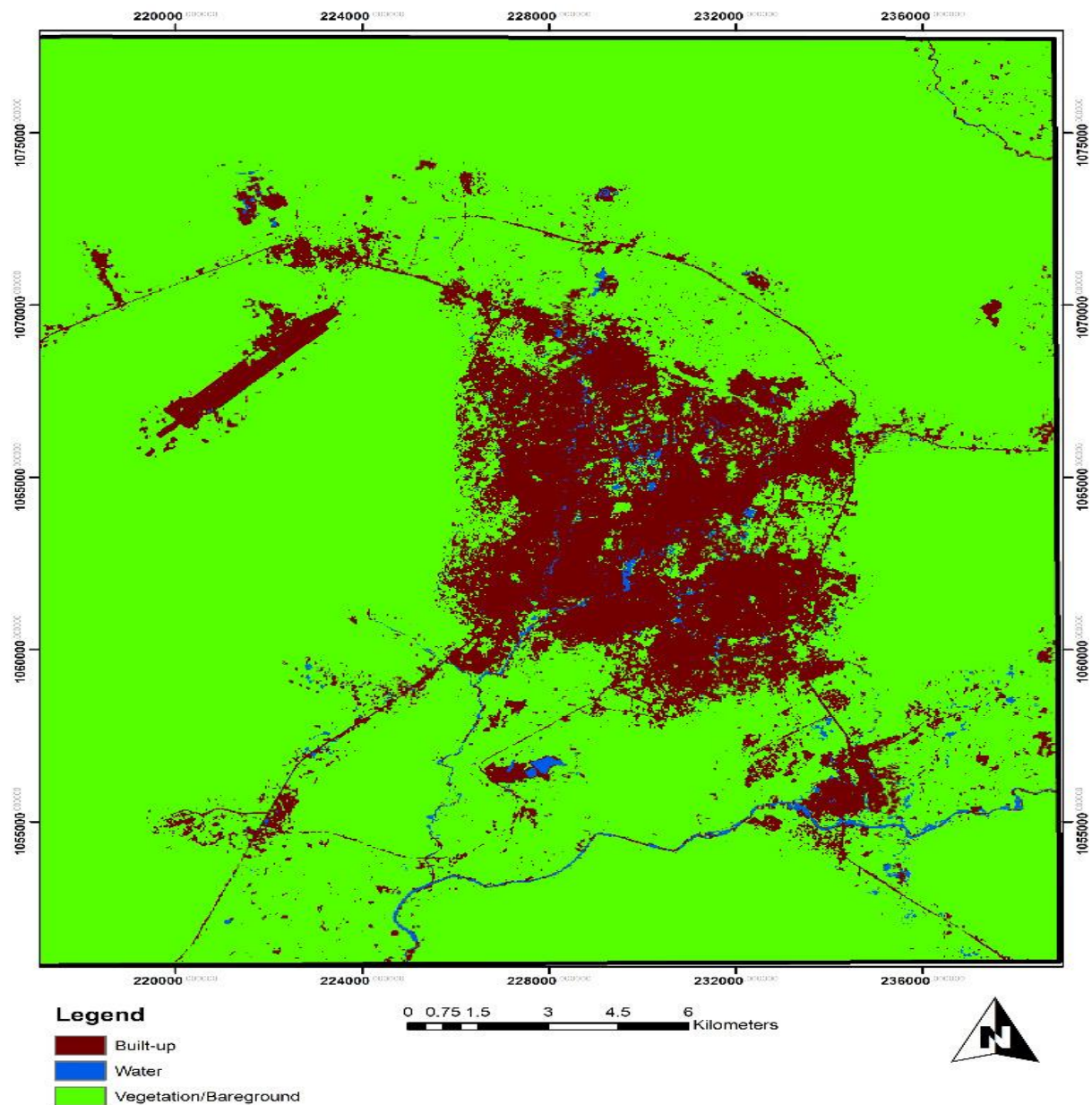


Figure 6.2: Minna City's Spatial Extent in 2009

Source: GloVis Viewer (2021)

6.2.1.3 Growth analysis of Minna City in 2019

Another 10-year analysis was conducted using the Global thematic mapper of 2019. The result is presented in Table 6.3. The research showed that the built-up area increased to about 10,706.7 Ha in 2019. This showed an increase of 28.9 per cent, increasing the city's total built-up land to 18.0 per cent of the full spatial extent of the city. Water bodies in the city shrank from 462.4 Ha in 2009 to 329.9 Ha in 2019 (a decrease of 28.6%). The total area covered by water bodies was thus 0.5 per cent of the spatial extent of the city. The vegetal cover/bare

ground was also diminished to 48,355.4 Ha in 2019 compared to 50,624.4 Ha in 2009. The size of the reduction was 4.9 per cent.

Table 6.5: Growth Analysis of Minna City in 2019

Land Cover	Area 2019 (Ha)	Area 2009 (Ha)	% Δ in 10 Yrs.	% Δ
Built-up	10,706.7	8,305.3	2,401.4	4.0
Vegetal Cover/Bare Ground	48,355.4	50,624.4	-2,269.0	-3.8
Water Bodies	329.9	462.3	-132.4	-0.2
Total	59,392.0	59,392.0		

Source: Author's Computation (2021)

As presented in Figure 6.3, the analysis indicated an increase in the spatial growth of the built-up areas along the south-western axis of the city, where some critical infrastructure such as the university, the national office of the National Examination Council, and several such public infrastructures are located. There was also observable growth around the eastern axis of the city. Overall, from the growth pattern depicted in the figure, the city was judged to be sprawling on all sides, which requires urgent planning intervention.

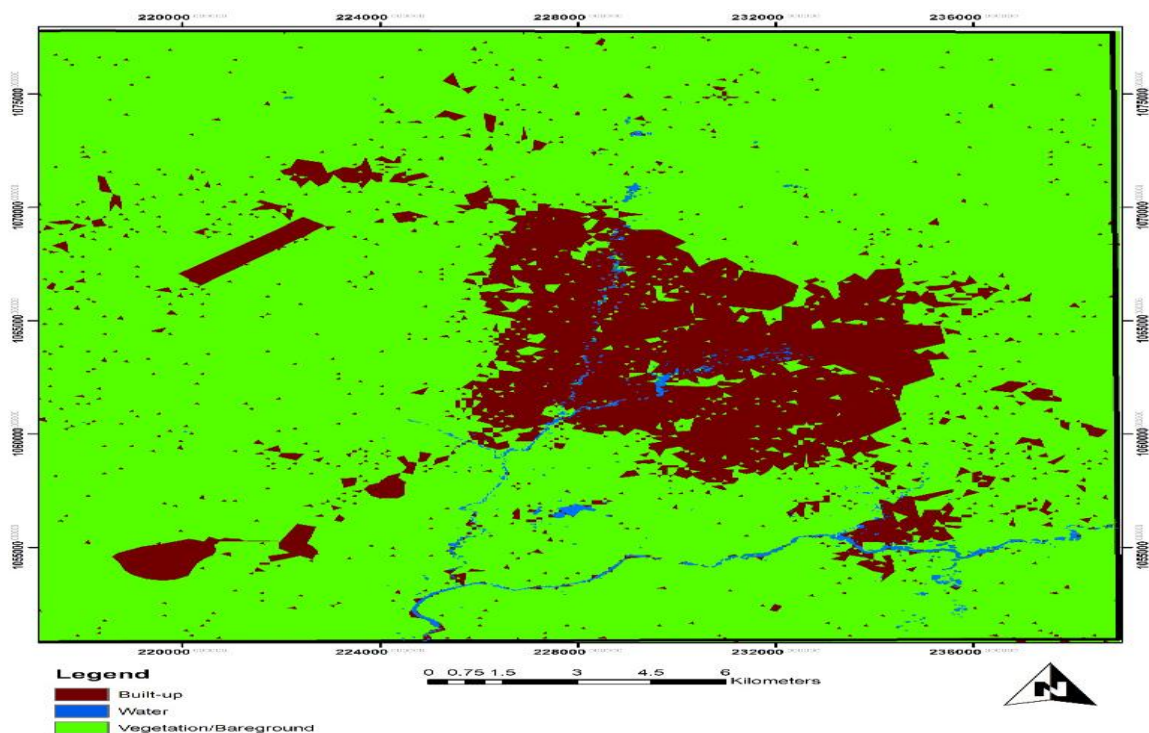


Figure 6.3: Minna City's Spatial Extent in 2019

Source: GloVis Viewer (2021)

6.2.1.4 Growth projection and analysis of Minna City in 2029

Based on the growth patterns observed and compared (presented in Table 6.6), and barring unforeseen circumstances, it was estimated that the city's growth would continue with increasing of the built-up areas and shrinking of the areas of bare land. An annual growth estimate was simulated based on the changes observed, and this is shown in Table 6.6. Table 6.6 indicates that the yearly growth of the built-up area was increasing at the rate of 9.5 per cent, and the shrinkage of the vegetal cover was 8.2 per cent. Also, the change in land areas covered by water bodies increased annually by 161.8 per cent.

Table 6.6: Annual Growth Analysis of Minna City between 1999 and 2019

Land Cover	Area 2019 (Ha)	Area 1999 (Ha)	% Δ	Annual Growth Rate (%)
Built-up	10,706.7	5,501.4	5,205.3	18.0
Vegetal Cover/Bare Ground	48,355.4	53,764.6	-5,409.2	81.4
Water Bodies	329.9	126.0	203.9	0.6
Total	59,392.0	59,392.0		

Source: Author's Analysis (2021)

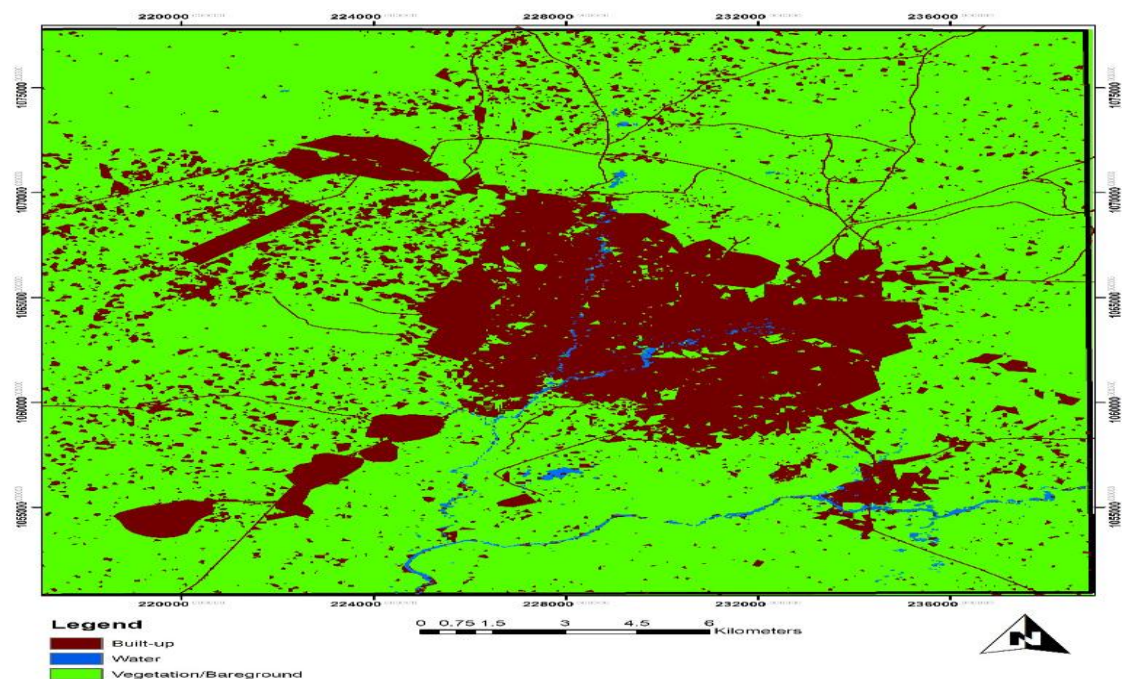
Further to the analysis of the land use/land cover changes between 1999 and 2019, the research went on to project and analyse the spatial growth and changes in the city's limits for the next ten years. This projection, as stated in the methodology, involved copying the land use/land cover algorithm into the Artificial Neural Network (ANN), which helps to project the growth of cities based on indicators such as road networks, existing infrastructure, and the nature of the terrain. All of these indicators worked together to determine the pattern of growth expected in Minna City in 2029. As indicated in Table 6.7, by 2029, the built-up area in the city was expected to increase to about 13,251.2 Ha, covering about 22.3 per cent of the total spatial extent of the city.

Table 6.7: Growth Projection and Analysis of Minna City in 2029

Land Cover	Area (Ha)	% Δ
Built-up	13251.2	22.3
Vegetal Cover/Bare Ground	45687.2	76.9
Water Bodies	453.6	0.7
Total	59392.0	100.0

Source: Author's Computation (2021)

Furthermore, the analysis showed that vegetal cover/bare grounds would be reduced to 45,687.2 Ha of the total spatial extent of the city, reducing by 76.9 per cent. In comparison, the water bodies would account for 0.7 per cent of the land cover (covering an area of 453.6 Ha). This spatial growth was projected to be the 2029 human development signature of the cityscape. Based on this estimation, Figure 6.4 shows the expected spatial evolution of the city in 2029. The growth was projected to continue in an uncoordinated manner through the primary arteria road with city infrastructure provision and the continuous quest for housing space dictated by urbanisation and the population explosion.

**Figure 6.4: Simulated Spatial Extent of Minna City in 2029**

Source: GloVis Viewer (2021)

6.2.1.5 Land use changes in Minna between 1999 and 2029

This section discusses the land use changes in the land area and the percentages of the changes from 1999 to 2029. These analyses are presented in tables and figures that show the growth and decline of specific spaces within the city. The analyses are of the land use/land cover changes in Minna between 1999 and 2019 and the understanding of the city space's projection for 2029. The underlying factors of the land use and land cover changes in Minna City range from a population explosion to expansion of the government's offices, and extension of the infrastructure such as roads, schools, hospitals, and commercial activities as they all play a significant role in these changes. They will continue to play the role as development is concentrated in the capital city at the expense of other neighbouring towns in the state. Another factor is the spill over effect of the population explosion in the Federal Capital, Abuja.

6.2.1.6 Land use changes between 1999 and 2009

The analysis presented in Table 6.8 shows that the percentage of the change between 1999 and 2009 was 4.7 per cent for the built-up areas within the city. Vegetal cover/bare ground dropped in spatial extent by -5.3 per cent, and the water bodies increased by 0.6 per cent between 1999 and 2009. A final summation of the spatial changes gave a 0.0 per cent change, indicating that all land spaces were accounted for in the land use/land cover analyses.

Table 6.8: Land Use Changes between 1999 and 2009

Land Cover	1999	2009	Δ	2009%	2009 Value
Built-up	5,501.4	8,305.3	2803.9	4.7	14.0
Vegetal Cover/				-5.3	85.2
Bare Ground	53,764.6	50624.4	-3140.2		
Water bodies	126.0	462.3	336.3	0.6	0.8
Total	59392.0	59392.0		100.0	

Source: Author's Computation (2021)

6.2.1.7 Land use changes between 2009 and 2019

The analysis in Table 6.9 shows a breakdown of spatial and percentage changes in the city of Minna between 2009 and 2019. Between 2009 and 2019, the total built-up areas increased by 4.0 per cent, the vegetal cover/bare ground shrunk by -3.8 per cent, and the water bodies were also observed to shrink by -0.2 per cent over the ten-year-period. The spatial changes show

2,401.4 Ha of developed land, 2269.0 Ha of land lost to development from the vegetal cover and bare ground, and about 132.4 Ha of water bodies were also lost.

Table 6.9: Land Use Changes between 2009 and 2019

Land Cover	2009	2019	Δ	2009%	2019%	Δ %
Built-up	8305.3	10,706.7	2,401.4	14.0	18.0	4.0
Vegetal Cover/Bare Ground	50624.4	48,355.4	2,269.0	85.2	81.4	-3.8
Water bodies	462.3	329.9	-132.4	0.8	0.6	-0.2
Total	59392.0	59392.0	0.0	100.0	100.0	0.0

Source: Author's Analysis (2021)

6.2.1.8 Trend analysis of the pattern of land use/land cover changes in Minna between 1999 and 2019

Figure 6.5 presents a simple line graph of the trend patterns of the spatial growth of the city's different land uses/land covers. The line graph shows a blue coloured line for the built-up areas within the city, showing an increasing level of upward growth from 1999 to 2019. The vegetal cover, which is represented by the orange-coloured line, shows that from 1999 to 2019, these spaces decreased. Finally, the grey-coloured line represents the growth path taken by the water bodies in the city space. This line shows that the water bodies continued to shrink from 1999 to 2019.

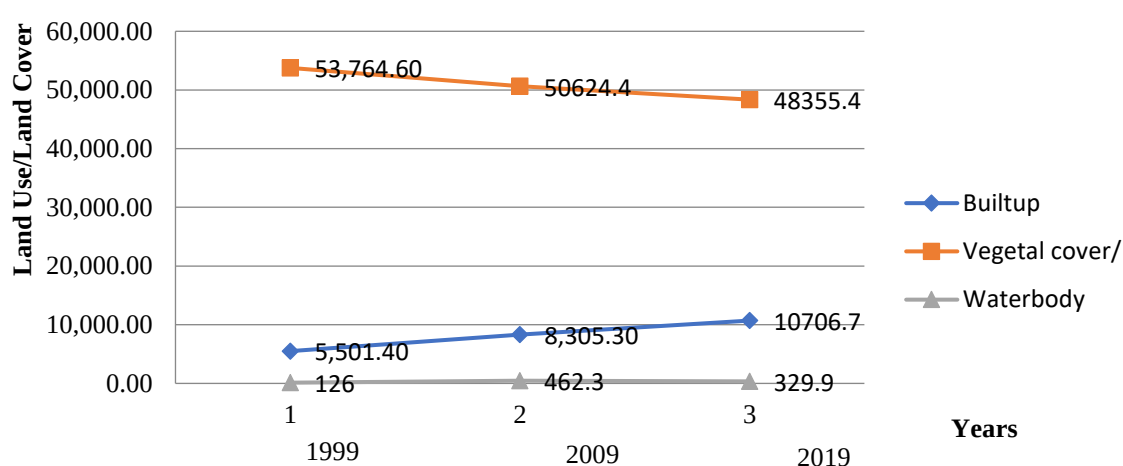


Figure 6.5: Pattern of Spatial Growth in Minna from 1991 to 2019

Source: Author's Analysis (2021)

6.2.2 Spatial analysis and projection of Lokoja City's Limits in North-Central Nigeria from 1999 to 2029

Another city in North-Central Nigeria used for the study was Lokoja, the capital of Kogi State. Lokoja City was the second of three cities used for this research. It was one of the pre-colonial cities in Nigeria and one of the country's capitals established during the colonial regime in the country under the leadership of Sir Lord Fredrick Lugard. The analyses are presented in tabular and pictorial forms.

6.2.2.1 Growth analysis of Lokoja City in 1999

The analysis of the land use/land cover of Lokoja City is presented in Table 6.10. The analysis showed that in 1999, Lokoja had an estimated land area of 61,178.8 Ha of land. In 1999, the total built-up area was 3,631.0 Ha (6.0% of the total spatial extent of the city). The vegetal cover/bare ground was estimated at 55,689.7 Ha (91.0% of the total city's extent), and the water bodies were estimated at 1,857.8 Ha (3.0% of the city's total spatial extent). This implied that Lokoja City was a vital city linking Southern Nigeria and Northern Nigeria and was thus a strategic route for commuters and settlers.

Table 6.10: Growth Analysis of Lokoja City in 1999

Land Cover	Area (ha)	% Δ
Built-up	3631	6.0
Vegetal Cover/Bare ground	55689.7	91.0
Water Bodies	1857.8	3.0
Total	61178.5	100.0

Source: Author's Computation (2021)

The spatial configuration of Lokoja City in Kogi State in 1999 is presented in Figure 6.6. It reveals that the green spaces representing the vegetal cover and bare grounds were widespread. The built-up area defined in brown was concentrated along the confluence of the River Niger and the River Benue and spread northwards. The water body depicted in blue was the River Niger which formed a confluence with the River Benue around the Ganaja-Adankolo area of the city. Furthermore, the bare ground/vegetal cover was comprised of hilly and rough terrain, too sloped for physical development.

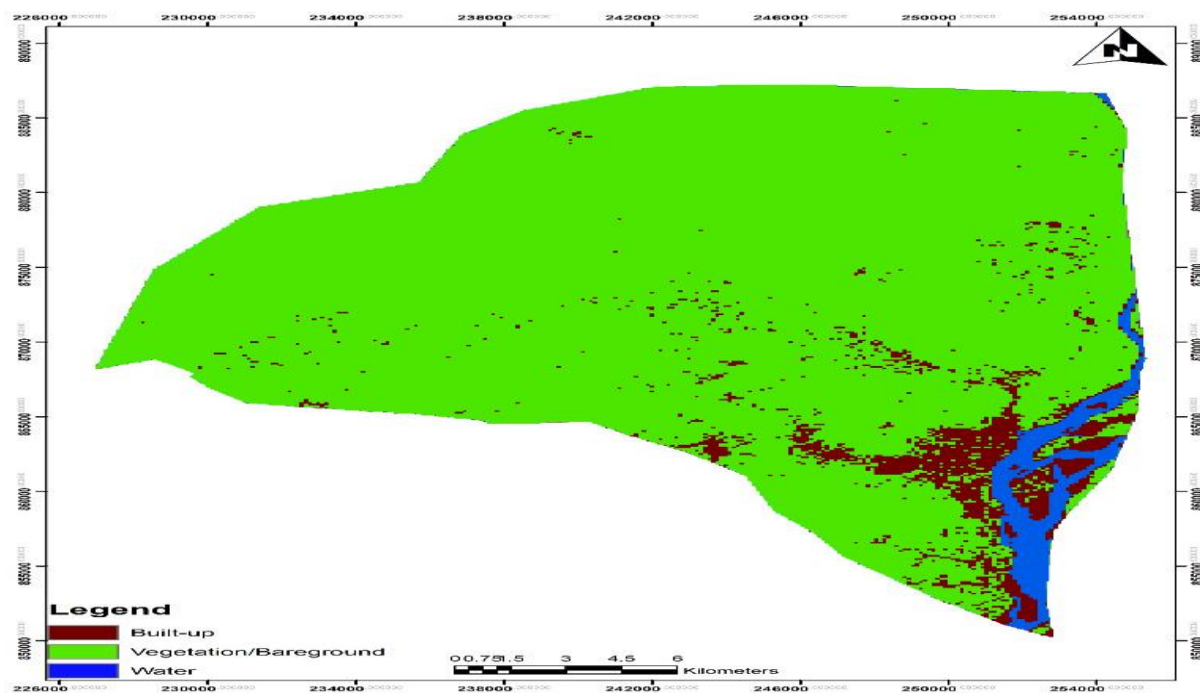


Figure 6.6: Lokoja City's Spatial Extent in 1999

Source: GloVis Viewer (2021)

6.2.2.2 Growth analysis of Lokoja City in 2009

Analysis of the land use and land cover changes in the city of Lokoja using the Global thematic mapper of 2009 showed a decline of the vegetal cover from 55, 689.7 Ha in 1999 to 49,623.9 Ha in 2009. This implied that 10.0 per cent of the vegetal cover was lost (91.1% in 1999 and 81.1% of the city's total extent in 2009, respectively). The built-up areas increased from 3,681.0 Ha in 1999 to 9,388.0 Ha in 2009. This was a 15.3 per cent change in the land cover of the city's space. The water body was also observed to have enlarged to about 2,166.6 Ha in 2009, a 3.5 per cent change in the spatial extent of the city. These analyses are shown in Table 6.11.

Table 6.11: Growth Analysis of Lokoja City in 2009

Land Cover	Area 2009 (Ha)	Area 1999 (Ha)	% Δ in 10 Yrs.	% Δ
Built-up	9,388.0	3,631.0	5,747.0	15.3
Vegetal Cover/Bare Ground	49,623.9	55,689.7	-6,065.8	81.1
Water Body	2,166.6	1,857.8	-308.8	3.5
Total	61178.5	61178.5		100.0

Source: Author's Computation (2021)

Figure 6.7 depicts the spatial extent of Lokoja City in 2009. Analysis of the data revealed dense clustering of developments along the bank of the River Niger because of the imposing Mount Patti, which poses a challenge to physical development in the area. The green spaces within the image indicate the bare grounds, vegetal cover, and non-developable terrain observed in Lokoja. The brown patches are the built-up areas that include all forms of development or human alteration of the space noticeable in the city. In contrast, the blue patch is the water body in the city, namely the confluence of two important rivers in Nigeria.

The physical development in Lokoja showed similar characteristics to those of Minna, in that they were both state capitals and nodal points of transportation. However, Lokoja differed in that it is a transit point between Northern and Southern Nigeria. It is a fast-growing city because of its location in the transition zone between the Northern and the Southern part of the country. The state is blessed with the merging of the two main rivers in the country (Niger and Benue Rivers), which serves as a tourist attraction and thereby increases the rate of urbanisation and physical development in the city.

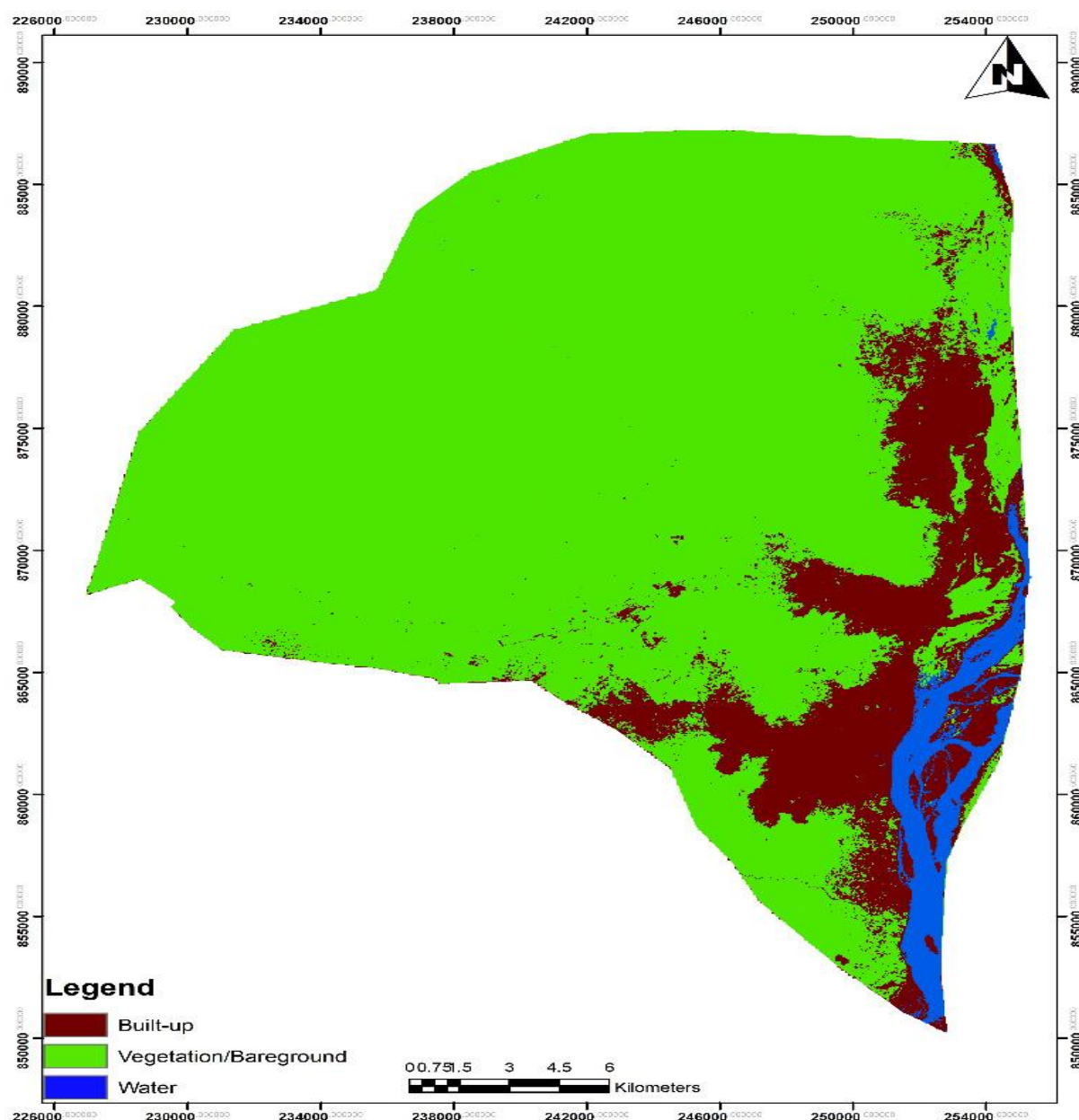


Figure 6.7: Lokoja City's Spatial Extent in 2009
Source: GloVis Viewer (2021)

6.2.2.3 Growth analysis of Lokoja City in 2019

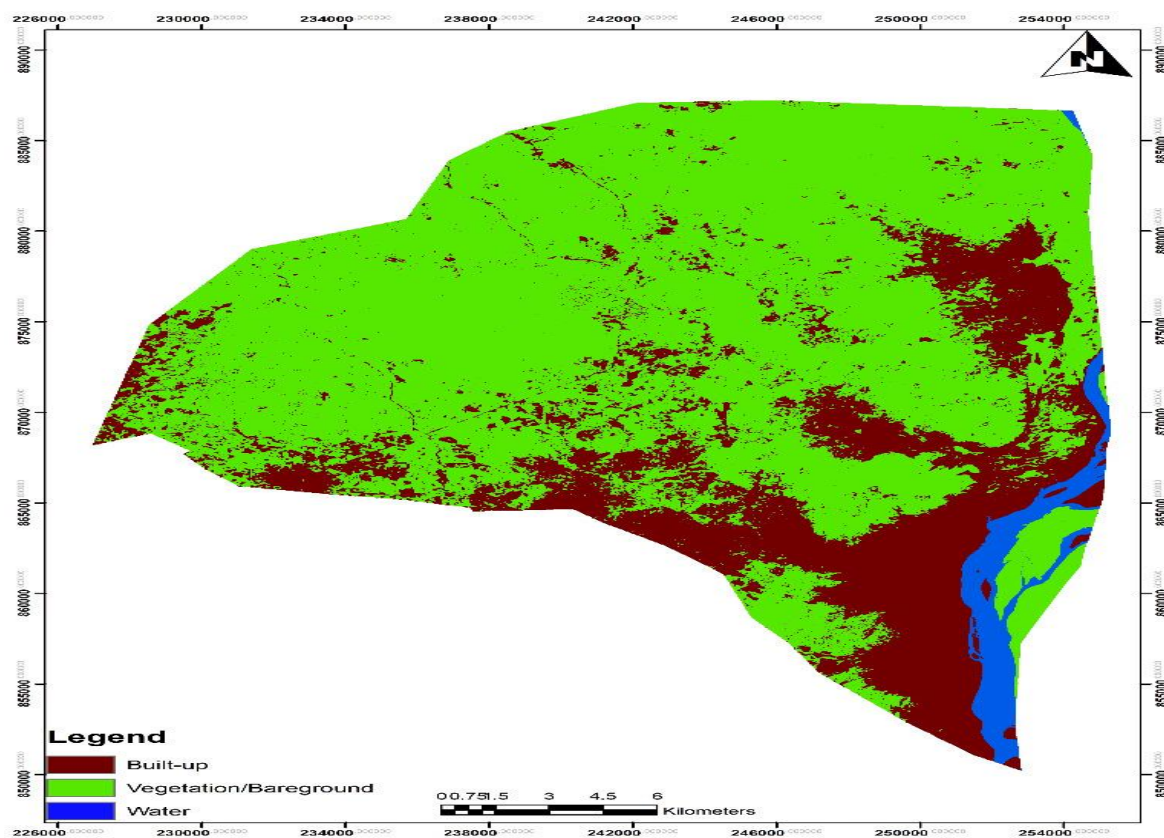
Table 6.12 depicts the analysis of the growth of Lokoja City in the year 2019, as determined using the Global thematic mapper. The results indicated that the size of the built-up area grew rapidly and reached an estimated 14,833.3 Ha by 2019 (24.2% of the total spatial extent of the city). The vegetal cover/bare ground shrunk to 44,531.0 Ha, to comprise 72.8 per cent of the full spatial extent of the city, and the water body shrunk marginally to 1,814. 0Ha (3.0%) of the total spatial extent of the city.

Table 6.12: Growth Analysis of Lokoja City in 2019

Land Cover	Area 2019 (Ha)	Area 2009 (Ha)	% Δ in 10 Yrs. (Ha)	% Δ
Built-up	14,833.3	9,388.0	5,445.3	24.2
Vegetal Cover/Bare Ground	44,531.0	49,623.9	-5,092.9	72.8
Water Body	1,814.2	2,166.6	-352.4	3.0
Total	61178.5	61178.5		100.0

Source: Author's Computation (2021)

Figure 6.8 reveals the spatial development of the city of Lokoja in 2019. The image shows the spread of the various physical features identified and detailed in the analysis presented in Table 6.12. The imagery shows that the brown patch representing the built-up area in 2019 had increased in size from that of its size in 2009, while the water body, depicted by the blue patch, had shrunk by about 0.5 per cent. The 2019 analysis showed a continuous loss of vegetal cover/bare ground over time.

**Figure 6.8: Lokoja City's Spatial Extent in 2019**

Source: GloVis Viewer (2021)

6.2.2.4 Growth projection and analysis of Lokoja City in 2029

The projected growth of Lokoja City in 2029 was estimated, as for the estimation carried out for the city of Minna. The analysis of the projection is presented in Table 6.13. This analysis showed that when keeping all of the critical indicators of development such as road infrastructure, security, and other factors constant, the city was expected to have its built-up area increase to 30.3 per cent. The water body was projected to remain unchanged at 3.0 per cent, and the vegetal cover was projected to deplete to about 66.7 per cent of the total spatial area of the city by the year 2029.

Table 6.13: Growth Projection and Analysis of Lokoja City in 2029

Land Cover	Area (Ha)	% Δ
Built-up	18,545.7	30.3
Vegetal Cover/Bare Ground	40,817.5	66.7
Water Body	1,815.3	3.0
Total	61178.5	100.0

Source: Author's Analysis (2021)

The analysis shown in Figure 6.9 depicts the simulated imagery of the city of Lokoja by 2029. It was assumed that if the pace of the spatial changes remained constant, the built-up area would increase to about 18,545.7 Ha. The area of vegetal cover/bare ground was predicted to shrink to 40,817.5 Ha, while the water body was projected to remain unchanged at 1,815.3 Ha over the 10 years from 2019. Urbanisation, physical development, and the population explosion were the underlying factors that caused the city's land cover/land use changes over the study period. The massive infrastructure development and centralisation of the government of Kogi State were predicted to be the attraction factors that would attract the population to the city. The quest for land for the built-up area was predicted to increase. Because of the limiting factor of Mount Patte, the riverbank was predicted to remain attractive to developers, as was already the case. The attendant effect of the increasing development will be flooding that can lead to loss of lives and properties in the city's foreseeable future if development is not checked.

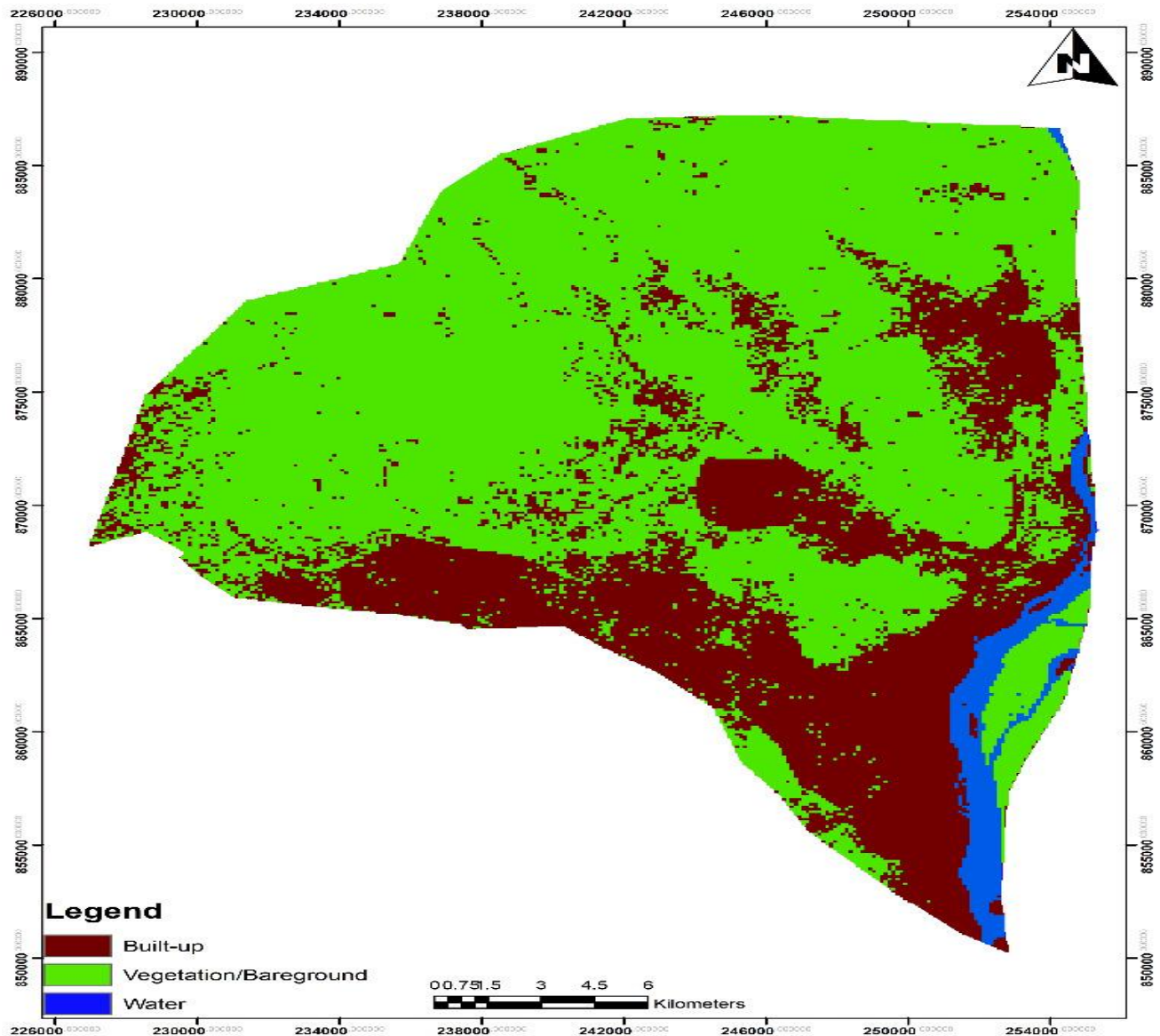


Figure 6.9: Simulation of the Spatial Extent of Lokoja City in 2029

Source: GloVis Viewer (2021)

6.2.2.5 Land use/land cover changes in Lokoja City between 1999 and 2019

A significant feature in the spatial analysis of the city of Lokoja was the changes detected over the 20 years, and the outcomes are presented. These outcomes indicated the percentages of the changes in the spatial extent of specific land uses over time and the rate of these changes. The analysis also indicated the spatial changes in the number of hectares of land gained and lost by the various land uses identified within the period under review. The striking fact was that the vegetal cover/bare ground continued to lose space to the built-up areas in the city over the 20-year period.

6.2.2.6 Land use/land cover changes in Lokoja between 1999 and 2009

Table 6.14 shows the land use/land cover changes in the city of Lokoja between 1999 and 2009. The analysis showed that between 1999 and 2009, the built-up area increased from 3,631.0 Ha in 1999 to 9,388.0 Ha in 2009. This showed a spatial change of 5,757.0 Ha within 10 years, representing a 9.3 per cent change in space which signified an increase in development and human alterations in the area. The analysis also showed that vegetal cover and bare ground were depleted by about 6065.8 Ha between 1999 and 2009. The percentage of loss in the vegetal cover/bare ground space was 9.8 per cent. Also, between 1999 and 2009 the water body expanded by about 0.5 per cent, accounting for the remaining percentage of the vegetal cover/bare ground lost over this period. The water body was observed to have expanded by about 308.8 Ha over the ten-year period.

Table 6.14: Land Use Changes in Lokoja between 1999 and 2009

Landcover	1999	2009	Δ	1999%	2009%	Δ %
Built-up	3631	9388	5757	6.0	15.3	9.3
			-			
Vegetal Cover/Bare Ground	55689.7	49623.9	6065.8	91.0	81.2	-9.8
Water Body	1857.8	2166.6	308.8	3.0	3.5	0.5
Total	61178.50	61178.50	0.0	100.0	100.0	0.0

Source: Author's Computation (2021)

6.2.2.7 Land use changes between 2009 and 2019

The spatial analysis of the land use/land cover changes in Lokoja indicated quite an exciting finding for the period from 2009 to 2019, as presented in Table 6.15. The built-up area increased from 9,388.0 Ha to 14,833.3 Ha between 2009 and 2019 (8.9% and 5445.3 Ha). The vegetal cover/bare ground shrunk to 44,531.0 Ha from 49,632.9 Ha (8.4% spatial loss in this city component). This implied that the total land use/land cover change was directly due to the conversion of vegetal cover into built-up areas. This was unique. The analysis also revealed a marginal change in the land area occupied by the water body, as the water body shrunk to 1,814.2 Ha in 2019 from 2,166.6 Ha in 2009 (a decrease of 0.5%). This area was also lost to the expanding built-up area as the riverbank was filled in with sand to enable the building of houses. The area along the riverbank thus became saturated with houses.

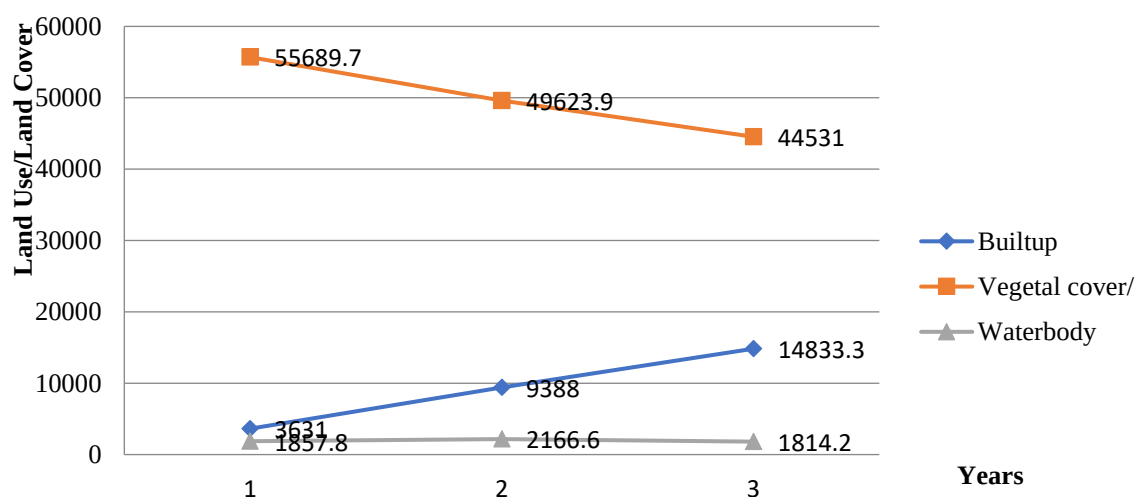
Table 6.15: Land Use Changes in Lokoja between 2009 and 2019

Land Cover	2009	2019	Δ	2009%	2019%	Δ %
Built-up	9388.00	14833.30	5445.30	15.3	24.2	8.9
Vegetal Cover/Bare Ground	49623.90	44531.00	-5092.90	81.2	72.8	-8.4
Water Body	2166.60	1814.20	-352.40	3.5	3.0	-0.5
Total	61178.50	61178.50	0.00	100.0	100.0	0.0

Source: Author's Analysis (2021)

6.2.2.8 Trend analysis of the pattern of the land use/land cover changes in Lokoja between 1999 and 2019

The trend analysis of the land use/land cover changes in the city of Lokoja is presented graphically in Figure 6.10. The built-up areas are represented by the blue line, which shows a continuous increase in this city feature, as was presented in the earlier discussions. However, as indicated in the graph, the water body maintained its stability as the amount of space occupied by the water body remained unchanged for the 20-year period. The vegetal cover/bare ground was also analysed, and the data indicated that this component of the city was seriously on the decline. In the graph below the land use is plotted on the graph's X-axis, while the spatial changes in the extent of the individual characteristics are plotted on the graph's Y-axis.

**Figure 6.10: Trend Analysis of the Spatial Changes in Lokoja between 1999 and 2019**

Source: Author's Analysis (2021)

1999 2009 2019

6.2.3 Spatial analysis and projection of the Lafia City limits in North-Central Nigeria from 1999 to 2029

Another city was examined for this research, and the land use/land cover analysis was carried out in the city of Lafia in Nasarawa State. Lafia is one of the state capitals of the last sets of states created in 1996 by the military government of General Sani Abacha. The city currently sits on a land hectarage of about 11,854.4 Ha. The land use/land cover analysis of the city is now presented in the following sections and sub-sections.

6.2.3.1 Growth analysis of Lafia City in 1999

Table 6.16 presents the spatial growth analysis of the city of Lafia in 1999. The city's spatial extent was examined using four critical features: built-up areas, vegetal cover, bare ground, and water bodies. The analysis showed that in 1999, 9.8 per cent of the total land area was adjudged to be built-up. Vegetal cover accounted for 11.3 per cent of the city's total land area, while 79.0 per cent of the city's total land area was bare ground, and there was no record of the water body estimate for the city in 1999.

Table 6.16: Growth Analysis of Lafia City in 1999

Land Cover	Area (Ha)	% Δ
Built-up	1,159.9	9.8
Vegetal Cover	13,34.6	11.3
Bare Ground	9,359.9	79.0
Water Body	0	0.0
Total	11854.4	100.0

Source: Author's Computation (2021)

Figure 6.11 shows that the city's components are depicted by different colours. The built-up area in the city is represented by the brown colour, and it was estimated at 1,159.9 Ha of the total land area in 1999. The vegetal cover was estimated at 1,334.6 Ha and is shown in green, while the bare ground was estimated at 9,359.9 Ha and is represented by the yellow colour.

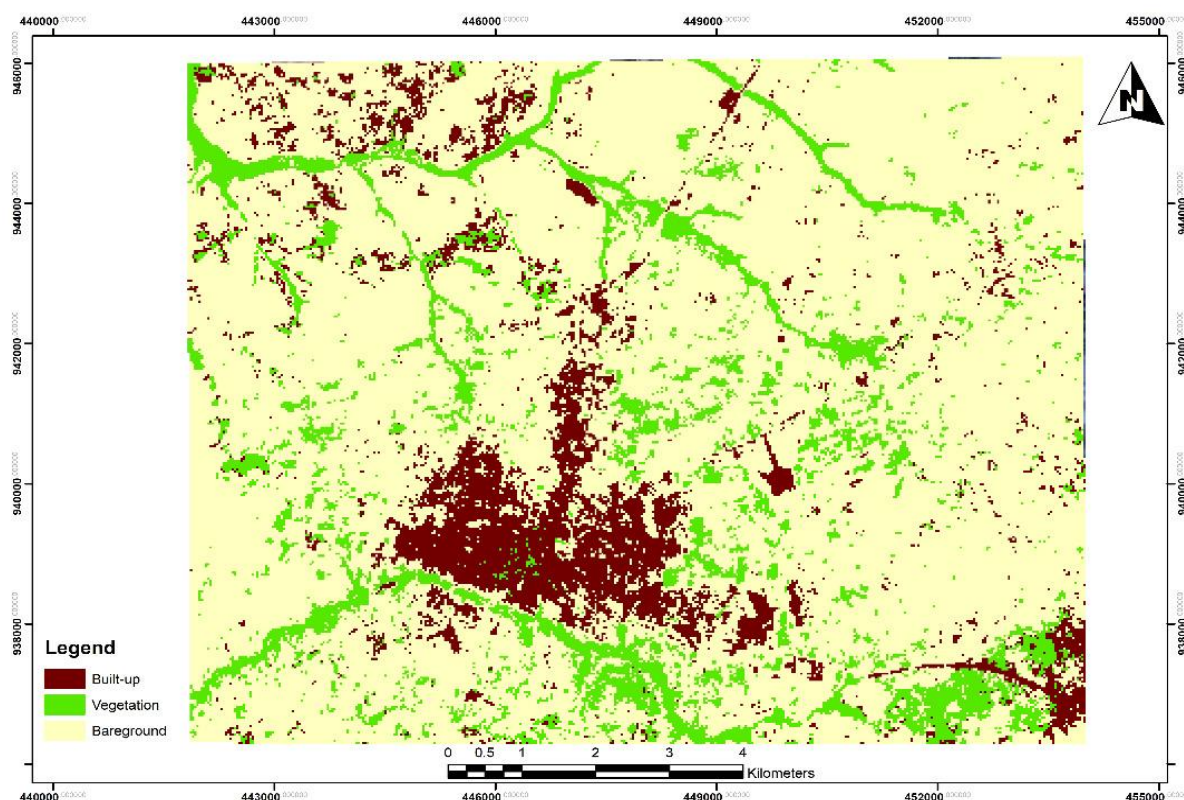


Figure 6.11: Lafia City's Spatial Extent in 1999

Source: GloVis Viewer (2021)

6.2.3.2 Growth analysis of Lafia City in 2009

The 2009 analysis of the land use/land cover of Lafia City is presented in Table 6.17. The analysis indicated that the built-up area in the city was 20.6 per cent in 2009; the vegetal cover was estimated at 20.2 per cent; and the bare ground accounted for 59.2 per cent; but there was no estimate available for the water body in the city in 2009. The total spatial extent of the town stood at 11851.60 Ha.

Table 6.17: Growth Analysis of Lafia City in 2009

Land Cover	2009	% Δ
Built-up	2,442	20.6
Vegetal Cover	2,391.7	20.2
Bare Ground	7,017.9	59.2
Water Body	0	0.0
Total	11851.60	100.0

Source: Author's Computation (2021)

The analysis further broke down the spatial characteristics of the hectareage of space occupied by the various identified land uses. Figure 6.12 shows that the built-up area, estimated at 20.6 per cent, occupied 2442 Ha of land. The vegetal cover was at 2391.7 Ha, the bare ground occupied 7017.9 Ha, and there was no estimate for the water body.

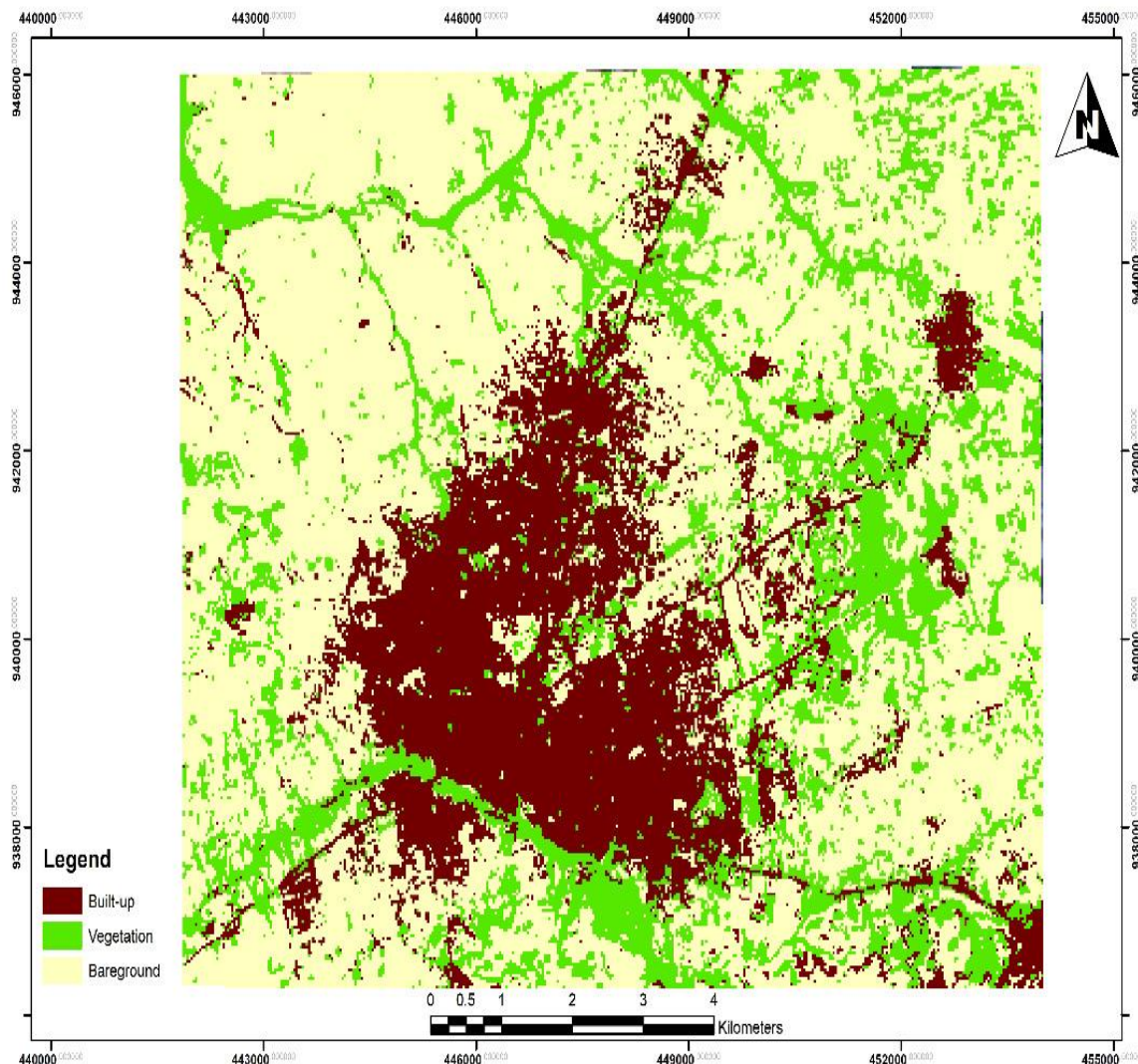


Figure 6.12: Lafia City's Spatial Extent in 2009

Source: GloVis Viewer (2021)

6.2.3.3 Growth analysis of Lafia City in 2019

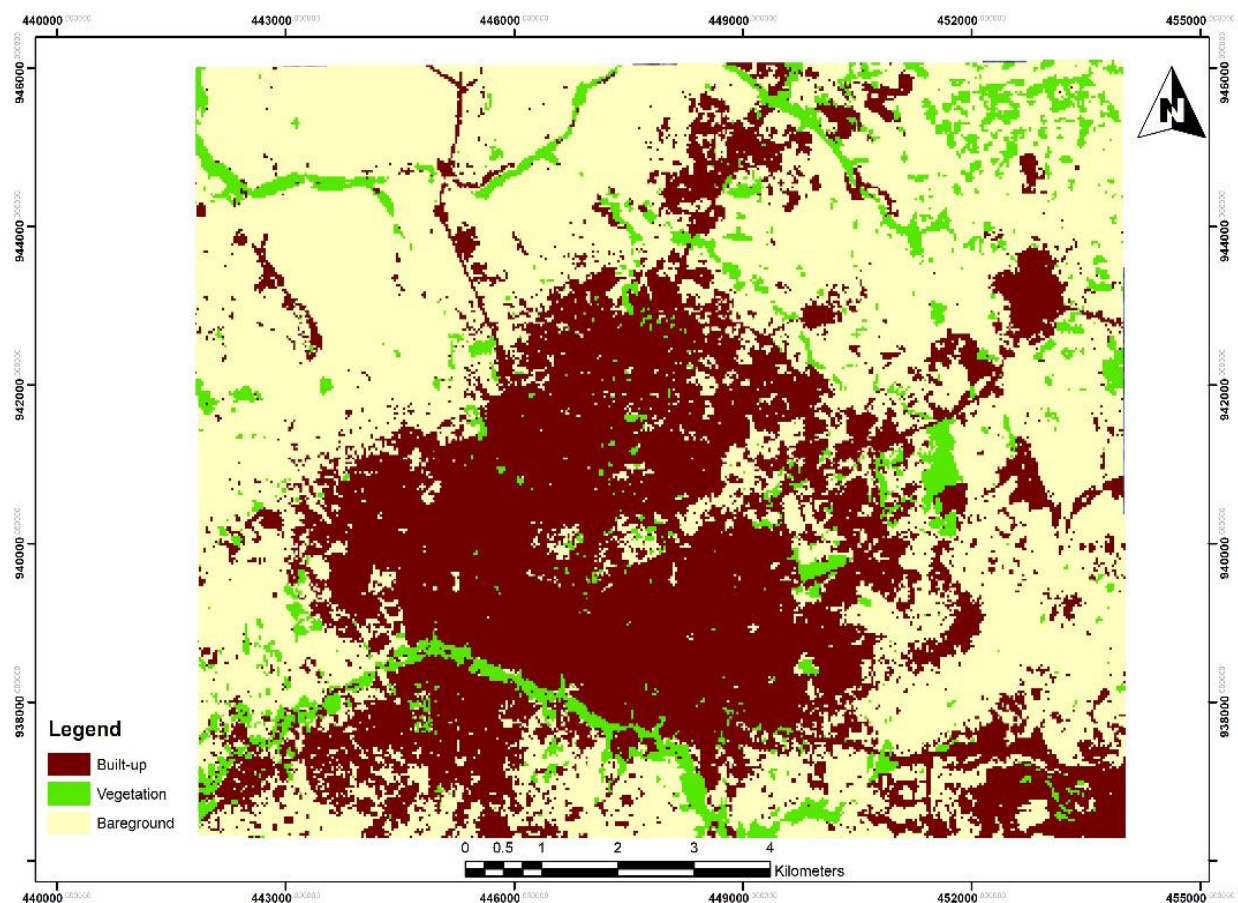
Table 6.18 shows the 2019 analysis of the land use/land cover in Lafia City in 2019. The built-up areas in the city were estimated at 39.9 per cent, and the vegetal cover stood at 7.3 per cent. Furthermore, bare ground was estimated to occupy 52.9 per cent of the city's total land area of 11853.1 Ha.

Table 6.18: Growth Analysis of Lafia City in 2019

Land Cover	Area (Ha)	% Δ
Built-up	4,724.8	39.9
Vegetal Cover	861.1	7.3
Bare Ground	6,267.2	52.9
Water Body	0.0	0.0
Total	11853.1	100.0

Source: Author's Computation (2021)

The imagery of the city in 2019 is presented in Figure 6.13. The spread of the brown patches on the map, which represents the built-up areas, was estimated at 4,724.8 Ha. The vegetal cover indicated by the green patches was estimated at 861.1 Ha. The city's bare ground, indicated by the yellow patches, represented all of the spaces that had not been altered within the city's space and stood at 6,267.2 Ha.

**Figure 6.13: Lafia City's Spatial Extent in 2019**

Source: GloVis Viewer (2021)

6.2.3.4 Projection and analysis of the spatial growth of Lafia City in 2029

A spatial growth projection/simulation was also carried out for the city of Lafia, and the outcomes are presented in Table 6.19. The analysis predicted that if all factors were kept constant, i.e., the current growth trajectories were maintained, then by the year 2029, 10 years after the 2019 analysis, the percentage of built-up land in the city would be 49.5 per cent of the total land usage. Vegetal cover would account for 7.0 per cent of the total land area, and bare ground would account for 43.5 per cent of the total land area of the city. No water bodies were predicted to be present.

Table 6.19: Projection and Analysis of the Spatial Growth of Lafia City in 2029

Land Cover	Area (Ha)	% Δ
Built-up	5863.2	49.5
Vegetal Cover	832.43	7.0
Bare Ground	5157.5	43.5
Water Body	0	0.0
Total	11853.1	100.0

Source: Author's Computation (2021)

The growth simulation in terms of the volume of land hectarage occupied is presented in Figure 6.14. The analysis showed that the brown patches that signified the city's built-up areas would have a spatial extent of 5863.2 Ha of land by 2029, if all of the growth trajectories remained stable. The vegetal cover would occupy 832.4 Ha, while the bare ground would occupy 5157.5 Ha by 2029, as presented in the image.

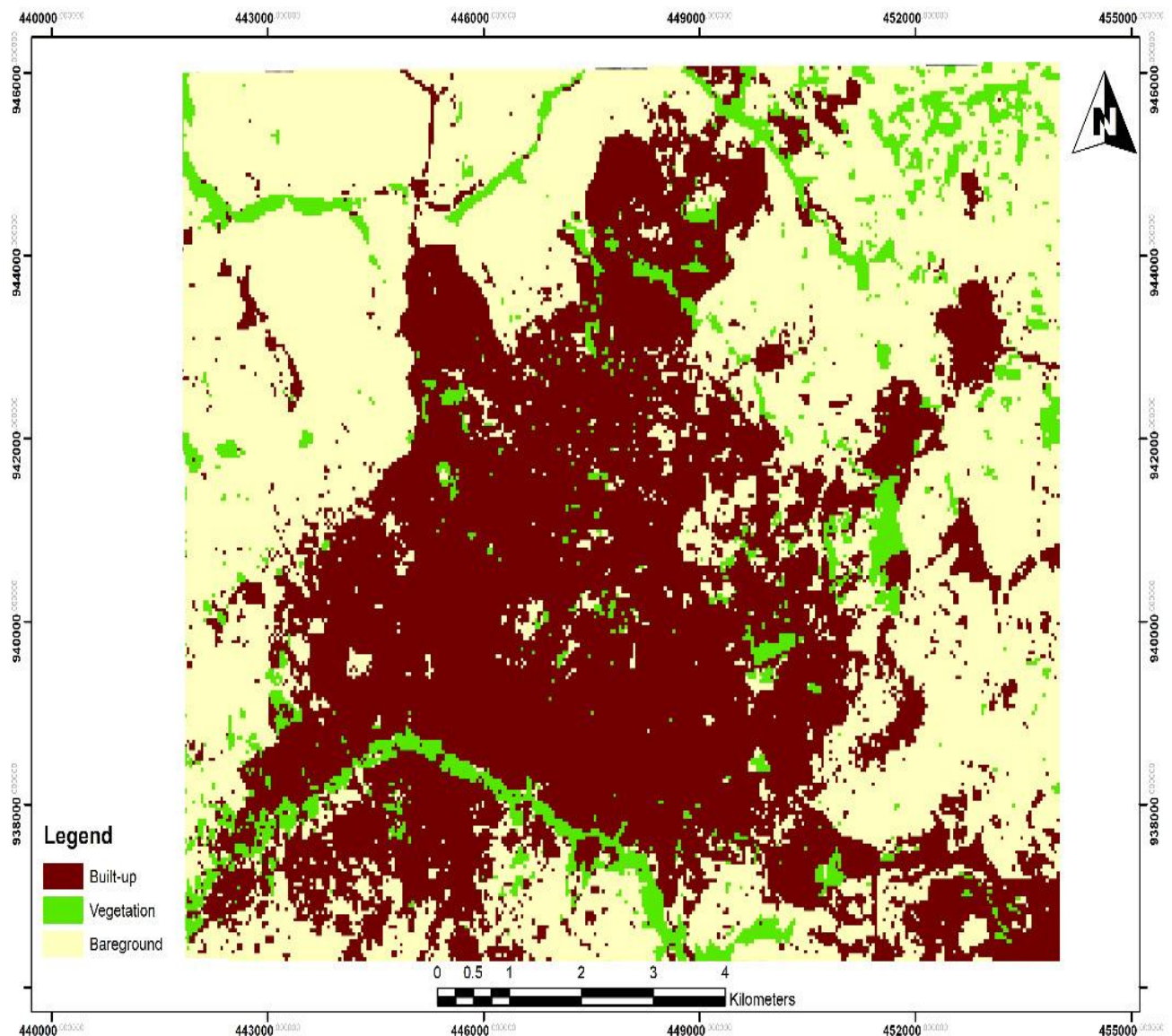


Figure 6.14: Simulation of the Spatial Extent of Lafia City in 2029

Source: GloVis Viewer (2021)

6.2.3.5 Land use/land cover changes in Lafia between 1999 and 2019

Another essential feature in the spatial analysis of the city of Lafia was the detection of changes over the 20-year period, and the outcomes are presented here. These outcomes indicated the percentage of the changes in the spatial extent of the specific land uses over time and the rate of these changes. The analysis also showed the spatial changes in hectares of the land gained and lost by the various identified land uses within the period under review. The striking fact was that over the 20-year period, the vegetal cover and bare ground continued to lose space to the built-up areas in the city. Other noticeable spatial vagaries are also presented in this section.

6.2.3.6 Land use/land cover changes in Lafia between 1999 and 2009

Lafia City was observed to have a total land area of 11854.40 Ha, as shown in Table 6.20. The city experienced a change in the built-up area over the ten years from 1159.9 Ha in 1999 to 2444.8 Ha in 2009; representing a spatial increase in the built-up area of 1284.9 Ha (representing an increase of 10.8%). The change in vegetal cover in the city was also analysed. The analysis showed that the vegetal cover was estimated at 1334.6 Ha in 1999. This was observed to increase to 2391.7 Ha in 2009; representing a change in the spatial extent of the vegetal cover of 1057.1 Ha (an 8.9% change over the ten-year period). The analysis showed that no water body was estimated for the city of Lafia between 1999 and 2009. Furthermore, the analysis also showed that bare ground was at the receiving end of the spatial loss within the city, having reduced from 9359.9 Ha in 1999 to 7017.9 Ha in 2009. This was a total loss of 2342 Ha over the ten years, representing a 19.7 per cent change in the spatial extent of the city over this period.

Table 6.20: Lafia Land Use Changes Between 1999 and 2009

Land Cover	1999	2009	Δ	1999%	2009%	Δ %
Built-up	1159.9	2444.8	1284.9	9.8	20.6	10.8
Vegetation	1334.6	2391.7	1057.1	11.3	20.2	8.9
Bare Ground	9359.9	7017.9	-2342	79.0	59.2	-19.7
Water Body						0.0
Total	11854.40	11854.40	0	100.0	100	

Source: Author's Analysis (2021)

6.2.3.7 Land use changes between 2009 and 2019

The analysis of the spatial changes in the city between 2009 and 2019 is presented in Table 6.21. Analysing the total land area of 11854.4 Ha, Lafia experienced a change in the built-up area over those ten years from 2444.8 Ha in 2009 to 4724.8 Ha in 2019. This was a 2280 Ha or 19.3 per cent spatial increase of the built-up area. The change in vegetal cover in the city was also analysed. The analysis showed that the vegetal cover was estimated at 2391.7 Ha in 2009 but this was reduced to 862.39 Ha, representing a decline of 1529.31 Ha (12.9%) in the spatial extent of the vegetal cover over this period. The analysis also showed that the spatial extent of the bare ground also declined from 7017.9 Ha in 2009 to 6267.21 Ha in 2019. This

was a loss of 750.7 Ha of bare ground within ten years, representing a 6.3 per cent change in the spatial extent of the city.

Table 6.21: Lafia Land Use Changes between 2009 and 2019

Land Cover	2009	2019	Δ	2009%	2019%	Δ %
Built-up	2444.8	4724.8	2280	20.6	39.9	19.3
Vegetation	2391.7	862.39	-1529.31	20.2	7.3	-12.9
Bare Ground	7017.9	6267.21	-750.69	59.2	52.9	-6.3
Water Body						0.0
Total	11854.4	11854.4	0	100.0	100.0	

Source: Author's Computation (2021)

6.2.3.8 Trend analysis of the pattern of land use/land cover changes in Lafia between 1999 and 2019

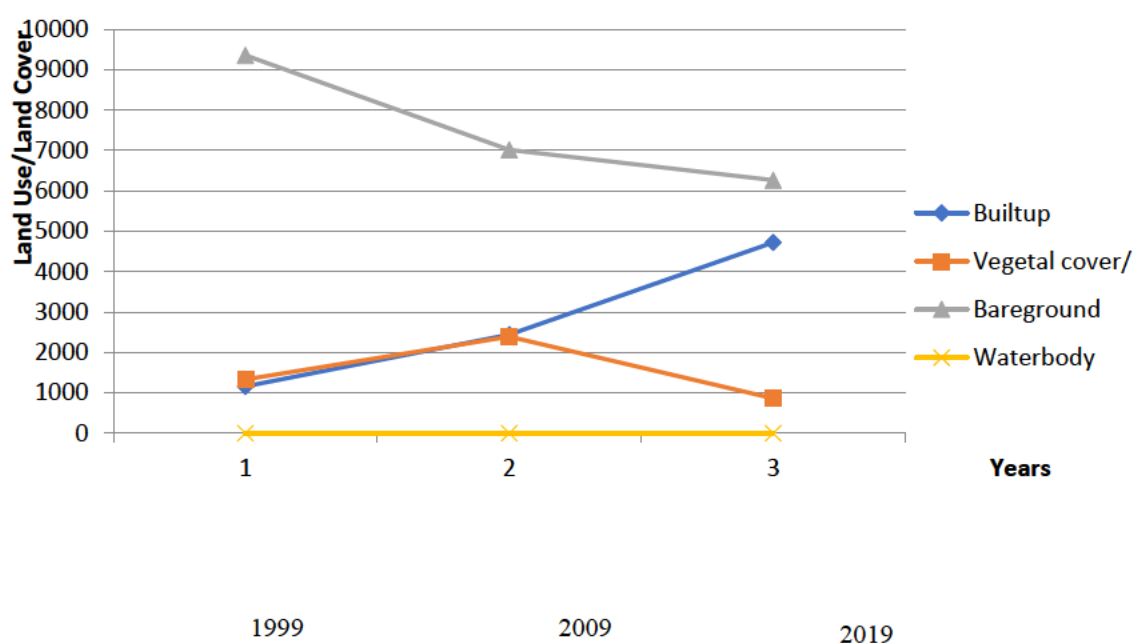


Figure 6.15: Trend Analysis of the Spatial Changes in Lafia City between 1999 and 2019

Source: Author's Analysis (2021)

6.3 The Effects of Urban Expansion on Urban Spatial Patterns

Two geographical indexes assess urban expansion: The Urban Expansion Differentiation Index (UEDI) and the Urban Expansion Intensity Index (UEII) (sprawl ratio indexes). They are treated as separate variables when examining the link between urban growth and changes in land use. A specific value of the spatial metrics is also expected to be the dependent variable. The GWR proved to be an excellent model for examining the connection between these two data types. Table 6.22 shows the GWR model's adjusted R^2 and AICt values.

Table 6.22: Results of the GWR Analysis from 1999-2019

City	Period	Spatial Metrics	Adjusted R^2		AICt	
			UEII	UEDI	UEII	UEDI
Minna	1999-2009	AI	0.71	0.29	180.8	144.0
		GYRATE_MN	0.64	0.32	177.2	167.9
		ENN_MN	0.77	0.23	272.3	292.2
Lafia	1999-2009	AI	0.51	0.49	170.2	134.0
		GYRATE_MN	0.84	0.12	187.2	157.9
		ENN_MN	0.57	0.43	262.3	242.7
Lokoja	1999-2009	AI	0.61	0.39	190.1	134.1
		GYRATE_MN	0.54	0.48	177.7	197.2
		ENN_MN	0.67	0.33	272.5	222.8
Minna	2010-2019	AI	0.88	0.12	177.8	122.2
		GYRATE_MN	0.62	0.38	188.8	167.2
		ENN_MN	0.70	0.30	229.2	276.8
Lafia	2010-2019	AI	0.66	0.34	187.1	122.9
		GYRATE_MN	0.82	0.18	198.2	157.8
		ENN_MN	0.80	0.20	269.4	236.6
Lokoja	2010-2019	AI	0.74	0.26	157.7	162.3
		GYRATE_MN	0.52	0.48	198.8	157.2
		ENN_MN	0.50	0.50	259.4	246.8

Source: Author's Calculations (2021)

The coefficients differed significantly between cities. The UEII levels fluctuated spatially among the cities, and the coefficient of spatial change expressed this variation. For the last two

decades the trends of the coefficients for each spatial pattern were relatively stable. Over the past two decades the cities exemplified how the UEII and the AI were intertwined in varied land uses. The commencement of a trend was strongly linked to positive outcomes. This suggested that the aggregation process could be accelerated by increasing the expansion rate. Between 2009 and 2019, the cities' responses to the urban growth remained mostly the same. This research findings were consistent with the urban trend. According to the resultant negative coefficients in the spatial expansion, the greater value of UEII led to a reduction in the aggregation process. As a result, there was a decline in the formation of big patches of land and an increase in land fragmentation in the three cities' peri-urban areas. According to the GWR analysis, the geographical patterns of the selected cities could be identified by the intensification of their expansions, using the built-up areas' average population densities.

6.4 Socio-Economic Patterns

A way to stem urban sprawl is to control the socio-economic patterns in the city. These can be determined by assessing the dimensions of density function, density gradient, and the Gini coefficient.

6.4.1 Density functions

Analysis of the quantitative data revealed that the selected cities had a socio-economically based pattern of urban expansion. The three aspects of the socio-economic design (density, clustering, and distribution) could be used to determine the corresponding indexes of the urban form (i.e., the Gini and Moran coefficients). While the first dimension has been extensively studied, the other two have received little attention (i.e., density and density gradient).

The built-up area matrix was created after the Landsat pictures were classified and the built-up areas were extracted. Over time, the analysis of the cities' various patterns and changes relied on the built-up areas and the socio-economic elements (people). The municipal districts served as the spatial foundation for estimating the districts' populations in the selected cities. According to the methods outlined in Chapter Two (Methodology), the total built-up areas of the cities could be calculated. Each district's population and built-up area were calculated over a 20-year period. These factors were measured using three preliminary socio-economic dimensions. The population, employment, and extent of the built-up area for each district in 1990, 2000, and 2010 are shown in Table 6.21, together with their yearly rates of change.

Analysis of the city form relies heavily on the concept of density. Population, housing, and employment are the density measures employed in urban literature to describe the urban form (Alberti et al., 2008). The population density is simply the ratio of the population to the land area. A land area of any size can be described from a single property to an entire region, and population data can be obtained from census databases. The Iranian Census Data Centre is an example of a data repository, and it provides ten years' worth of population data. Observing the density of the population is the first step in assessing the socio-economic development forms because the population serves both as a source of labour and a source of consumer demand. Table 6.23 shows how the built-up areas of the chosen cities changed over time. Between 1999 and 2009, Lafia built-up area expanded by 3.22 per cent, but its population declined by -2.06 per cent, according to this graph. However, the yearly rate of population changes in zone Lokoja was significantly higher than the annual rate of change in a built-up area (1.83%).

Table 6.23: Annual Changes in the Populations and Urban Areas in North-Central Nigeria

City	Population				Built-up Area (Km ²)			
	1999	2009	2019	Annual change	1999	2009	2019	Annual change
Lafia	329,756	451,845	563,315	70.8	1,159.9	2,444.8	4,724.8	19.3
Minna	315,387	432,143	538,748	70.8	5,501.4	8,305.3	10,706.7	14.0
Lokoja	113,018	154,857	193,060	70.8	3631	9388	14,833.3	8.9

Source: Author's Calculations (2021)

In the analysis of the socio-economic patterns of the selected cities, two critical dimensions of density were calculated: the average population density of the built-up area and the average amount of built-up area taken up by each resident of each of the cities. The results are presented in Table 6.23.

6.4.2 Density gradient

The monocentric density function was fitted using linear and non-linear least square models. The best model was chosen as one with the highest overall R^2 value. As shown in Table 6.24, the negative exponential model provided the best fit in all three periods.

Table 6.24: Results of the Regression Models to Test the Density Gradients

City	Model	Year	Equation	R^2
Minna	Linear	1999	$Y = -0.6993x + 12962$	0.3271
		2009	$Y = -0.5267x + 10101$	0.4429
		2019	$Y = -0.5130x + 12506$	0.2452
	Exponential	1999	$Y = 15270e^{-8E-05x}$	0.2710
		2009	$Y = 14432e^{-E-04x}$	0.6443
		2019	$Y = 14835e^{-8E-05x}$	0.3019
	Power	1999	$Y = 183209x^{-0.364}$	0.3904
		2009	$Y = 372508x^{-0.458}$	0.3054
		2019	$Y = 152759x^{-0.374}$	0.2687
	Logarithmic	1999	$Y = -2779\ln(x) + 31948$	0.2111
		2009	$Y = -2671\ln(x) + 30134$	0.3622
		2019	$Y = -2324\ln(x) + 25005$	0.1384
Lafia	Linear	1999	$Y = -0.5193x + 11762$	0.1272
		2009	$Y = -0.5267x + 10601$	0.4497
		2019	$Y = -0.513x + 12507$	0.3372
	Exponential	1999	$Y = 13270e^{-8E-05x}$	0.451
		2009	$Y = 12432e^{-E-04x}$	0.4435
		2019	$Y = 13835e^{-8E-07x}$	0.3002
	Power	1999	$Y = 163209x^{-0.464}$	0.3804
		2009	$Y = 372508x^{-0.558}$	0.3024
		20109	$Y = 152759x^{-0.334}$	0.1678
	Logarithmic	1999	$Y = -2279\ln(x) + 21948$	0.2656
		2009	$Y = -2771\ln(x) + 20034$	0.3544
		2019	$Y = -2824\ln(x) + 22008$	0.1483
Lokoja	Linear	1999	$Y = -0.5993x + 12762$	0.2272
		2009	$Y = -0.5267x + 10601$	0.5479
		2019	$Y = -0.513x + 11506$	0.3472
	Exponential	1999	$Y = 13270e^{-8E-05x}$	0.361
		2009	$Y = 12432e^{-E-04x}$	0.5453
		2019	$Y = 12835e^{-8E-05x}$	0.4009
	Power	1999	$Y = 183209x^{-0.364}$	0.2804
		2009	$Y = 332508x^{-0.458}$	0.4024
		20109	$Y = 182759x^{-0.374}$	0.2687
	Logarithmic	1999	$Y = -2679\ln(x) + 31948$	0.1656
		2009	$Y = -2671\ln(x) + 30034$	0.4644
		2019	$Y = -2324\ln(x) + 28008$	0.2348

Source: Author's Calculations (2021)

6.4.3 Gini coefficient as a measure of the distribution patterns

The North-Central Nigerian cities studied were ranked according to the population inequalities in the selected areas using the Gini coefficient. The 2006 National Population and Housing Census provided the demographic information used for this study (NPC, 2011). The higher the Gini coefficients, the more densely populated these cities were. People were spread equally in an area where the Gini coefficient was near 0. According to the census data for Lafia, Minna,

and Lokoja, the Gini coefficients fluctuated from 0.73 to 0.69 to 0.57 respectively. The computed Gini index is shown in Table 6.25.

Table 6.25: Gini Index of the Populations in the Selected Cities in North-Central

Nigeria

City	Gini Coefficient	1999	2009	2019	Mean
Minna		0.58	0.62	0.87	0.69
Lafia		0.45	0.84	0.90	0.73
Lokoja		0.52	0.55	0.64	0.57

Source: Author's Calculations (2021)

It was calculated that in 1999 the Gini index of the population distribution in Minna was 0.58, which indicated a moderate concentration of people on the land in the city. In 2009, the Gini coefficient of the population was 0.62, while in 2019, it was 0.87. Minna had an average Gini Coefficient of 0.69. The Gini coefficient for Lafia was 0.45 in 1999 and since climbed to 0.84 in 2009 and 0.90 in 2019, with an average value of 0.73. Lokoja's average Gini coefficient was 0.57, and it had increased from 0.52 in 1999, to 0.55 in 2009, and then to 0.64 in 2019. The Gini coefficient thus showed an overall improvement in population inequality over the past two decades in these three cities in North-Central Nigeria.

6.5 Creating the Scenario for the Stemming of the Land Use/Land Cover Usage in the Selected Cities

According to the research above, a city's compactness, which may or may not be complex, must be considered when measuring its sprawl. It is even more important to do so when it comes to determining the specific repercussions of a liveable and welcoming city (the effects of pollution, traffic congestion, health, and energy consumption on the population). Urban areas can be measured physically (i.e., their size and population density). Here, the study focuses on describing the compactness of the cities rather than analysing its effects and the reasons for the selected cities' sprawling.

The decision to look more closely at the figures and present the closest and most crucial compactness indicators should reflect the reality of the compactness of a city. The population and employment density were given consideration in this study.

6.5.1 General measure

To begin, comparing a city's population density to that of other cities can be tempting when determining whether or not it is compact. In government reports and much further research, this measure is regularly mentioned. The World Bank (2020) notes that the population density is the mid-year population divided by the land area in square kilometres. The “population” is based on the de facto definition of a population, which counts all residents regardless of legal status or citizenship - except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of their country of origin. The land area is a country's total area, excluding the areas under inland water bodies, national claims to the continental shelf, and exclusive economic zones. In most cases the definition of inland water bodies includes major rivers and lakes. As of 2019, the municipalities of Minna, Lafia, and Lokoja collectively occupied 59,392.0 Ha of land. Of that, 11,854.4 Ha, 61,178.5 Ha, and 14833.30Ha were home to 538,748, 563,315, and 193,060 people respectively. A density of 9.1, 47.2, and 3.1/Ha was measured. The measurement of the population densities when compared with the World Bank’s benchmark of 5.8 persons/Ha showed that the city of Lafia was the most compact city amongst the selected cities, with 41.4 persons/Ha above the benchmark. This was followed by Minna with 3.3 persons/Ha above the benchmark set, and Lokoja was the least compact as it fell below the benchmark with just 2.7 persons/Ha resulting in the sprawl (Arnold Jr & Gibbons, 1996; Ganesan & Lau, 2000; Yucel et al., 2019).

6.6 Results and Findings of the Spatial Analysis of the Selected Cities in North-Central Nigeria

The land cover and land use change patterns in the three North-Central Nigerian cities were comparable. The results demonstrated that the built-up areas had lost significant amounts of vegetation every year due to various circumstances. An important aspect was an increase in the sizes of the cities and the concentration of government activity in the cities. Because of the high concentration of people in the urban districts of these cities, a considerable portion of the vegetal land was lost to the built-up areas. Urbanisation encouraged the construction of new homes, infrastructure, and social services in the places where the people were moving to. There was a ballooning of the number of homes needed to house the increasing population, which required the destruction of natural habitats to make way for new mixed development as a land use.

The fourth republic of governance in the country since independence had helped contribute to the country's political stability. Because these cities studied were the capitals of their respective states, the local governments were building a slew of housing estates and other infrastructure. People had increasingly moved to the state capitals in search of better prospects due to the centralisation of the administrations, placing pressure on the land use and land cover. As a result of the immense strain, some villages on the outskirts of the cities had been absorbed into the metropolitan areas as we know them today. A noteworthy example was the neighbourhood of Maikunkele on the outskirts of Minna, which had evolved into a suburb of the city. It was hitherto a fledgling peri-urban area and its population had since grown, largely as a result of the location of the Minna airport and the air force base in Minna. This increase in population was further enhanced by the conscious efforts of the Niger State government to build/commission the airport city estate and several housing development programmes in the city (Alhassan et al., 2018; Shaba et al., 2015). As a result of Minna City's rapid growth, slums, ghettos, and shantytowns had sprouted up in several areas of the city (Abd' Razack et al., 2012; Abubakar et al., 2019; Morenikeji et al., 2015). Several recreational infrastructures had also been converted into housing development spaces, both in Minna and Lokoja (Bloch et al., 2015; Maichibi et al., 2022; Zakka et al., 2017).

It was also found that Lokoja's need for more built-up regions had led to landfilling of its watershed area to build extra dwellings, limiting the river's ability to absorb carbon dioxide and thus damaging the city. Flooding also occurred more easily in Lokoja because the waterways had been obstructed with the building of the new homes. Ten years after the devastating floods of 2011, communities were still feeling the effects (Buba et al., 2021; Egbenta et al., 2015; Po et al., 2017). The land use changes had led to a rise in the use of non-conventional energy sources, and Abd' Razack et al. (2012) noted that Nigerian cities had had to deal with the consequences of this, which included deforestation, daily warming and the formation of urban heat islands (Ayodele, 2015; Leal et al., 2019; Nwakaire et al., 2020). In order to meet their domestic energy demands for cooking, many individuals in this area had cut down trees and plants (Adedayo et al., 2010; Maconachie et al., 2009; Maina et al., 2020).

Gentrification was also a problem in the cities because all of the land was already inhabited (Ezema et al., 2016; Nwanna, 2012; 2015). As a result, these cities had turned into concrete jungles, and the ambient temperature had risen accordingly (Ajibola et al., 2020; Fuwape & Onyekwelu, 2011; Haider, 2019). A significant difficulty for the cities was that all of the

governments' functions were concentrated in a few places. The rural residents were thus compelled to move to the capital cities to take advantage of the services that had fuelled the population expansion in these state capitals. Nothing significant was happening in the rural areas surrounding these three cities, so as a result many rural dwellers had migrated to these metropolitan areas, where they faced poverty and crime, and illegally converted forest land into built-up spaces.

The challenges of the selected cities in North-Central Nigeria could be attributed to the failure of several of the stakeholders in the cities' development; from politicians who did not have the political will to address the urban development failures, to residents who flouted proper development principles, and developers who preferred to partake in underhand dealings when undertaking development. All of these factors had rendered the cities' spaces chaotic environments that made it difficult to manage them (Gyang & Ashano, 2010; Okunola, 2019; Onazi et al., 2018; Windapo & Rotimi, 2012). Further significant challenges to the sustainable development of these cities in North-Central Nigeria were the issues of having the right kind of infrastructure in place, urban poverty, the mismanagement of resources, poor living conditions, and the rise of slums (Adama et al., 2021; Amuche & Kukwi, 2013; UNICEF, 2008).

These capital cities served as critical growth points for urban expansion, with commercial operations concentrated in the city centres and along the major transit corridors, in alignment with extant literature (Burgess, 2000; Fang & Yu, 2017; Freestone, 2009). The loss of vegetation was linked to the cities' growth, and this land use/land cover change placed pressure on the remaining agricultural land in the region (Oladipo, 1993). The neighbourhoods were transformed with the construction of the transportation networks, shopping centres, and residential areas. The increasing density of the built-up regions in the cities' cores demonstrated how new residential buildings had displaced city parks and urban gardens (Ronner et al., 2016). These Greenfields were being sacrificed in the same way as the other suburban areas (Echendu, 2020), and even though these green spaces were being used increasingly for transportation and parking networks, they could not meet the demand (Farr, 2011; Herndon, 2011; Ogwude, 2011).

6.7 Planning Implications of the Spatial Analysis Conducted

To ensure that cities continue their expansion in a sustainable manner, it is necessary to promote coordinated spatial planning. Spatial planning is a critical tool for achieving urbanisation that has little impact on the land use and land cover. Planning for land use and land cover, strategic urban infrastructure development, and improvements in local government are the fundamental functions of spatial planning, and long-term, rational use of the land and water resources is vital for achieving this.

Several challenges were observed to form the backdrop when conducting this analysis of the land use/land cover changes in the selected cities in North-Central Nigeria. Also, very important issues emanated from these research findings, namely: poor coordination of planning; poor city management; unchecked rural-to-urban migration leading to the destruction of urban spaces; and continuous sprawling of the urban space through the proliferation of slums, shanties, and other informal developments. Other findings emanating from the research included: urban heat islands, which are a result of continuous felling of trees and turning of the urban spaces into concrete jungles with poor and depleted greenery; poor government efforts to provide infrastructure and to ensure compact development and limit sprawling; urban poverty and reduced living standards for urban dwellers; and depletion of the ground water, green spaces and open spaces within the city spaces in the selected cities.

The implications of the research findings included, amongst others:

The construction of large cities represents a fundamental, inextricable change from the natural environment (Li et al., 2019; Yow, 2007). In most respects, urbanisation is beneficial as it enables increased standards of living - urban areas create more than 90 per cent of the global gross value added. Unfortunately, urbanisation also brings with it some negative environmental, social, and economic consequences. The creation of urban heat islands (UHI) is one such concern. The UHI effect is defined as the difference in temperature between the built environment and the natural (surrounding) environment.

The morphological characteristics and the thermal and radiative properties of the built-up surfaces have a direct impact on the surface energy exchanges, which are quite different compared to those observed above natural soils and vegetation (Oke et al., 1987). During the day, UHIs persist over tremendously densely populated urban spaces/areas with poor greening

and significant concrete spaces. The strong interactions between chemical and dynamic processes have a very significant impact on the representation of pollutants on a regional scale, increasing the risk of health challenges for residents (Phelan et al., 2015).

Poor functionality of the urban space was another challenge of the urban space in the selected cities. Manna (2018) noted that urban governance has to provide shelter to its citizens, and when the poor occupy a sizable portion of this population, the roles of urban governance become more crucial. A significant portion of the city dwellers had in-migrated into the cities from the surrounding areas. They were mainly unskilled or semi-skilled people, who had migrated into the cities in search of livelihoods, and they had settled down in places which had gradually transformed into slums. This had exacerbated the urban challenges in the selected cities and made the city spaces less functional and competitive.

One of the consequences of sprawl is the lack of planned public spaces (Kępkowicz & Mantey, 2016). Public space refers to sites of sociability and face-to-face interaction. Truly public spaces encourage social interaction among individuals with diverse interests, opinions, and perspectives (Alexander, 1977; Gehl, 1987; Németh, 2006; Whyte, 1980; Young, 1990). These interactions lead to particular acquaintances, known as “weak ties”, in the literature (Granovetter, 1973), and weak ties are possible beginnings of deeper, more enduring social interactions, which might contribute to a sense of community and build social capital (Mehta, 2013; Talen, 1999; 2000).

Finally, people should be aware that rapid, unplanned, and unsystematic urbanisation has led to inefficient use of the essential natural resources like land and water in the areas over the past several decades, resulting in social, economic, and environmental problems. In order to combat the negative consequences of the fast urbanisation on the many socio-economic and ecological aspects, the local governments and NGOs should implement effective capacity building and awareness programmes.

CHAPTER SEVEN

INFRASTRUCTURE PROVISION AND CHARACTERISTICS IN NORTH-CENTRAL NIGERIA

7.1 Introduction

This chapter considers the concerted efforts of the successive governments in the selected cities of North-Central Nigeria to understand the infrastructure's characteristics, locations, types, and functionalities. It also seeks to establish the motivations for and level of involvement of the residents of the cities in sustainability and inclusion. The infrastructure provision and the issues surrounding them are presented at the city level to provide the necessary avenues for comparative analysis of the trends in the infrastructure provision in the region and to create a holistic analysis of the infrastructure and services in North-Central Nigeria. The chapter is subdivided into sub-sections regarding the varieties of infrastructure in the cities and the locational attributes of the infrastructure.

7.2 Infrastructure Provision and Characteristics in Lokoja

When evaluated, infrastructure is the driving force for physical development and the city's spatial scenery. This infrastructure ranges from educational, economic, commercial, and health care, to transportation facilities. Others are water supply and power utilities, all of which help to give shape and form to the city and ensure comfort for the various resident of the city (Abulibdeh et al., 2019; Amri & Giyarsih, 2021; Medayese et al., 2016; 2020; 2021). This infrastructure determines, to a large extent, the city's liveability, as infrastructure is essential in measuring urban liveability through the place making indicator of urban liveability. The infrastructure also determines, to a large extent, the threshold of the sustainable urban development through the consumption pattern of physical space and vegetal cover for the provision of the infrastructure (Abd' Razack et al., 2013; 2016). The level of inclusivity achieved in the city is also tied to the style or measures taken by the policymakers in providing the infrastructure. Measures that seek to provide the infrastructure through comprehensive community consultation and participatory planning ensure better inclusivity (Medayese et al., 2016; Wahab et al., 2021). A predominant feature of urban infrastructure is that it is a considerable driver for populations. The economic growth of cities around the world is tied to the populations of the cities, as the greater the population in the cities, the higher their GDP

ratios. The cities' populations are influenced to a large extent by the provision of infrastructure as the populations often gravitate from areas of inadequate infrastructure to areas of higher infrastructure provision. The level of rural-urban migration in most African cities is linked mainly to the level of infrastructure provision in the towns and cities (Cattaneo, et al., 2021; Henderson, 2010).

7.3 Typology of the Infrastructure Provision in Lokoja City

The infrastructure provision in the city of Lokoja is assessed in this section of the research. The infrastructure assessed includes educational, recreational, health care, commercial and public infrastructure. The assessment was based on the characteristics and locational efficiency of the infrastructure.

7.3.1 Educational infrastructure in Lokoja

The importance of educational infrastructure has been underscored in several pieces of literature (Stevens, 2013). Garau and Pavan (2018) noted that in order to measure sustainable development, urban liveability, and inclusivity in cities effectively, the educational infrastructure must be evaluated. This includes the formal educational attainment, access to qualitative educational infrastructure, including in terms of distance to be travelled to attend the schools, and the availability of schooling at different levels. The appraisal of the educational infrastructure to enhance quality education attainment is a component of a liveable city.

Accurate information on the educational infrastructure in the city of Lokoja was identified. Different educational facilities included public and private primary schools, secondary schools, and tertiary institutions. The analysis proved that all of the stakeholders played a significant role in providing such facilities at all levels of education in the city. Figure 7.1 shows the spatial distribution of the educational infrastructure in Lokoja. The tertiary institutions in the city cater for all of the youth of the state and beyond. They are the Kogi State Polytechnic in Felele, the Federal University of Lokoja in Adankolo New Layout, and the Salem University, a privately-owned university.

7.3.1.1 Number of educational infrastructures available in Lokoja

Table 7.1 shows the number of private and public educational institutions in the city to cater for the educational requirements of the city's residents. As observed in Figure 7.2, there were

12 private institutions in the city and 6 public educational institutions. The institutions catered to the city's needs, however, planning standards implied that the number of primary schools available were inadequate, hence there were many out-of-school pupils and overcrowded classrooms. The case was the same for the numbers of secondary schools and tertiary schools.

Table 7.1: Number of Schools in Lokoja

Population	Type of School	Number Available	Required	Output	Remarks
193,080	Primary	11	38	-28	Inadequate
	Secondary	6	19	-13	Inadequate
	Tertiary	4	2	+2	Adequate

Source: Author's Analysis (2021)

The condition of the educational infrastructure in the city of Lokoja was also considered to ascertain its suitability to provide the function it was meant to. Factors considered for the classification of the educational facilities included the general appearance of the buildings - whether or not the foundations were exposed, the condition of the fascia boards, toilet facilities, and the walls, and whether or not windows, and doors were in the correct position. The classification was based on the 5-point Likert scale ranking, as shown below

Figure 7.1 shows the condition of one of the educational infrastructures in the city of Lokoja. The buildings were new and painted, and the variables (doors, windows, roofs, foundations, walls, and the toilet facilities) were in good condition. It could be concluded that some facilities were in excellent condition while some were in poor condition, thus overall, the educational infrastructure in Lokoja was found to be in fair condition. Figure 7.1 is a government secondary school in Lokoja (a day school). It can be observed from the picture that the buildings were in good condition, though the school's perimeter fencing was dilapidated. This did not affect the teaching and learning, however the effect that this had on the school was the exposure of the staff and students to continuous external distractions.



Figure 7.1: Government Secondary School in Lokoja, North-Central Nigeria

Source: Author's Field Survey (2021)

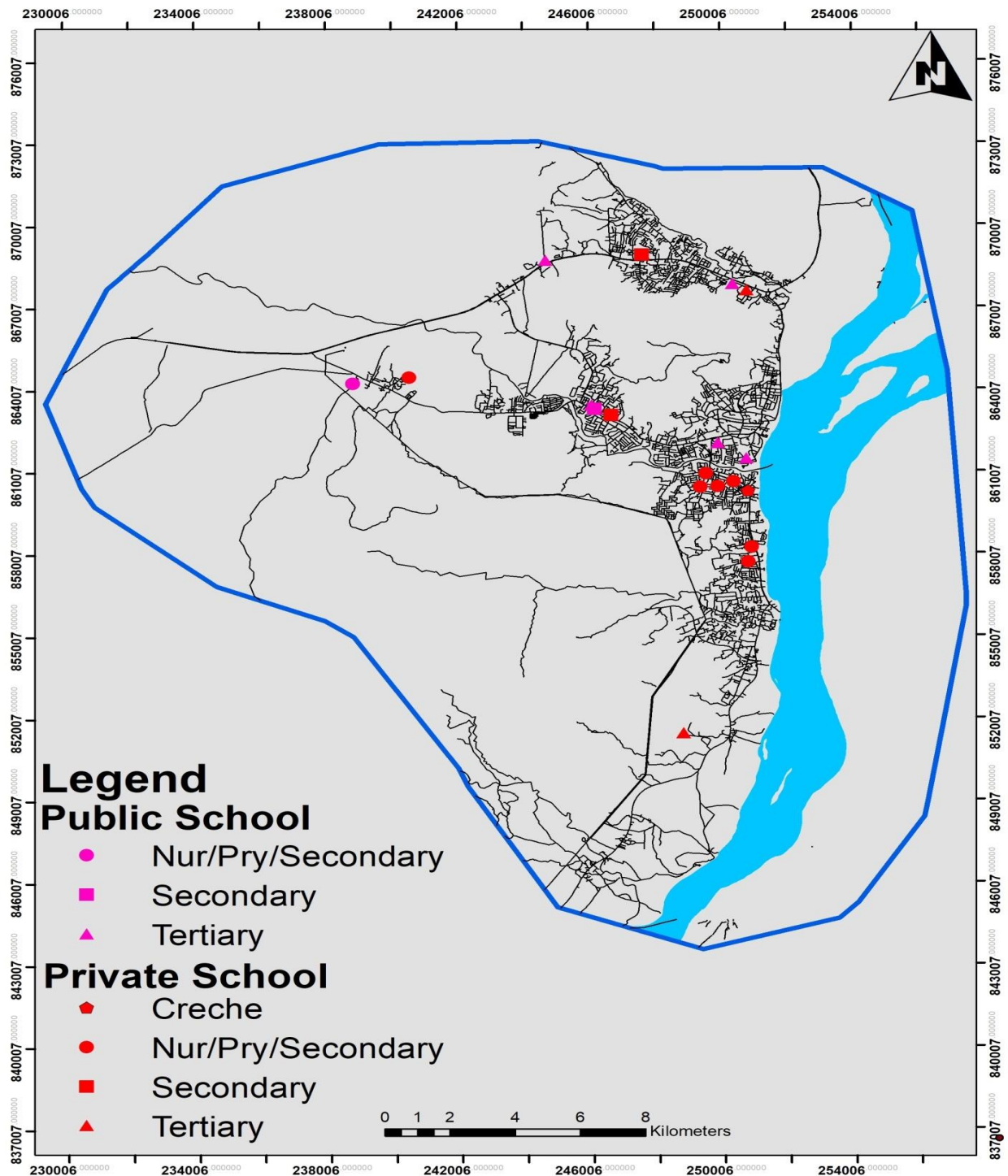


Figure 7.2: Schools in Lokoja, North-Central Nigeria

Source: Author's Field Survey (2021)

7.3.1.2 Locational attributes of the educational infrastructure

This research also evaluated the locational attributes of the identified educational infrastructure in Lokoja. This was assessed by computing the distance that the users had to travel to reach the

infrastructure and the adequacy of the infrastructure to cater for the educational needs of the populace. A nearest neighbour analysis (NNA) was carried out on the educational infrastructure. The analysis was made on the observed mean, the expected mean, the nearest neighbour ratio, the z-score, and the p-value. The result of the assessment of the locational attributes of the educational infrastructure in the city of Lokoja showed that the expected mean for the NNA of the educational infrastructure was approximately 2,257.97m; the observed mean was 2,097.37m; the nearest neighbour ratio was 1.076572; the z-score was 0.463233, and the p-value was 0.643197. This implied that the z-score of 0.46 indicated a pattern of educational infrastructure that was significantly random. The analysis also proved that the p-value was significant at 0.00, and the z-score ranged between -1.65 to 1.65. Figure 7.2 shows the NNA output generated from the study.

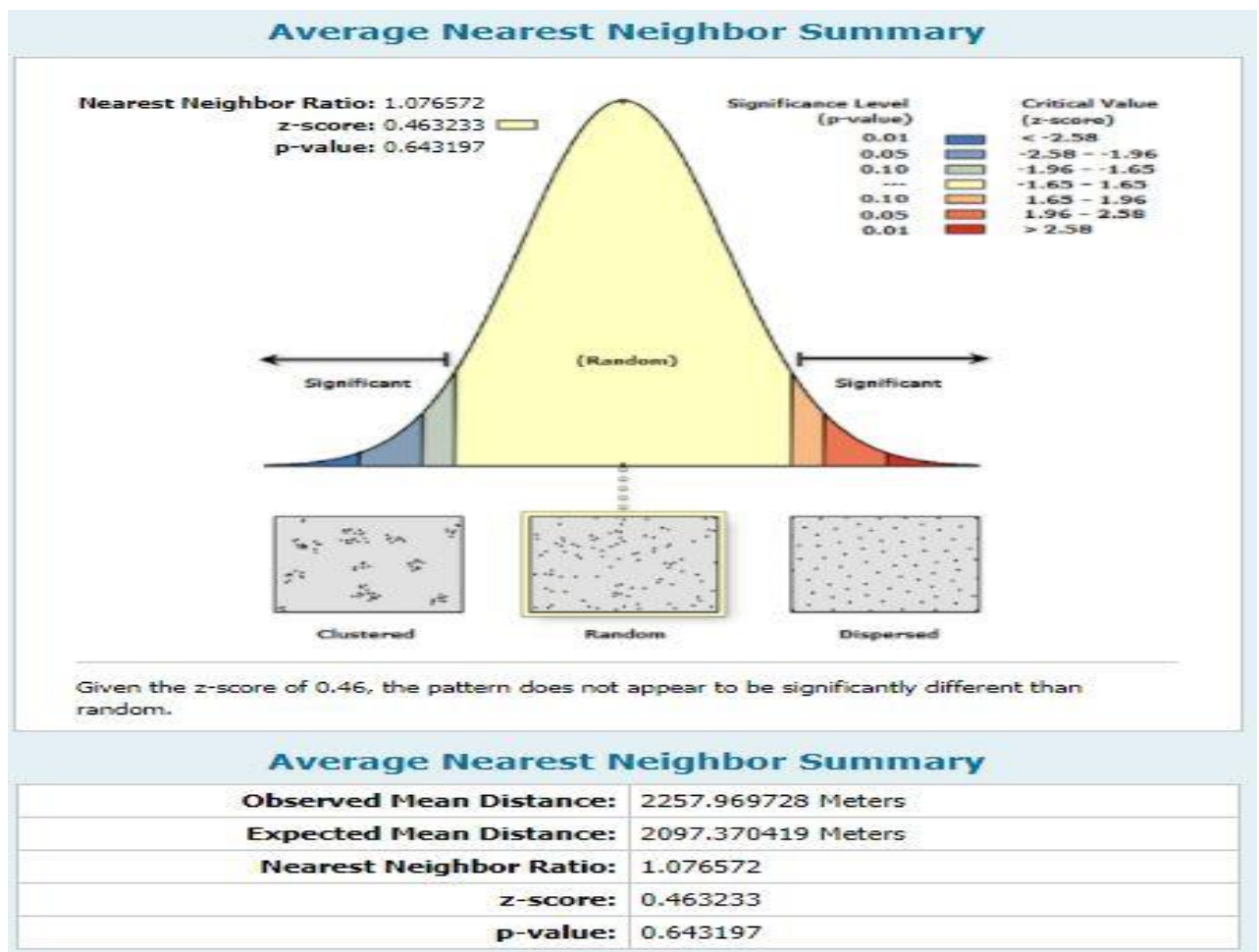


Figure 7.3: Spatial Analysis of the Schools in Lokoja, North-Central Nigeria

Source: Author's Analysis (2021)

7.3.2 Health care infrastructure in Lokoja

This section deals with the health care infrastructure in Lokoja. The necessary evaluation was conducted to determine its contribution to the urban livelihoods of the residents of the city. The health facilities considered for this research included primary, secondary, and tertiary health care centres. The primary health centres (PHCs) were numerous in the different wards in the city. The secondary health centres included the general hospital and private clinics, and the tertiary facility available was the specialist hospital. Figure 7.4 shows some of the identified health care infrastructure locations, mainly the public secondary health care facilities and the tertiary health care facility in Lokoja. The field survey and findings showed that Lokoja had a specialist hospital located in the Adankolo New Layout area, a federal medical centre in the GRA, and a general hospital. These infrastructures were constantly being supplemented by the services of the PHCs located in the various wards and neighbourhoods in the city.

7.3.2.1 Number of health facilities available in Lokoja

Figure 7.4 shows the spatial location of the health facilities in the city of Lokoja. The analysis indicated that the infrastructure was not evenly distributed as it was concentrated in the city centre. This infrastructure was available at different hierarchies or levels of care. Table 7.2 shows the adequacy or otherwise of the different levels of health infrastructure in the city of Lokoja.

Table 7.2: Number of Health Infrastructure Facilities in Lokoja

Population	Health Care Level	Number Available	Required	Output	Remarks
193,080	Primary	8	40	-32	Inadequate
	Secondary	4	20	-16	Inadequate
	Tertiary	2	2	-	Adequate
	Animal Care	2	=		Adequate

Source: Author's Analysis (2021)

The analysis showed that there was grossly inadequate provision of health infrastructure in the city, thus the city dwellers resorted to local and traditional means of curing their ailments. However, such action could lead to other health challenges. The inadequacy of the health facilities had led to the deaths of people with curable ailments (Bauer et al, 2014; Ferkol &

Schraufnagel, 2014). Malaria was a significant challenge in the city because of its proximity to the River Niger and its confluence point, which created pockets of stagnant water that promoted the breeding of mosquitoes.

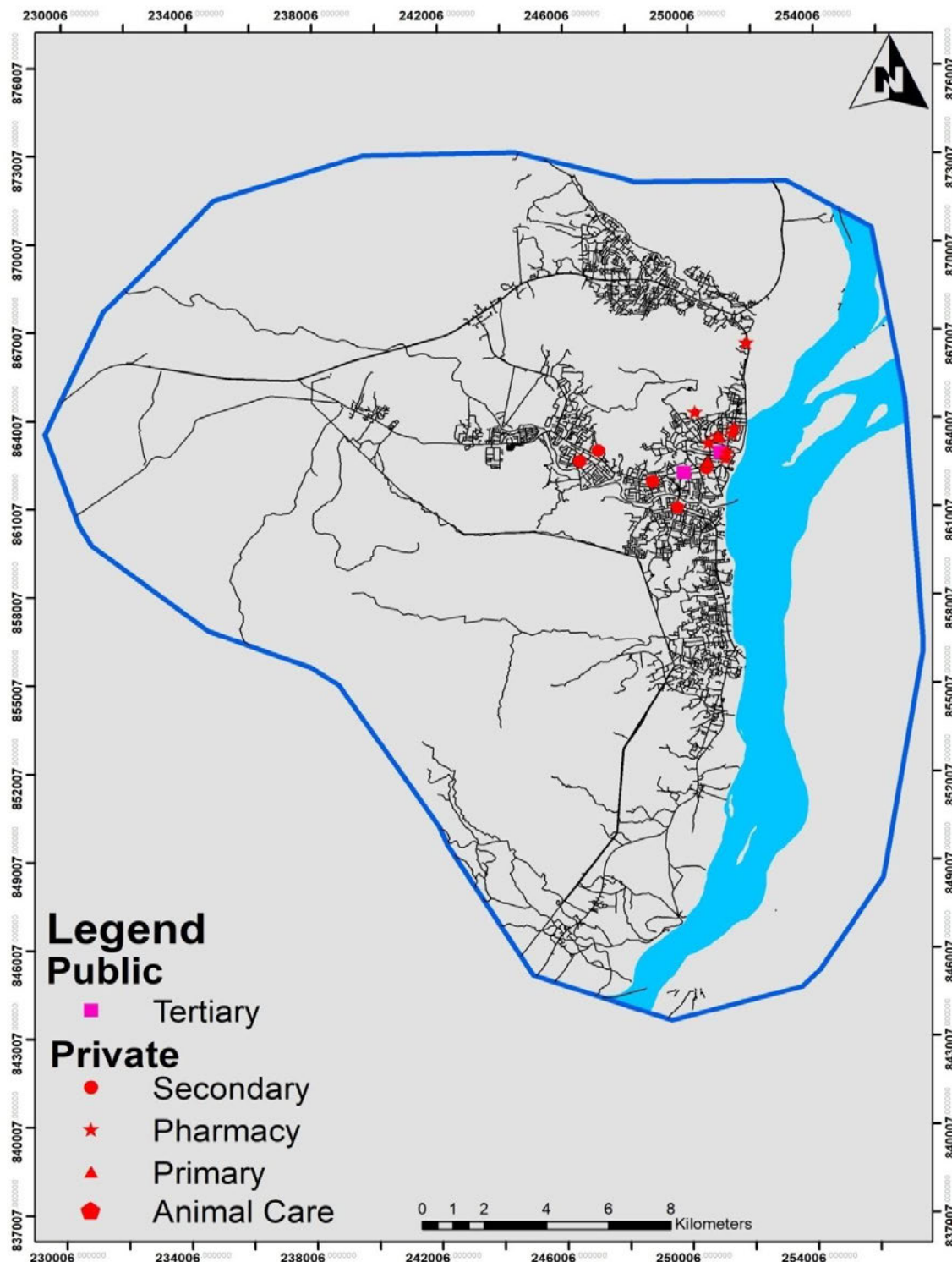


Figure 7.4: Hospital/Health Care Facilities in Lokoja, North-Central Nigeria

Source: Author's Field Survey (2021)

7.3.2.2 Locational attributes of the health care infrastructure in Lokoja

The distribution pattern of the health care infrastructure in Lokoja was determined using the NNA. The results indicated that the observed mean distance between the health care infrastructure in Lokoja was 1,301.52m; the expected mean distance was 708.34m; the nearest neighbour ratio was 1.837; the z-score value was 3.58; and the p-value was 0.000341. The z-score value of 3.58 implied a smaller than 1 per cent likelihood over dispersal pattern resulting from random chance. Figure 7.5 shows the results of the NNA carried out on the health care infrastructure in Lokoja. The p-value and z-score were 0.01 and 2.58, respectively. This was interpreted to mean that there was a significant relationship between the distribution of this infrastructure and its locations.

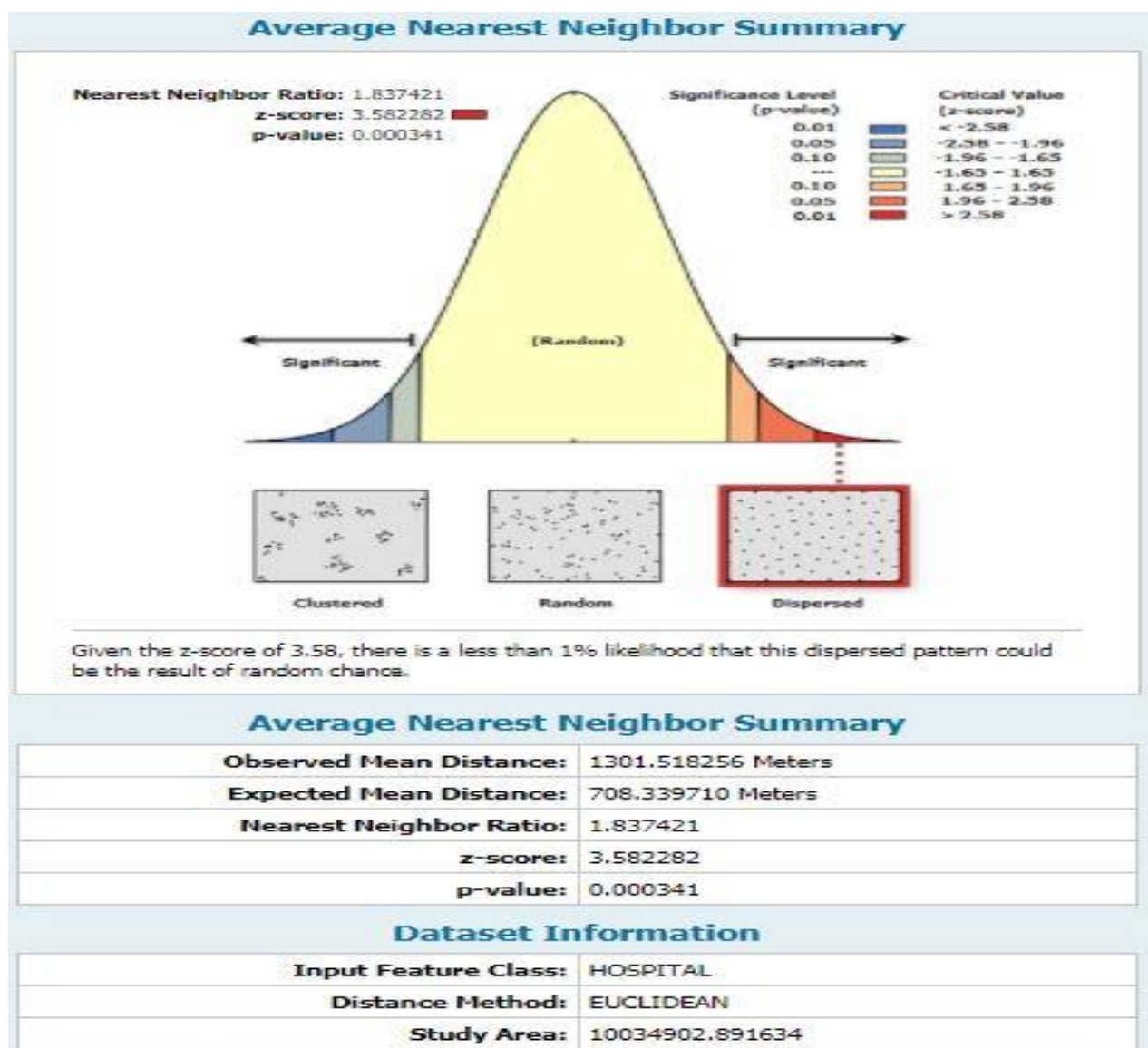


Figure 7.5: Spatial Analysis of the Health Care Infrastructure in Lokoja, North-Central Nigeria

Source: Author's Analysis (2021)

As mentioned earlier, there were three classes of health care facilities identifiable in Lokoja. The PHCs were numerous and dealt with the immediate and minor ailments of the citizens and provided maternity health care. There was only one secondary health care facility in the city (Lokoja General Hospital) that provided health care at a higher level than the PHCs and served a wider community than just the city dwellers alone. The third category was the tertiary health care facility, and the study observed that there were two such facilities, namely the Federal Medical Centre and the Kogi State Specialist Hospital. Figure 7.6 shows the Kogi State Specialist Hospital.

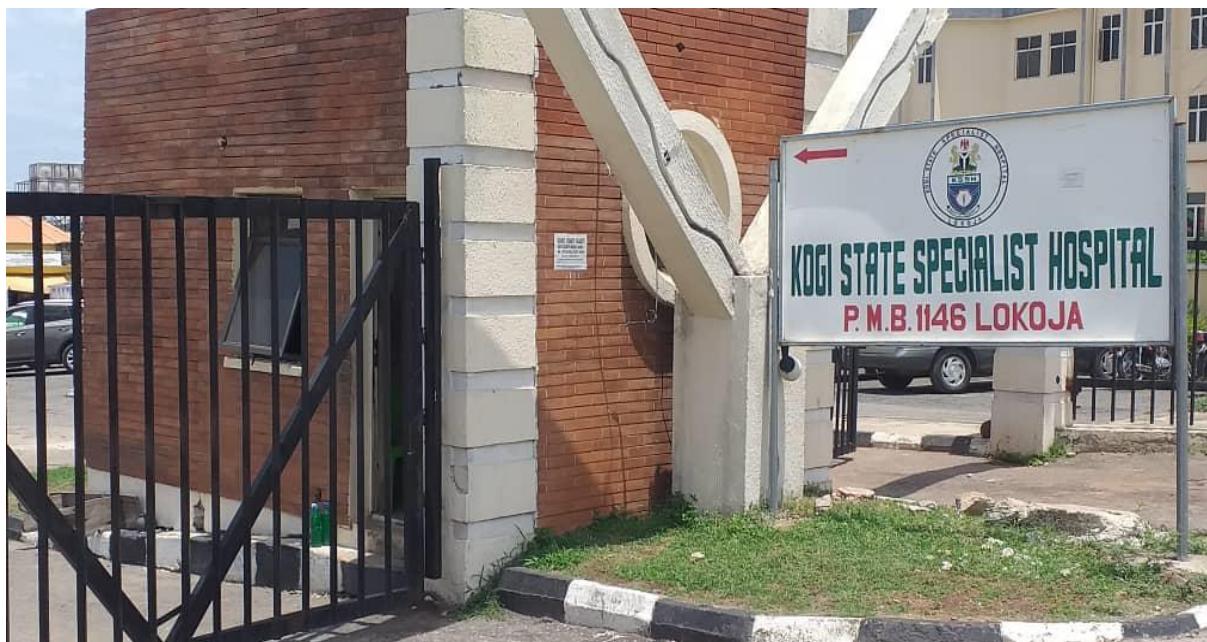


Figure 7.6: Kogi State Specialist Hospital in Lokoja, North-Central Nigeria

Source: Author's Analysis (2021)

When analysing the functionality of the health facilities, the results were different to those for the condition of the health facilities in the city. The mean condition of the health care facilities, based on the structure of the facilities, is presented in Table 7.3. It was concluded from the results that the PHCs were not adequately maintained (fair), whereas the secondary and tertiary health care facilities were well maintained. This was because of the number of facilities and the resources available to the local tiers of the government responsible for maintaining these facilities. The PHCs were numerous and maintained by the local government administration, with fewer resources. This lack of resources had a negative impact on the functionality of these health care infrastructures as it increased the burden on the administration. It is therefore desirable that responsibility for primary health care be completely removed from the local

government sphere and transferred to the state and federal governments for adequate financing and management. The secondary and tertiary health care facilities were in better condition (good) because they were well maintained by the state and federal governments. These facilities had adequate resources as they had been budgeted for by the Ministries of Health in both the state and federal governments.

Table 7.3: Mean Structural Conditions of the Health Care Facilities in Lokoja

Facility	Mean Structural Condition	Remarks
Primary Health Care Facilities	2.98	Fair
Secondary Health Care Facilities	3.15	Good
Tertiary Health Care Facilities	3.37	Good

Source: Author's Analysis (2021)

7.3.3 Recreational infrastructure in Lokoja

The recreational infrastructure considered in this study was mainly open spaces and places of leisure. This was infrastructure critical to urban liveability and a healthy city. One of the ideals of a healthy city is ensuring healthy lifestyles and the well-being of residents within the city (Barton, 2016; Vlahov et al., 2007; WHO, 2017). This study, therefore, examined the spatial characteristics of the recreational facilities in the city of Lokoja. The open spaces identified included the Mount Pate recreation centre, the open fields around the city, and the parks available. The study identified three organised open areas and twenty-one un-organised open spaces. The organised open spaces included the Mount Pate recreation centre, the recreational park, and a sports stadium. The unorganised parks included open spaces within the communities, the schools' fields, and other relaxation points in the city. The organised leisure areas included hotels and bars around the city. There were numerous hotels in the city, ranging from 5-star hotels (Confluence Hotel) to 3-star hotels and bars. Figure 7.7 shows the locations of the various hotels and leisure spots in Lokoja. The analysis showed that several of the recreational infrastructures were spread across the cityscape and they were patronised by various city residents who sought to unwind away from their homes to ease the stress of their busy city lives. These hotels also provided short-stay homes for visitors to the city who had a limited amount of time to spend there.

Sporting infrastructure in the city was categorised into two types - active and passive. The active infrastructure included the Kogi State stadium complex and the Mount Pate recreational

park. The city boasted of this open-roof stadium and indoor sporting activities. The Mount Pate recreation park provided fun seekers with the opportunity to observe the confluence point of the rivers from a distance, even though not close to the waterfront. Figure 7.7 shows the spatial locations of the active and passive recreational infrastructure in Lokoja. Figure 7.8 shows the various recreational sites in the city. Figure 7.9 shows the view of the rivers' confluence point from Mount Pate.

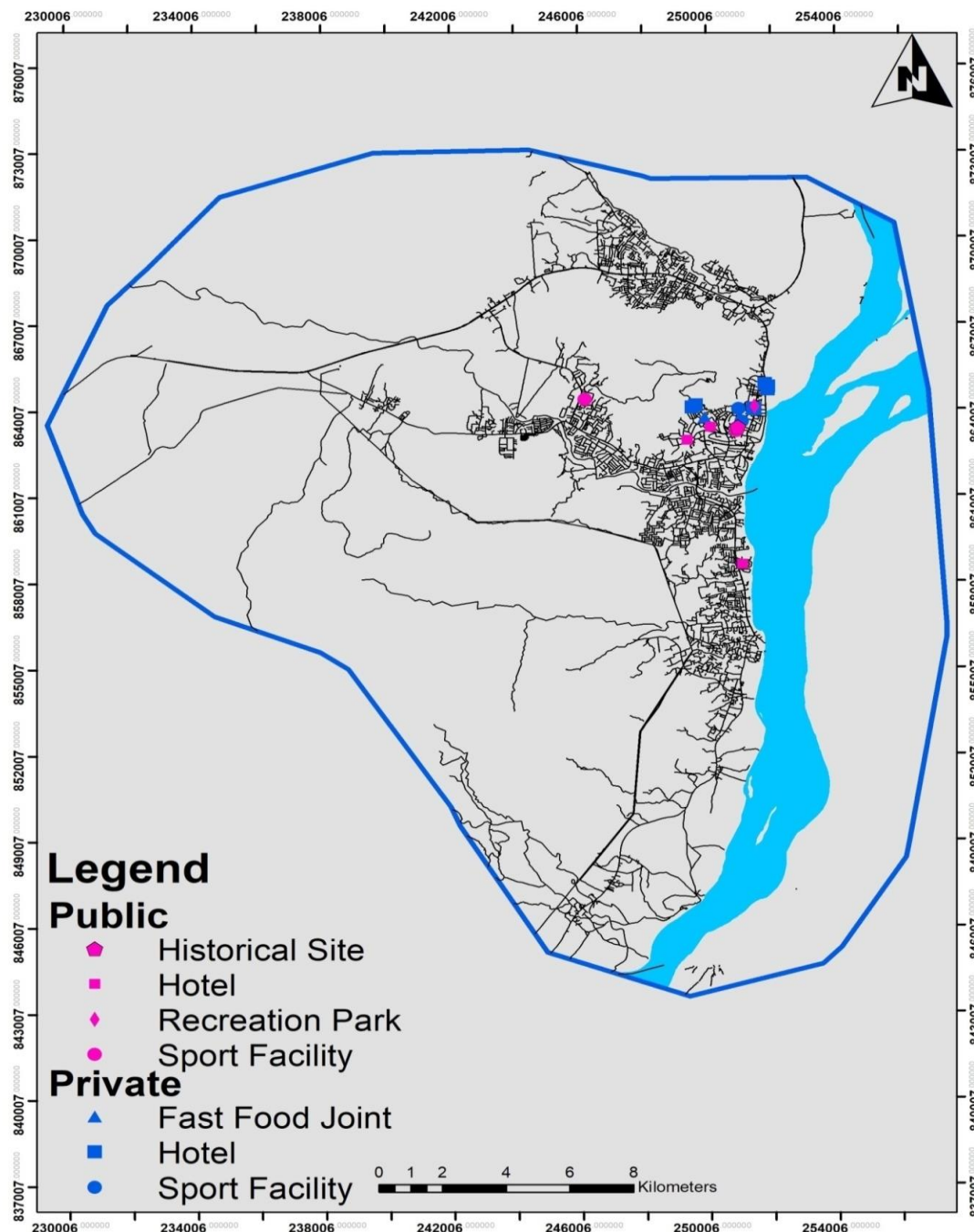


Figure 7.7: Recreational and Leisure Infrastructure in Lokoja, North-Central Nigeria

Source: Author's Field Survey (2021)



Figure 7.8: Some of the Recreational Facilities in Lokoja

Source: Author's Field Survey (2021)

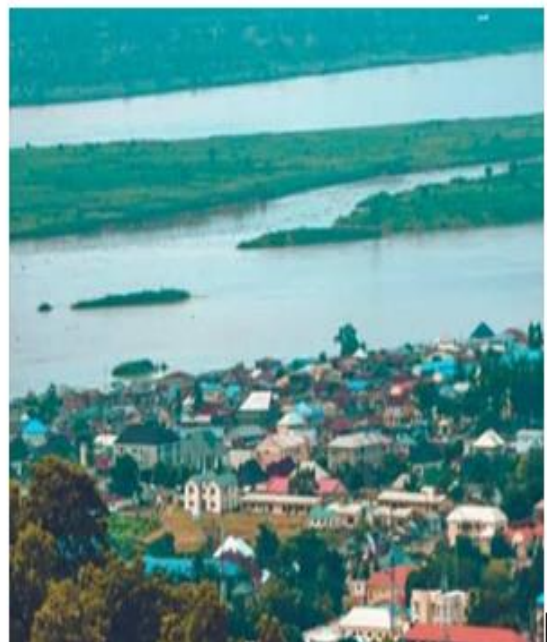
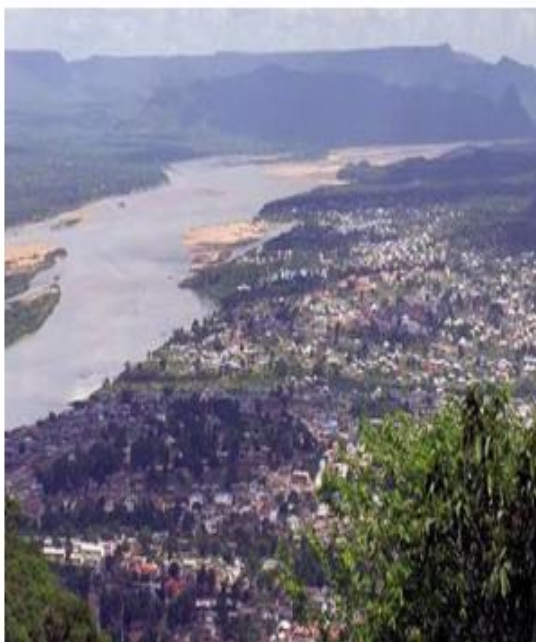


Figure 7.9: View of the Confluence Point from Mount Pate

Source: Author's Field Survey (2021)

7.3.3.1 Locational attributes of the recreational infrastructure in Lokoja

The locational availability (efficiency) of the recreational infrastructure was analysed using the NNA. This assessed the well-being and healthy living state of the residents of Lokoja city. The analysis results indicated that the mean distance observed between infrastructures was 1,205.62m; the expected mean distance was 1,325.05m; the z-score was -0.73, and the p-value was 0.46. The nearest neighbour ratio was 0.9098. Given the z-score (-0.7'), the infrastructure's distribution pattern did not appear significantly different from random distribution, as shown in Figure 7.10.

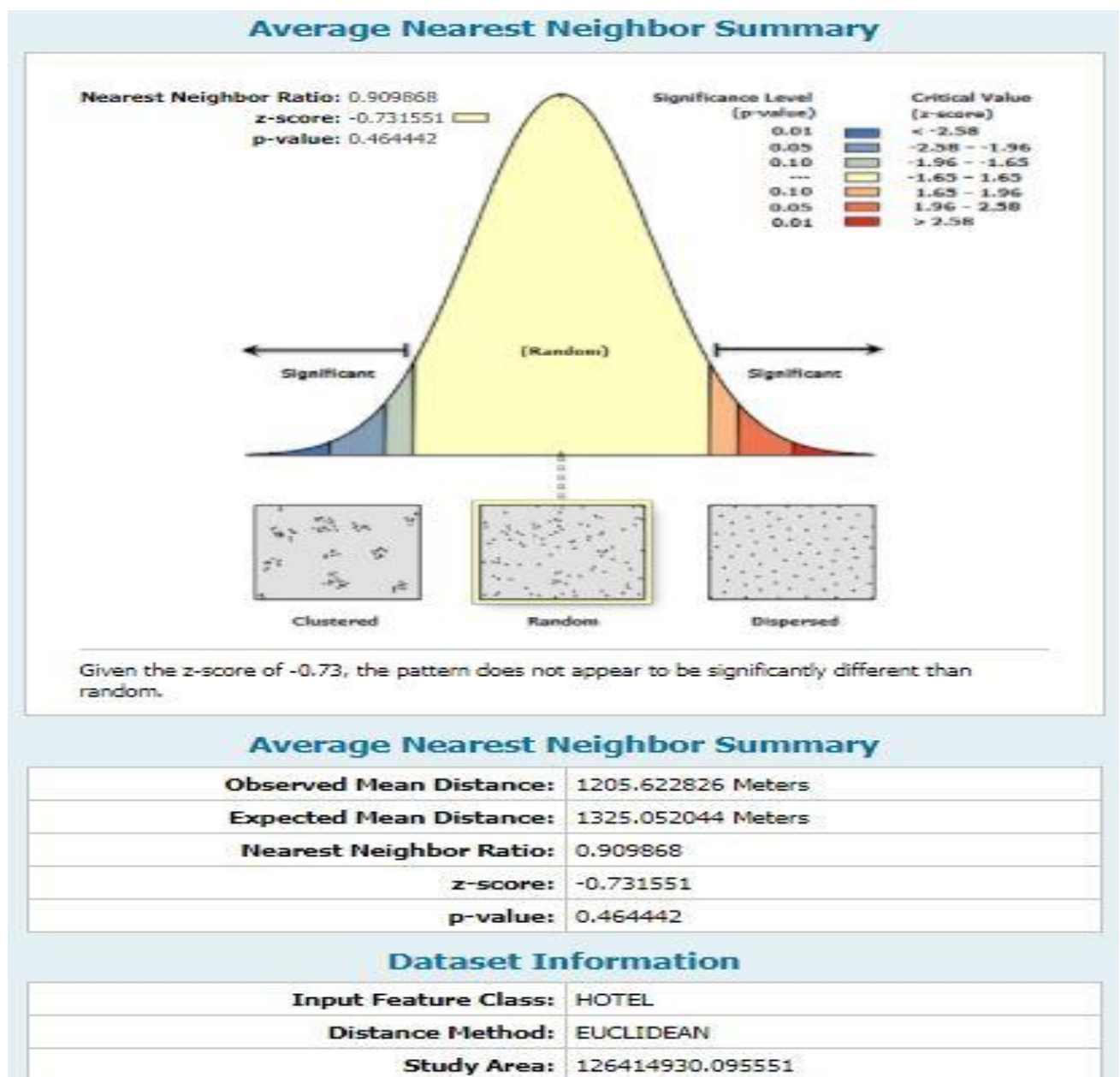


Figure 7.10: Spatial Analysis of the Leisure and Recreation Infrastructure in Lokoja

Source: Author's Analysis (2021)

7.3.4 Commercial infrastructure in Lokoja, North-Central Nigeria

The analysis of the commercial infrastructure in the study area identified markets (both organised and un-organised), commercial banks, and other ancillary facilities that were sited to improve the liveability in Lokoja. There were two organised markets in the city (the Kogi International Market and the Adankolo Market). Others were not organised and were numerous, depending on the neighbourhoods. Also, several transportation nodes had been turned into commercial centres. Many shopping complexes were emerging to cater for the commercial needs of the people in the city. The study also identified seven different banks in the city, each with branches around the city. Figure 7.11 shows the spatial distribution of the banks in Lokoja City. Figure 7.12 shows the entrance to one of the popular banks in the busy city-centre of Lokoja.

These commercial banks provided different financial services to residents within the city and were critical infrastructure, generating both vehicular and human traffic. These banks were observed to be situated along the central road in the city. The banks enjoyed a fairly equal distribution of customers because they were located about 30m – 50m apart on the main street.

The marketing activities in the city of Lokoja followed those of traditional open markets and a more organised market. The system was such that it met the demands of both the low-income earners and the high-income earners. The markets were organised so that both the municipal and state governments charged tax on the revenue, as well as other sundry charges. The markets were maintained by women's associations and market executives. Figure 7.13 shows the spatial distribution of the modern and traditional markets in Lokoja. It also depicts the shopping malls available in the city, and their spatial locations. Table 7.4 shows the availability of markets, shopping malls, and other commercial activities in the city.

Table 7.4: Mean Structural Conditions of the Commercial Facilities in Lokoja

Facility	Number Available	Mean Structural Condition	Remark
Open Market	4	2.98	Fair
Shopping Malls	10	3.15	Good
Private Businesses	2	3.37	ood

Source: Author's Analysis (2021)

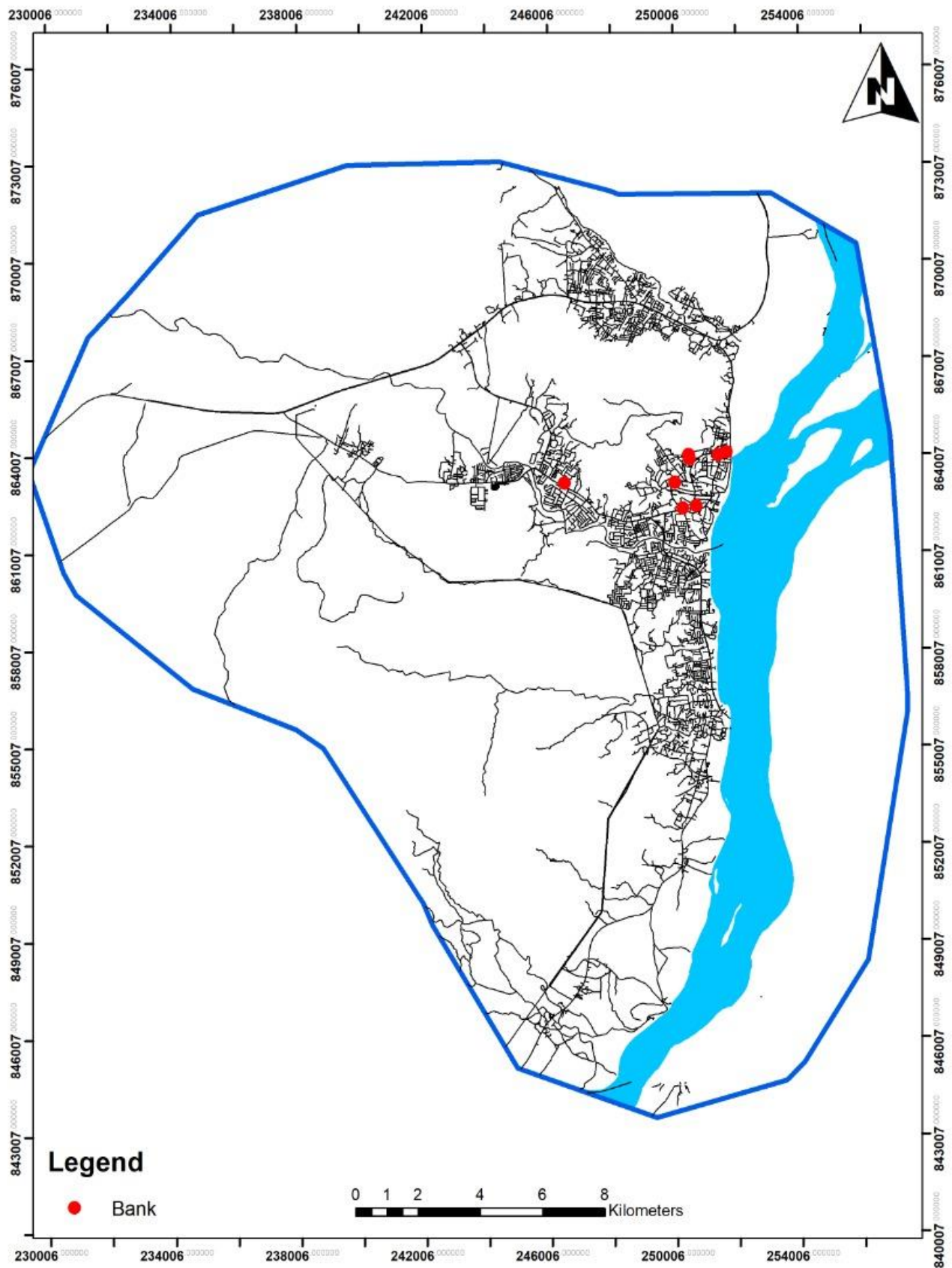


Figure 7.11: Commercial, Public, and Service Infrastructure in Lokoja

Source: Author's Field Survey (2021)



Figure 7.12: Commercial Bank in Lokoja, North-Central Nigeria

Source: Author's Analysis (2021)



Figure 7.13: Example of Shopping Complexes and an Open Market in Lokoja

Source: Author's Field Survey (2021)

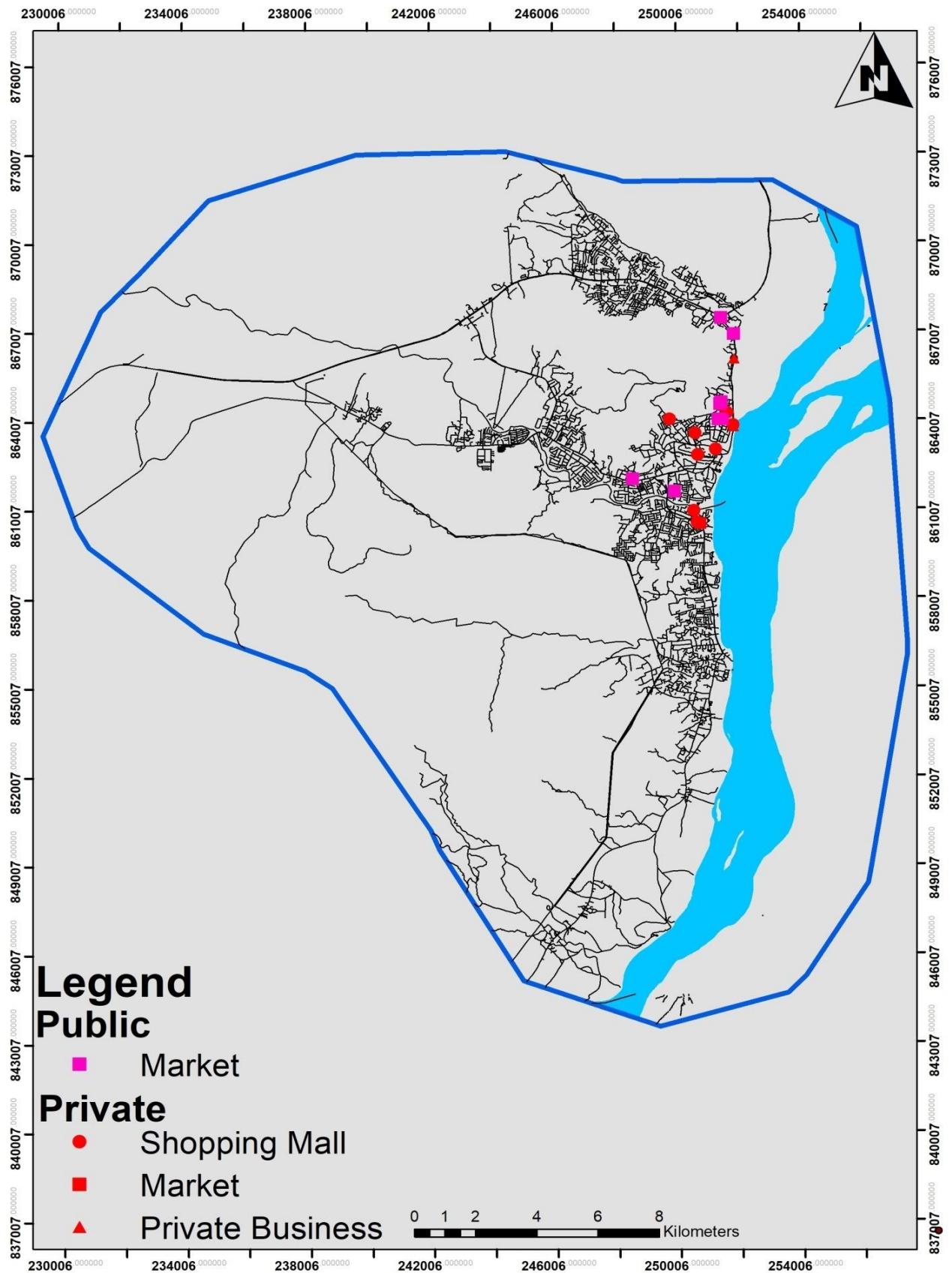


Figure 7.14: Spatial Locations of the Shopping Malls and Open Markets in Lokoja

Source: Author's Field Survey (2021)

7.3.4.1 Locational attributes of the commercial infrastructure in Lokoja

The NNA analysis of the commercial infrastructure in Lokoja (commercial banks and markets) is shown in Figure 7.15. The analysis of the results showed that the observed mean distance between them was 663.73m; the expected mean distance was 481.68m; the z-score was estimated at 2.169; and the p-value was 0.030. The nearest neighbour ratio was 1.377957. This implied that the z-score of 2.169 and the p-value of 0.030 had a value of less than 5 per cent likelihood of the dispersal pattern being the result of random chance.

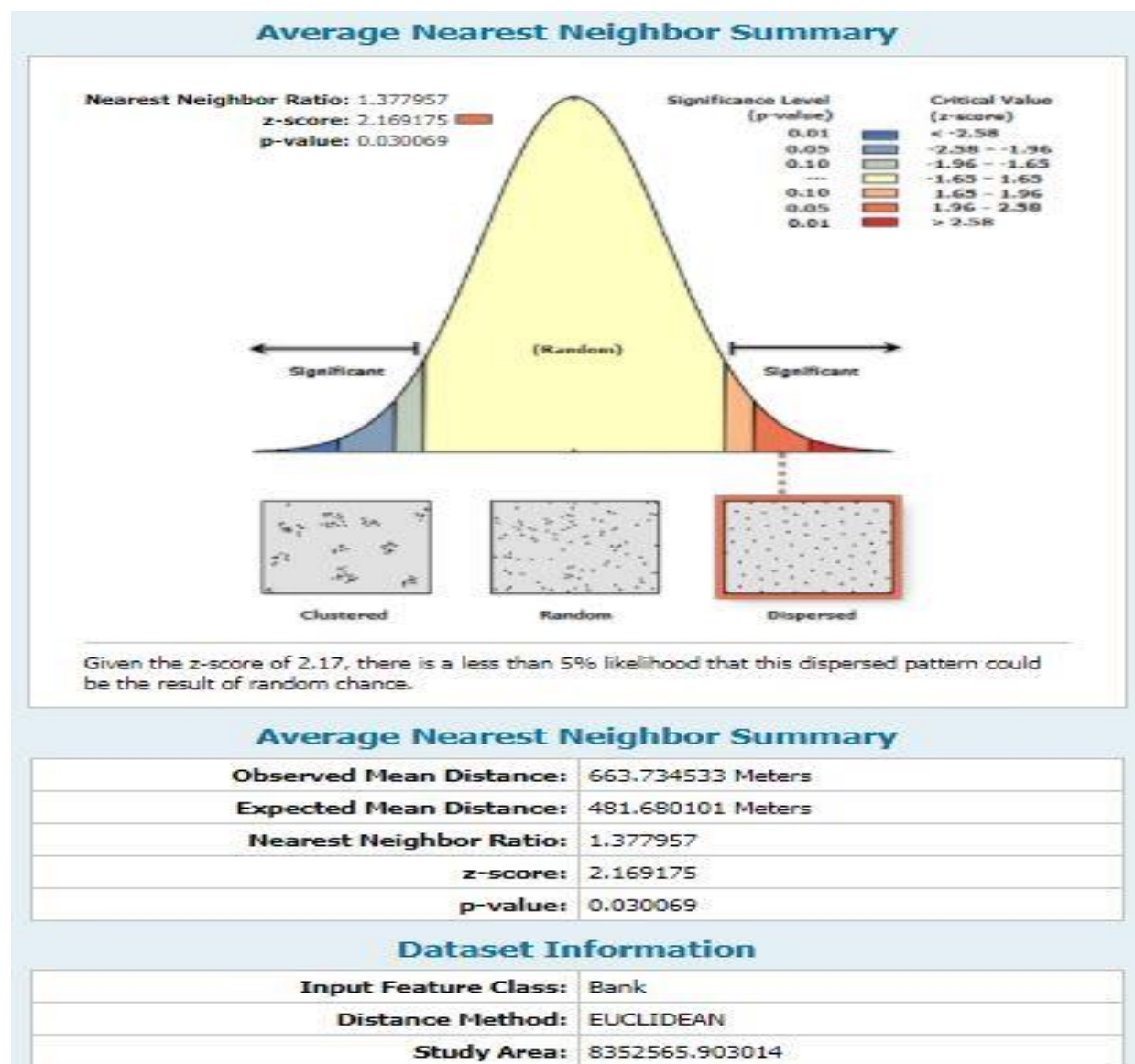


Figure 7.15: Locational Attributes of the Commercial Banks in Lokoja

Source: Author's Analysis (2021)

Another type of commercial infrastructure identified was petrol filling stations which dispensed petroleum products to the Lokoja City dwellers. The study identified two petrol filling station

categories: the significant and independent marketers. There were five different influential marketers in the city and seven independent marketers identified by the study. Figure 7.16 shows the spatial distribution of the petrol filling stations in Lokoja. The figure shows that these infrastructures were distributed across various spaces within the city for easy access. Some of these filling stations were situated along the significant carriageway in the town (the Abuja-Lokoja highway), and a few were also located along the city's corridors.

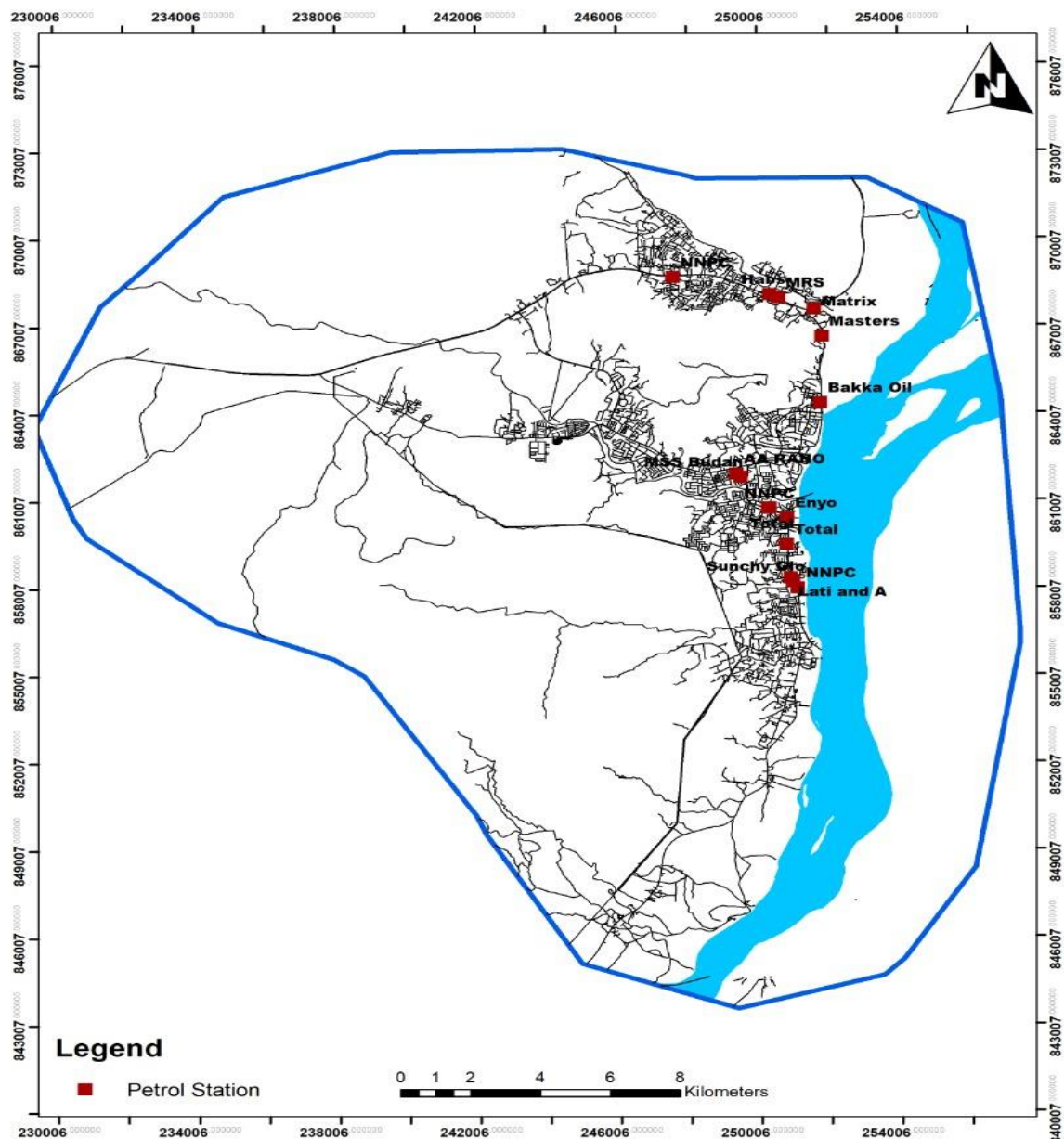


Figure 7.16: Commercial Infrastructure in Lokoja

Source: Author's Field Survey (2021)

The analysis of the NNA for the petrol stations in Lokoja is shown in Figure 7.17. The study of the distribution of petrol stations in Lokoja showed that the observed mean distance between them was 668.635m; the expected mean distance was 819.791m; the z-score for the analysis was -1.366; and the p-value was 0.171. The nearest neighbour ratio was 0.816. This implied that the z-score and p-value showed that the pattern did not appear to be significantly different from random positioning. Therefore, the analysis indicated that the locations of the petrol stations in Lokoja had a random pattern to their distribution.

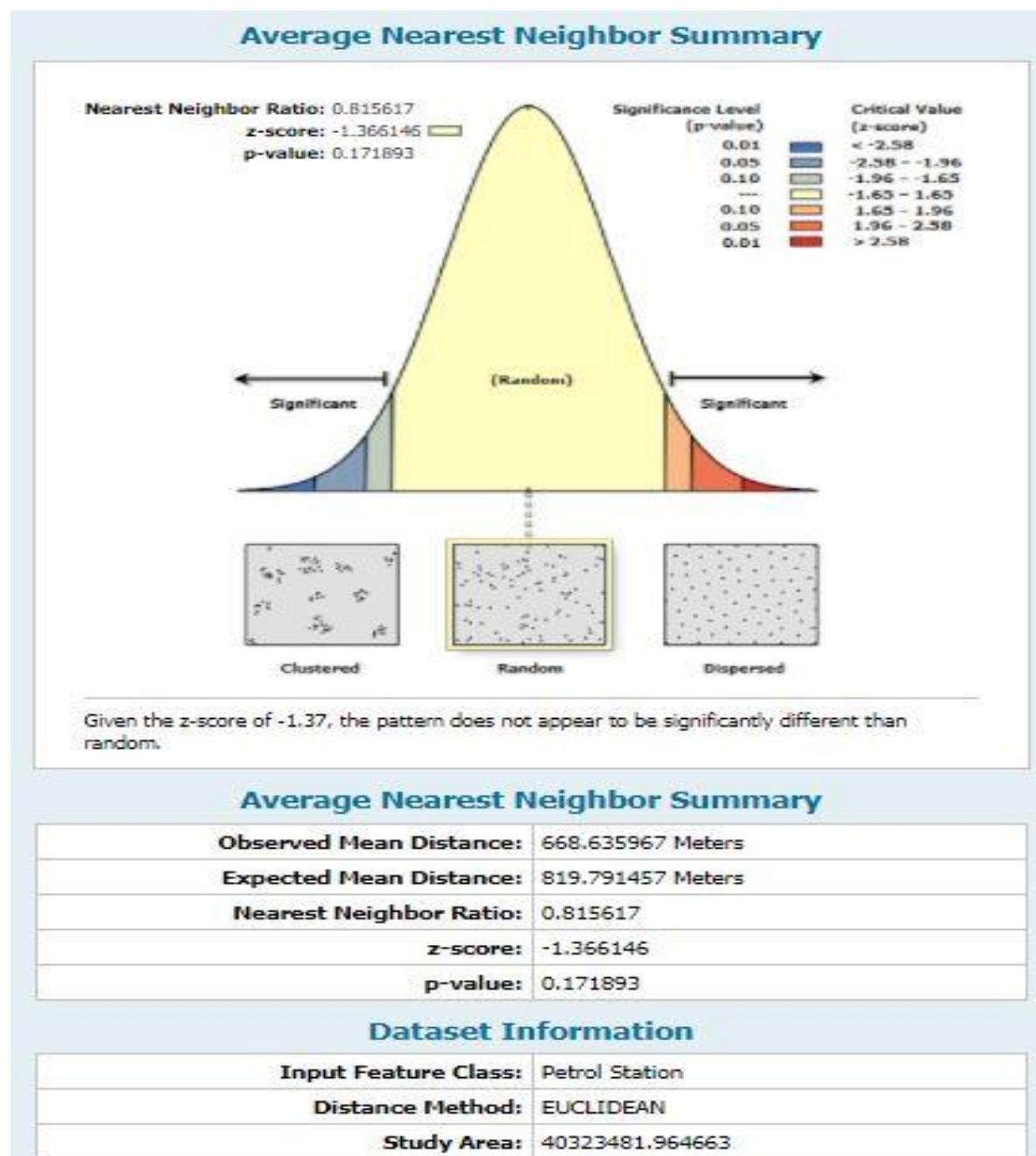


Figure 7.17: Locational Attributes of the Petrol Stations in Lokoja

Source: Author's Analysis (2021)

7.3.5 Places of worship infrastructure in Lokoja

The public places of worship infrastructure considered in this study included churches and mosques as Christianity and Islam were the two main religions in the state. Others were negligible and were thus not considered in this study. These buildings were too numerous and only a selected few are shown in Figure 7.18. These worship centres occupied a very strategic' component of the city's architecture in Lokoja. Most churches were attractive and that enhanced' the urban scenery in the city.

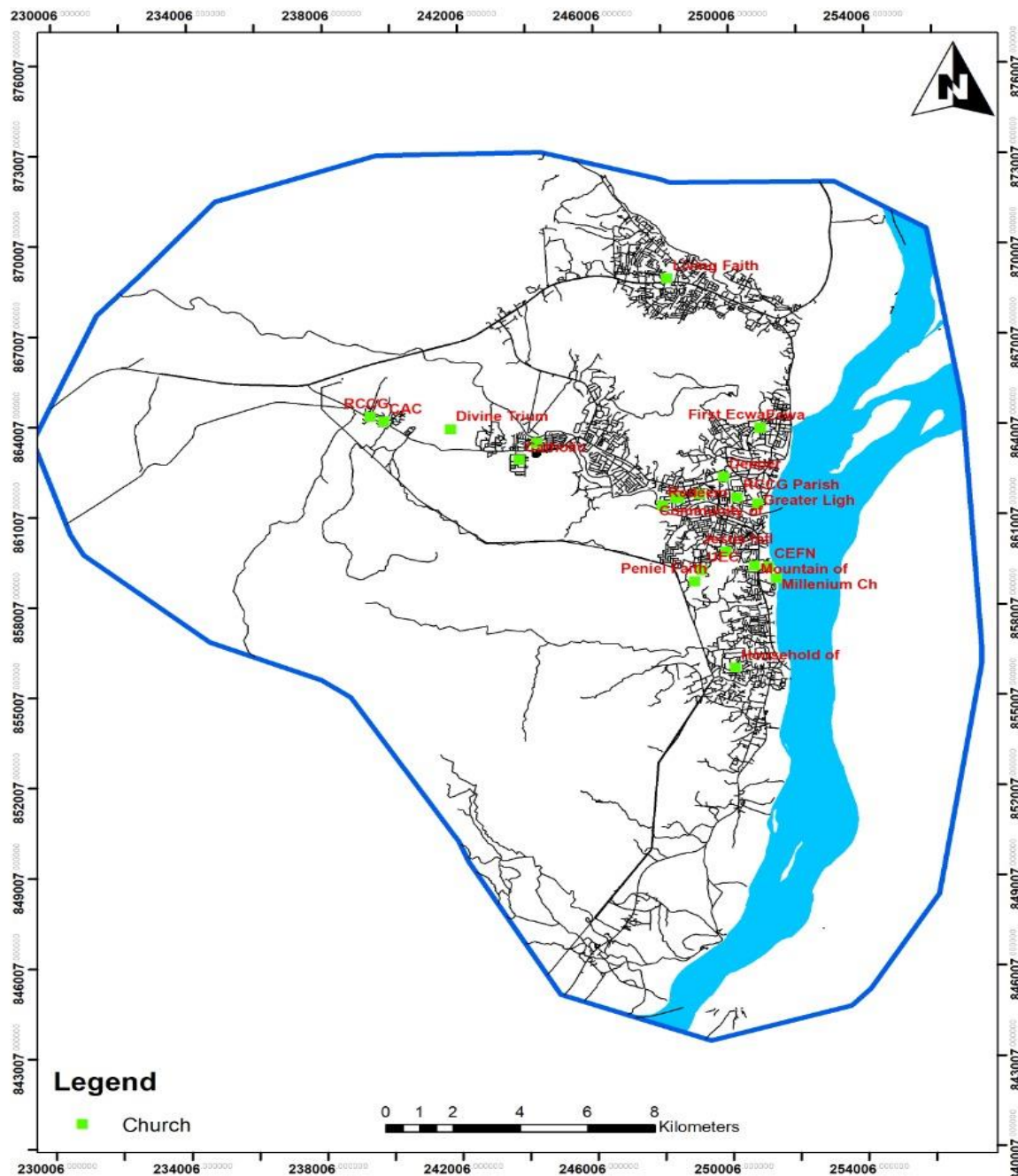


Figure 7.18: Churches in Lokoja, North-Central Nigeria

Source: Author's Analysis (2021)

7.3.5.1 Locational attributes of the places of worship infrastructure in Lokoja City

The NNA analysis of the places of worship infrastructure identified in the city was carried out. The analysis results indicated that the observed mean distance was 892.055m; the expected mean distance was 1,180.74m; the computed z-score was -2.19; and the p-value was 0.028. The nearest neighbour ratio was 0.756. This analysis of the z-score and p-value implied that there was a less than 5 per cent likelihood of the clustered pattern of churches being as a result of random chance. Hence, it was concluded that the places of worship were intentionally dispersed across the cityscape. Figure 7.19 shows the NNA analysis of the places of worship in Lokoja and the pattern exhibited by this infrastructure.

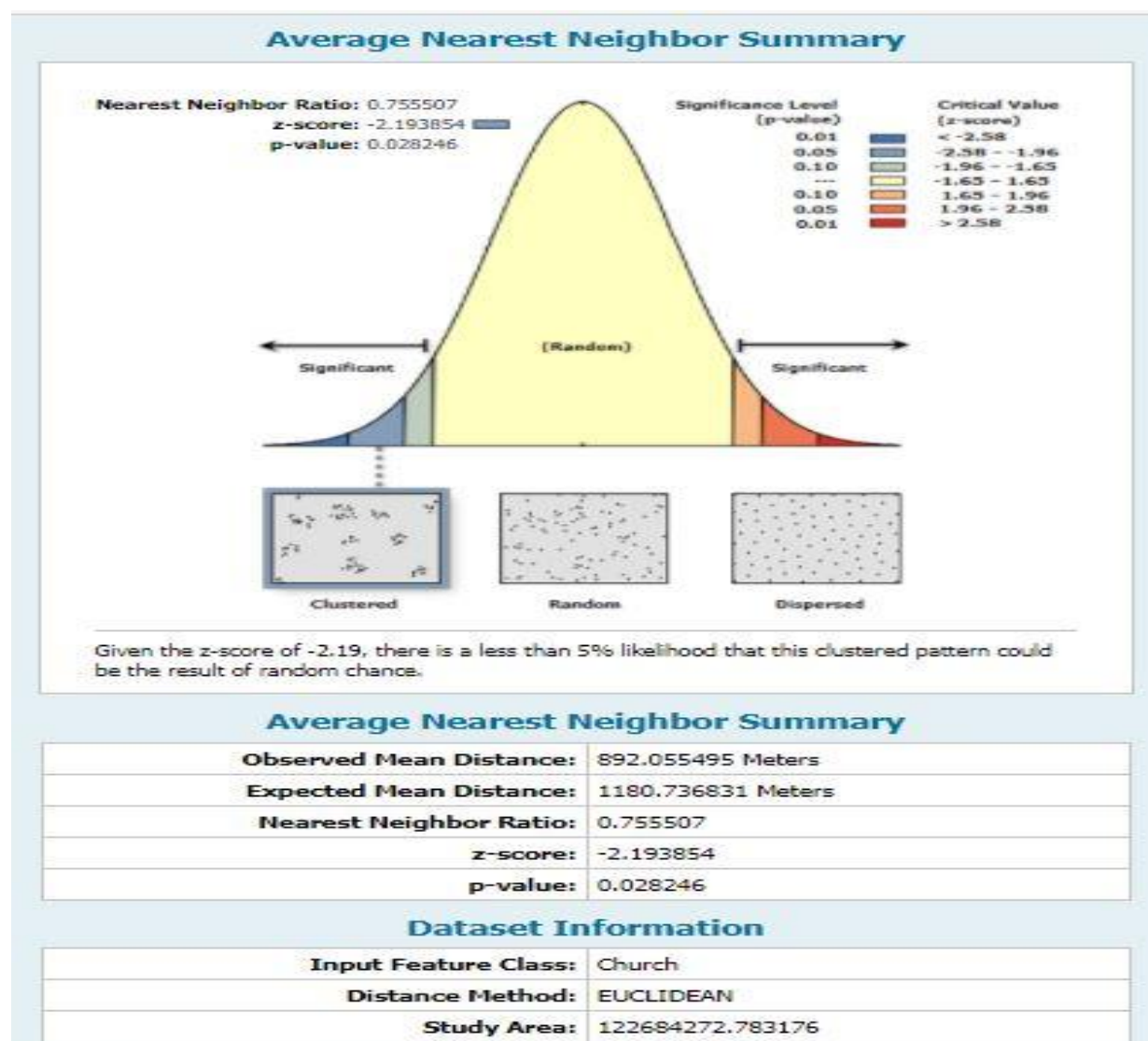


Figure 7.19: Locational Attributes of the Churches in Lokoja, North-Central Nigeria

Source: Author's Analysis (2021)

7.3.6 Transport Infrastructure in Lokoja City

An analysis was conducted of the transport infrastructure in the city. The variables considered in the transport infrastructure included the condition of the roads and the road furniture. Transportation and its attendant ancillary facilities (road infrastructure) were judged to be very critical for the liveability of this (indeed any) city. The roads allowed vehicles, goods, and people to reach the areas where they were needed or where they wanted to be. Transport infrastructure forms the interface between cities with rapidly growing urban centres. Transport infrastructure is a significant focus of urban gatekeepers for shaping development. The study identified three road hierarchies in the study area (Lokoja). These were the trunk A road (the expressway linking the city to the Federal capital of Abuja and to Southern Nigeria. There were also distributor roads and local access roads in the city.

The results indicated that the expressway linking Northern and Southern Nigeria was in good condition. The distributor roads that were the responsibility of the state government were also in fair condition, whereas the local access roads were in deplorable condition. The road fixtures (such as traffic lights and pedestrian bridges) in the study area (Lokoja) were not well maintained. This infrastructure was clogged by solid waste and some of the road fixtures had been abandoned by the local government. Figure 7.20 shows the condition of the road drainage in the city. The drains were blocked by solid waste and that predisposed the city to severe flooding. The Figure also shows the abandoned traffic lights and pedestrian bridge in the city centre.



Figure 7.20: Road and Road Fixture Conditions in Lokoja

Source: Author's Field Survey (2021)

7.3.6.1 Locational attributes of the transportation infrastructure in Lokoja City

The NNA analysis was carried out on the placement of the transportation infrastructure identified in the city. The analysis results indicated that the observed mean distance was 506.137m; the expected mean distance was 570.730m; the computed z-score was -0.813; and the p-value was 0.416. The nearest neighbour ratio was 0.756. This analysis implied that the z-score and p-value had a less than 5 per cent likelihood of having different pattern results due to random chance. Hence, it was concluded that the transportation infrastructure in the city was dispersed across the cityscape. Figure 7.21 shows the NNA analysis of the transportation infrastructure in Lokoja, and the pattern exhibited by this infrastructure.

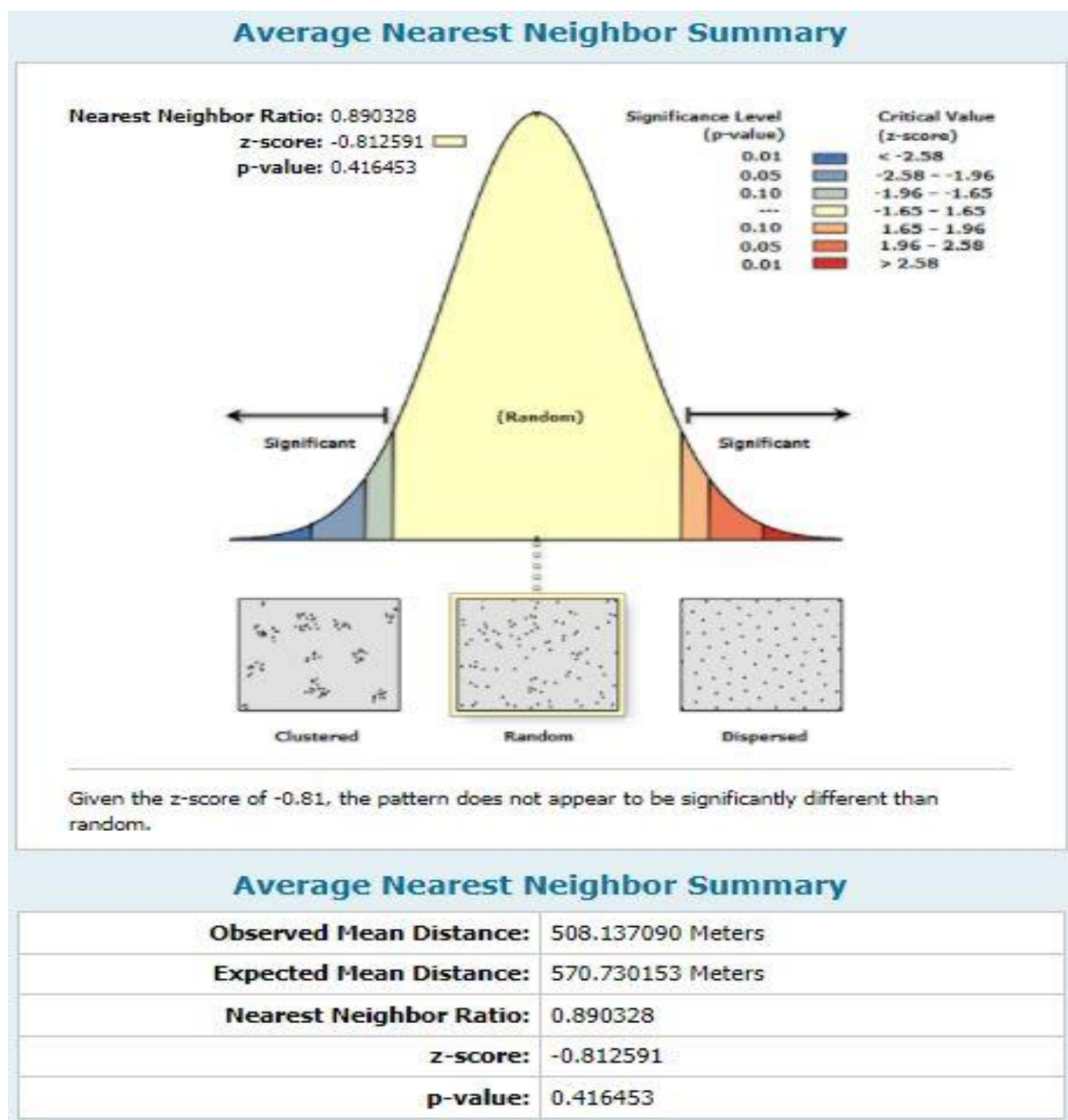


Figure 7.21: NNA Analysis of the Transportation Infrastructure in Lokoja

Source: Author's Field Survey (2021)

7.3.7 Security infrastructure in the city of Lokoja

The security of lives and properties is one of the criteria for measuring liveability and inclusivity in cities. The security situation in Lokoja was measured in terms of the number of police officers available to stem the wave of crime and criminality. The number of police stations in the city could not be ascertained because of the security situation in the country. There were many significant security challenges in the state, including kidnappings, theft, and armed robberies, and what a finding! Because of the situation, the Nigerian police were not ready/able to release the city's policing workforce to curb the violence and crime. It is pertinent to say that the average number of police personnel in the country is used as a yardstick to determine the capacity of the police force to curb the wave of crime in the cities. The rate of corruption in the city was escalating. The staffing records of the Nigerian police force indicated that there was one police officer to an average population of five thousand, which is a far cry from the international standard of one police officer to six hundred people (Abd' Razack & Shuaibu, 2017).

Figure 7.23 shows the spatial distribution of the police stations in the city of Lokoja. There was inadequate policing, and even though local vigilante groups complemented the efforts of the police, the spate of armed robberies, kidnappings, and other crimes was on the rise. Some factors that escalated the incidence of crimes were inequality, segregation, and the non-inclusion of certain groups in the city. Figure 7.22 shows policemen on duty at the police headquarters in Lokoja.



Figure 7.22: Police Officers at the Police Headquarters in Lokoja

Source: Author's Field Survey (2012)

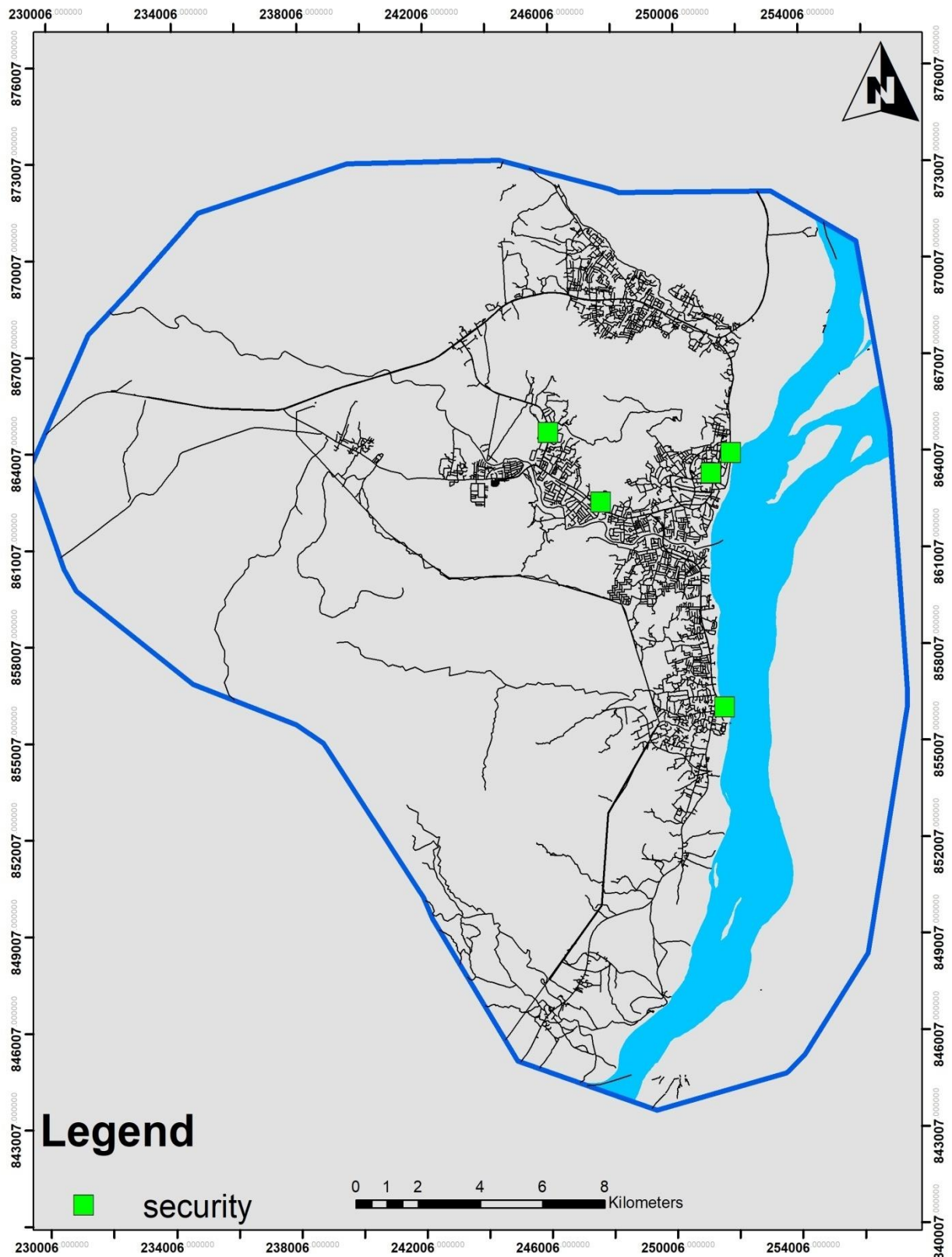


Figure 7.23: Spatial Location of the Police Stations in Lokoja

Source: Author's Analysis (2021)

7.3.8 Summary of the infrastructure provision in Lokoja

Analysis of the supply or provision of infrastructure has shown that several challenges interfered with the effective provision of infrastructure in the city of Lokoja. Five critical infrastructure areas were analysed, and the analysis was presented above. This analysis showed that Lokoja had a deficiency of 28 primary schools. The number of primary schools was judged to be inadequate when weighed against the standard of 39 for the size of the population in the city (Skinner et al., 2021). This meant that the number of primary schools and thus the primary school education in Lokoja was very inadequate. The secondary schools were also very inadequate in number, with a deficiency of 13 secondary schools, hence a deficiency in secondary school education in the city. There were two tertiary institutions, and this was judged to be adequate as their thresholds transcended the sphere of the boundaries of the city (adequate for the population number and they also served the community outside of the city's boundaries) (Souza, 2001; Lasch-Quinn, 2017).

The health infrastructure in Lokoja also presented a very interesting picture. The analysis showed that Lokoja had a shortfall of 32 primary health care centres, 16 secondary health care facilities, and 2 tertiary health care facilities (Babatimehin et al., 2011; Gupta et al., 2003). The analysis also indicated that the primary health care infrastructure was poor in terms of the mean structural condition of the facilities. The secondary health care facilities, though inadequate in terms of the number of facilities available, were structurally in a fair condition. When examining the tertiary health care infrastructure, the one tertiary health care facility available was found to be structurally adequate and fair in terms of its service delivery in the city.

Analysis of the commercial infrastructure in Lokoja indicated that the open markets were in a fair condition, the shopping malls were in a good condition, and the private business outfits were also observed to be in good condition. The mean structural condition of the infrastructure was poor, fair, and fair respectively for the open markets, shopping malls and private business spaces. The transport infrastructure in the city was deemed to be in poor condition and inadequate, as most of the roads in the city had very poor surfaces and inadequate or a complete absence of road fixtures and ancillary infrastructure. This included drainage, traffic lights and pedestrian bridges, etc.

The security infrastructure in the city was also inadequate, according to the analysis, as most of the security infrastructure such as the police stations and other facilities were observed to be in very poor condition. Manpower and equipment such as patrol vehicles and other tools to combat crime were also grossly inadequate. This heightened the challenges of insecurity in the city.

7.4 Infrastructure Provision and Characteristics in Lafia

Another city selected for the study was Lafia, the capital city of Nasarawa State. A similar study to that of the one conducted in Lokoja was conducted on the infrastructure provision in Lafia. The characteristics of the liveability and health of the city's residents were analysed, and the results presented above. The same infrastructures as those in Lokoja were examined in Lafia city. The infrastructure examined was the education, health care, commercial, recreational, places of worship, and transportation infrastructure. The focus was also placed on evaluating the locational attributes and distribution patterns of this infrastructure in the city of Lafia. The analysis employed tables, photographs, maps, and graphs showing the locations and the nearest neighbour analyses.

7.4.1 Education infrastructure in Lafia City

An analysis was conducted of the educational infrastructure in the city of Lafia. The study identified three categories of educational infrastructure in the city: primary school facilities, secondary school facilities, and tertiary institutions. Fourteen primary schools were identified. There were also a number of secondary schools identified, including the Command Science Secondary School and several Government Secondary Schools (for day-scholars), and the Kings Preparatory School. There were also special schools for people living with disabilities and special needs. The tertiary institutions in the city were the Federal University of Lafia, the Nasarawa State Polytechnic, and the National Open University. Figure 7.24 shows the spatial arrangement of some of the educational institutions identified in Lafia city. Table 7.5 shows the levels of adequacy of the educational infrastructure in Lafia. Based on planning standards, it was concluded that the city had a grossly inadequate number of schools, leading to many out-of-school children and overcrowding in the classrooms.

Table 7.5: Number of Schools in Lafia

Population	Type of School	Number Available	Required	Output	Remarks
563,315	Primary	14	100	-86	Inadequate
	Secondary	12	56	-44	Inadequate
	Tertiary	3	2	+1	Adequate

Source: Author's Analysis (2021)

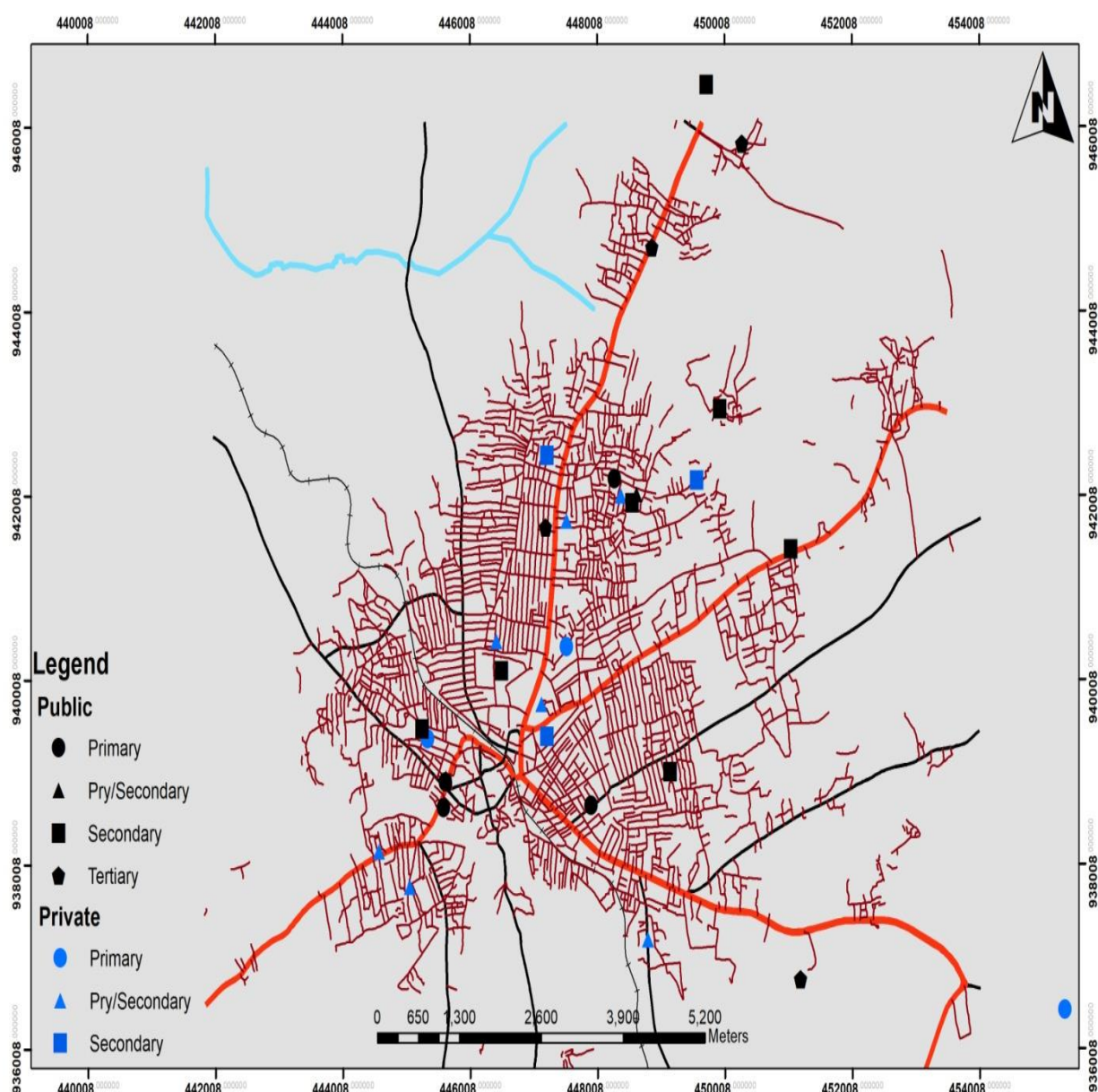


Figure 7.24: Spatial Distribution of the Educational Infrastructure in Lafia City

Source: Author's Field Survey (2021)

The analysis of the mean structural conditions of the educational infrastructure indicated that while the primary schools' and secondary schools' infrastructure was good (better doors, windows, roofs, walls, toilet facilities, and fences), the tertiary institutions were in perfect condition because they were still fairly new institutions, especially the Federal University (established in 2013). Results were recorded using a Likert scale. The analysis of the mean structural state of the educational infrastructure is presented in Table 7.6. Figure 7.25 shows the entrance of one of the educational infrastructures in the city.

Table 7.6: Mean Structural Conditions of the Schools' Facilities in Lafia City

Facility	Mean Structural Condition	Remarks
Primary Educational Infrastructure	3.18	Good
Secondary Educational Infrastructure	3.29	Good
Tertiary Educational Infrastructure	4.51	Very good

Source: Author's Analysis (2021)



Figure 7.25: A Special Needs School in Lafia, North-Central Nigeria

Source: Author's Analysis (2021)

7.4.1.1 Locational attributes of the education infrastructure in Lafia City

The results of the analysis conducted on the locational attributes of the educational infrastructure using the NNA analysis showed that the observed mean distance between the infrastructures was 1321.09m; the expected mean distance was 1117.88m; the z-score was 1.253; and the p-value was 0.2098. This implied a 1 per cent likelihood of the dispersal pattern being the result of random chance. Hence, it was concluded that educational locations in the city were randomly dispersed across the cityscape. Figure 7.26 shows the NNA analysis of the educational infrastructure in Lafia City, and the pattern exhibited by this infrastructure.

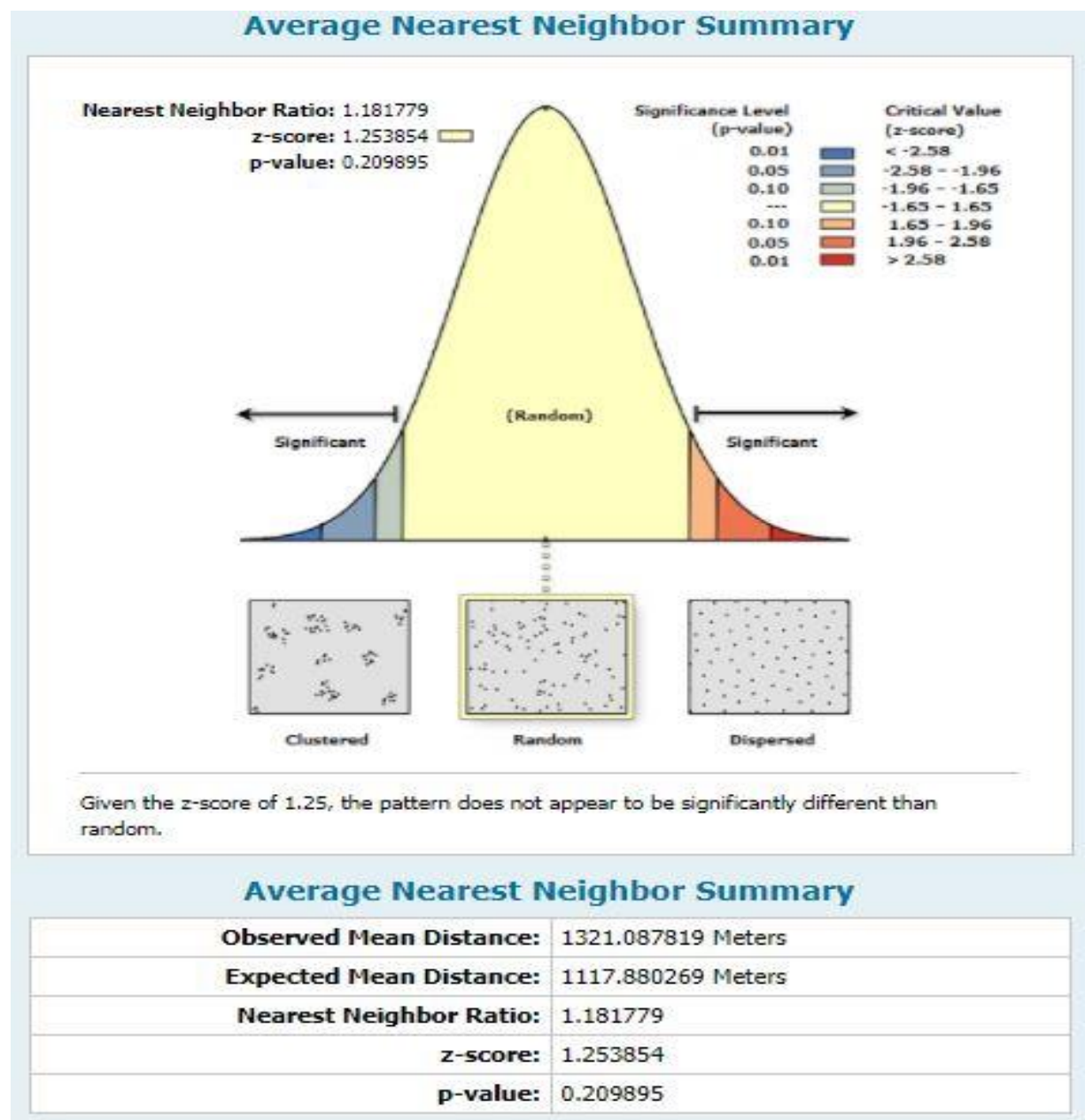


Figure 7.26: Spatial Attributes of the Schools in Lafia, North-Central Nigeria

Source: Author's Analysis (2021)

7.4.2 Health care infrastructure in Lafia City

Analysis of the health care infrastructure in Lafia City also identified three types of health infrastructure: primary health care centres (PHCs), secondary health care facilities, and tertiary health care facilities. Health care infrastructure is critical infrastructure for a liveable city as it ensures the well-being and healthy living of the city's dwellers. This research examined the spatial location and distribution of the health care infrastructure in the spaces in Lafia city. The study identified six PHCs in the city, several secondary health care facilities, and two tertiary health care facilities (the Federal Medical Centre and the Nasarawa State Specialist Hospital).

The study established that three of the health care facilities in Lafia, namely Kowa Hospital, Dalhatu Araf Hospital, and the Federal Medical Centre were grossly inadequate considering the city's population of 563,315, and in accordance with the projections from the National Population Commission's figure from 2006 (NPC, 2013). The consequence of the inadequacy of the health care infrastructure was that Lafia city dwellers had to travel a long distance to access adequate health care services, thus reducing the city's liveability. Figure 7.27 shows the locations of the city's secondary and tertiary health care infrastructure available.

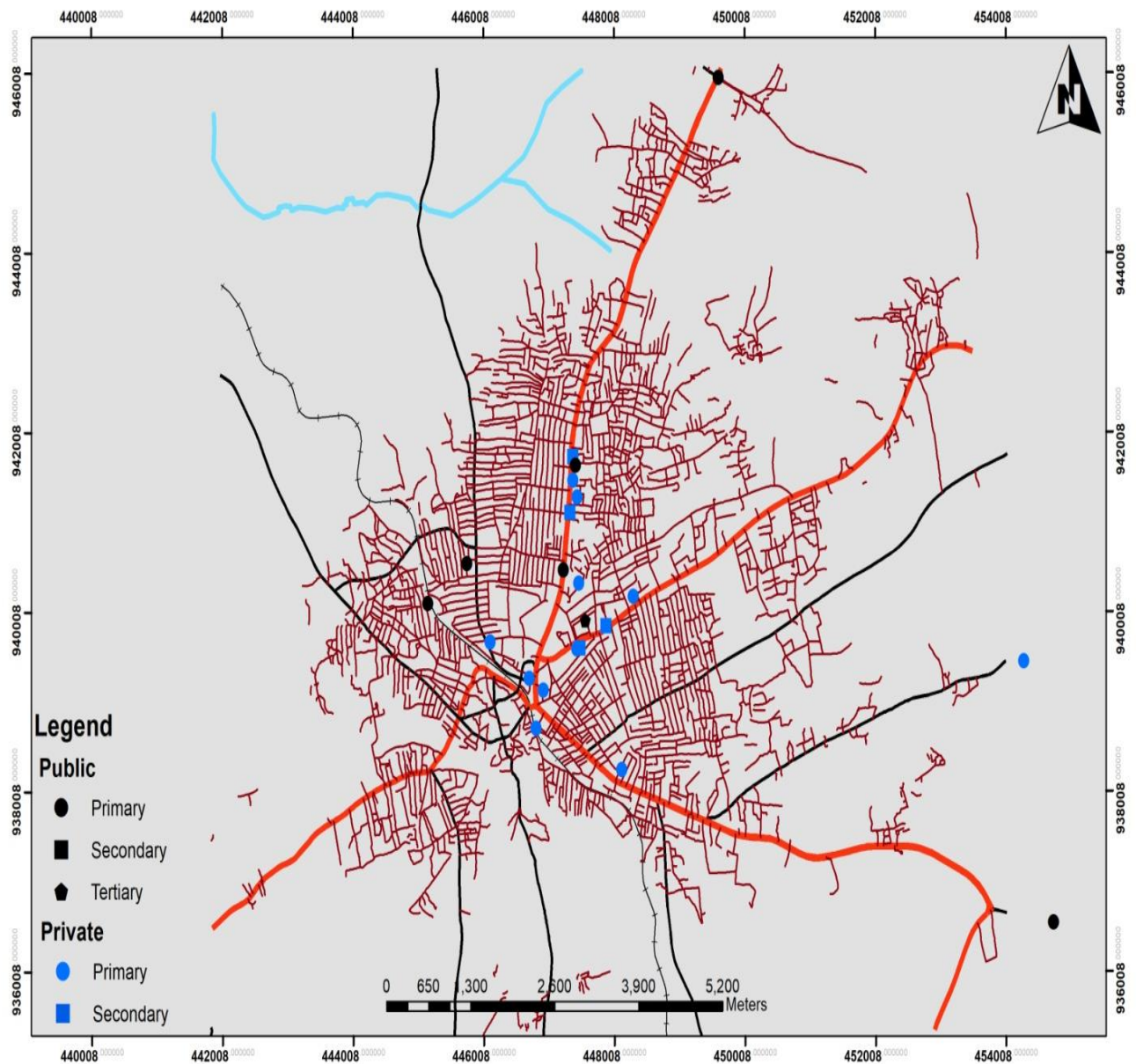


Figure 7.27: Spatial Distribution of the Health Care Infrastructure in Lafia

Source: Author's Analysis (2021)

Table 7.7 shows the number of health infrastructures available in Lafia and their level of adequacy. The analysis based on planning standards showed inadequate health infrastructure in the city (Krause et al., 2015; Giles-Corti et al., 2022).

Table 7.7: Number of Health Infrastructures in Lafia

Population	Health Infrastructure	Number Available	Required	Output	Remarks
563,315	Primary	20	95	-75	Inadequate
	Secondary	15	45	-30	Inadequate
	Tertiary	2	2	-	Adequate

Source: Author's Analysis (2021)

7.4.2.1 Mean structural conditions of the health care facilities in Lafia City

Analysis of the Likert scales used to assess the distribution of the health care infrastructure in Lafia indicated that the facilities were not evenly distributed in space, especially the secondary health care infrastructure. The condition of the health care facilities available in the study area also indicated diversity in the structure of the facilities used to provide the city dwellers in Lafia with health care. Table 7.8 shows the results of the analysis of the distribution of the various health care facilities. Furthermore, Figure 7.28 shows the approach view of Dalhatu Araf Specialist Hospital in Lafia City.

Table 7.8: Mean Structural Conditions of the Health Care Facilities in Lafia City

Facility	Mean Structural Condition	Remarks
Primary Health Care Facilities	2.73	Fair
Secondary Health Care Facilities	3.09	Good
Tertiary Health Care Facilities	3.61	Very good

Source: Author's Analysis (2021)



Figure 7.28: Approach to the Dalhatu Araf Specialist Hospital in Lafia City
Source: Author's Analysis (2021)

7.4.2.2 Locational attributes of the health care infrastructure in Lafia City

The analysis of the health care infrastructure's locational availability showed that the observed mean distance was 1,144.281m; the expected mean distance was 536.86m; the z-score value was 4.329; and the p-value of the analysed distance was 0.000015. The nearest neighbour ratio was 2.131. This implied that the z-score value and the p-value (4.329 and 0.000015, respectively), showed a less than 1 per cent likelihood of this dispersal pattern being the result of random chance. Hence, the locational pattern of the health care infrastructure (secondary and tertiary) in Lafia was dispersed. Figure 7.29 shows the nearest neighbour analysis carried out in the city to determine the distribution pattern of the city's health facilities available.

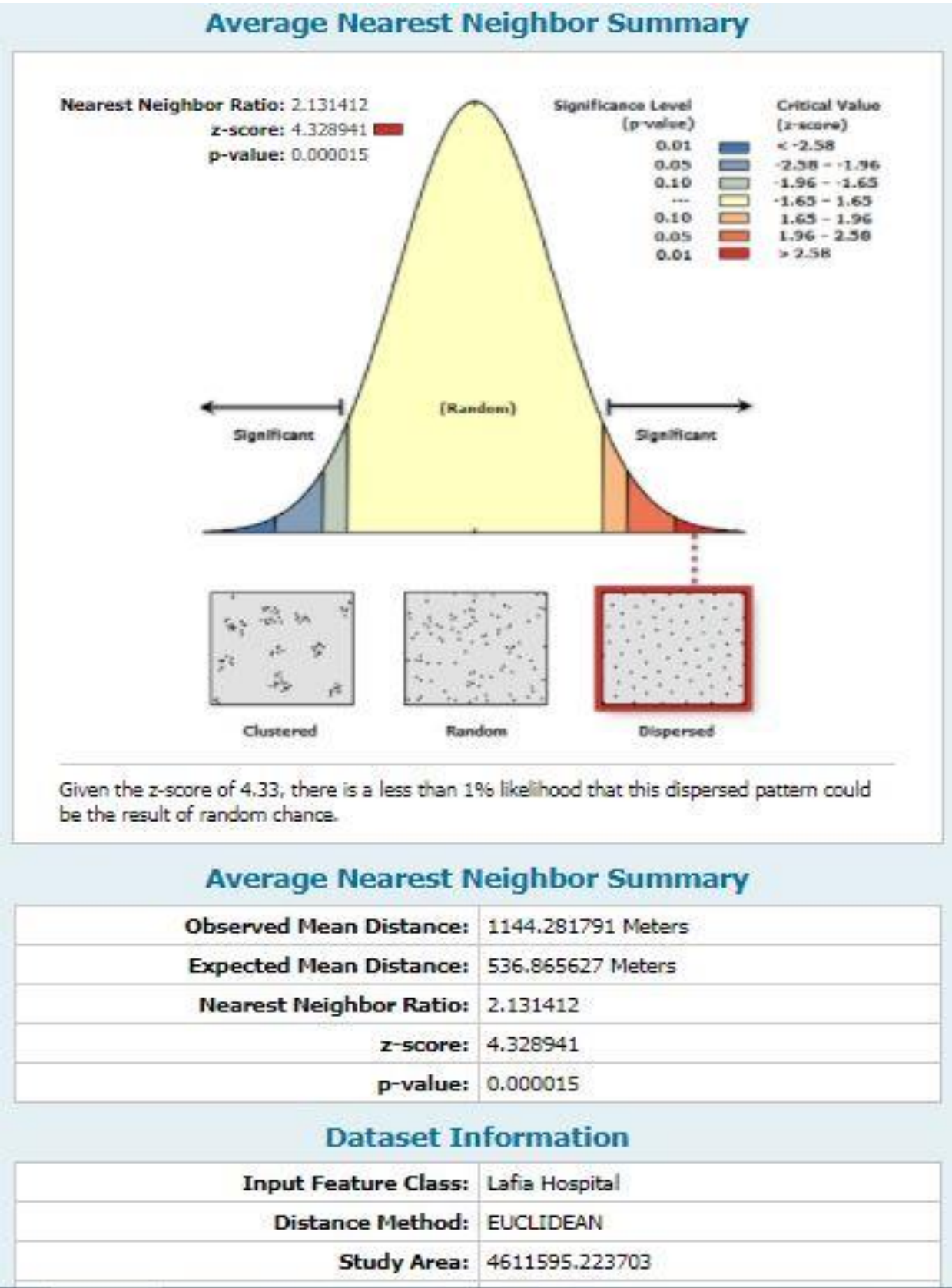


Figure 7.29: Spatial Attributes of the Health Care Infrastructure in Lafia

Source: Author's Analysis (2021)

7.4.3 Commercial infrastructure in Lafia City

Analysis of commercial infrastructure in the city of Lafia was conducted. The city's landscape is adorned with several commercial infrastructures: Banks, markets, shopping complexes, and petrol filling stations.

7.4.3.1 Banking infrastructure

Analysis of the banking infrastructure in the city of Lafia indicated that 12 different banks were identified within the city. These banks provided banking services to the people. Although this infrastructure was spread out in the city's space, the analysis showed that the banks were lined along the central road corridor in the city. The banks were located along Abuja-Makurdi Road and concentrated in the city centre (5 banks). Considering the spatial spread of the city; it was evident that people had to ensure that they had transportation fares to reach the banks to enjoy the banking services in the city. Figures 7.30 shows the spatial distribution of the banking halls and Figure 7.31 provides an example of a banking hall in the city.

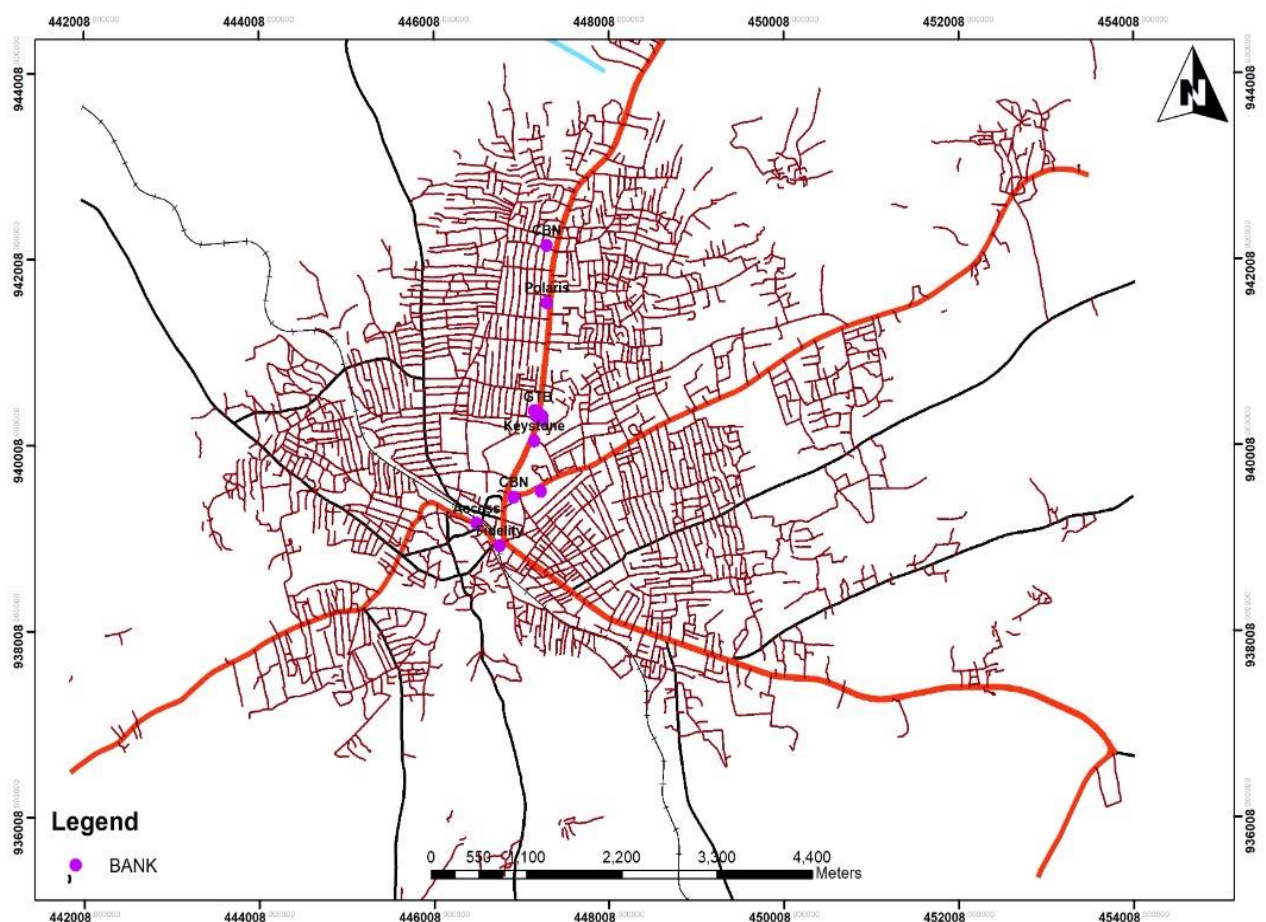


Figure 7.30: Spatial Distribution of the Banking Infrastructure in Lafia City

Source: Author's Field Survey (2021)



Figure 7.31: Example of a Banking Hall in Lafia City

Source: Author's Field Survey (2021)

Financial transactions are measures of the quality of life, and activities that are carried out in banks are significant elements of urban liveability. The nearest neighbour analysis was conducted to assess the distribution of the banking infrastructure in the city. The results showed that the observed mean distance of the bank distribution was 253.990m; the expected mean distance was 205.24m; the z-score value was 1.574; and the p-value was 0.12. The nearest neighbour ratio was 1.24. The implication was that the z-score value and the p-value had a distribution pattern that did not appear to be significantly different from that of random positioning. Hence, the spatial distribution of the banks in Lafia was random. Figure 7.32 shows the NNA of the banking infrastructure in Lafia City.

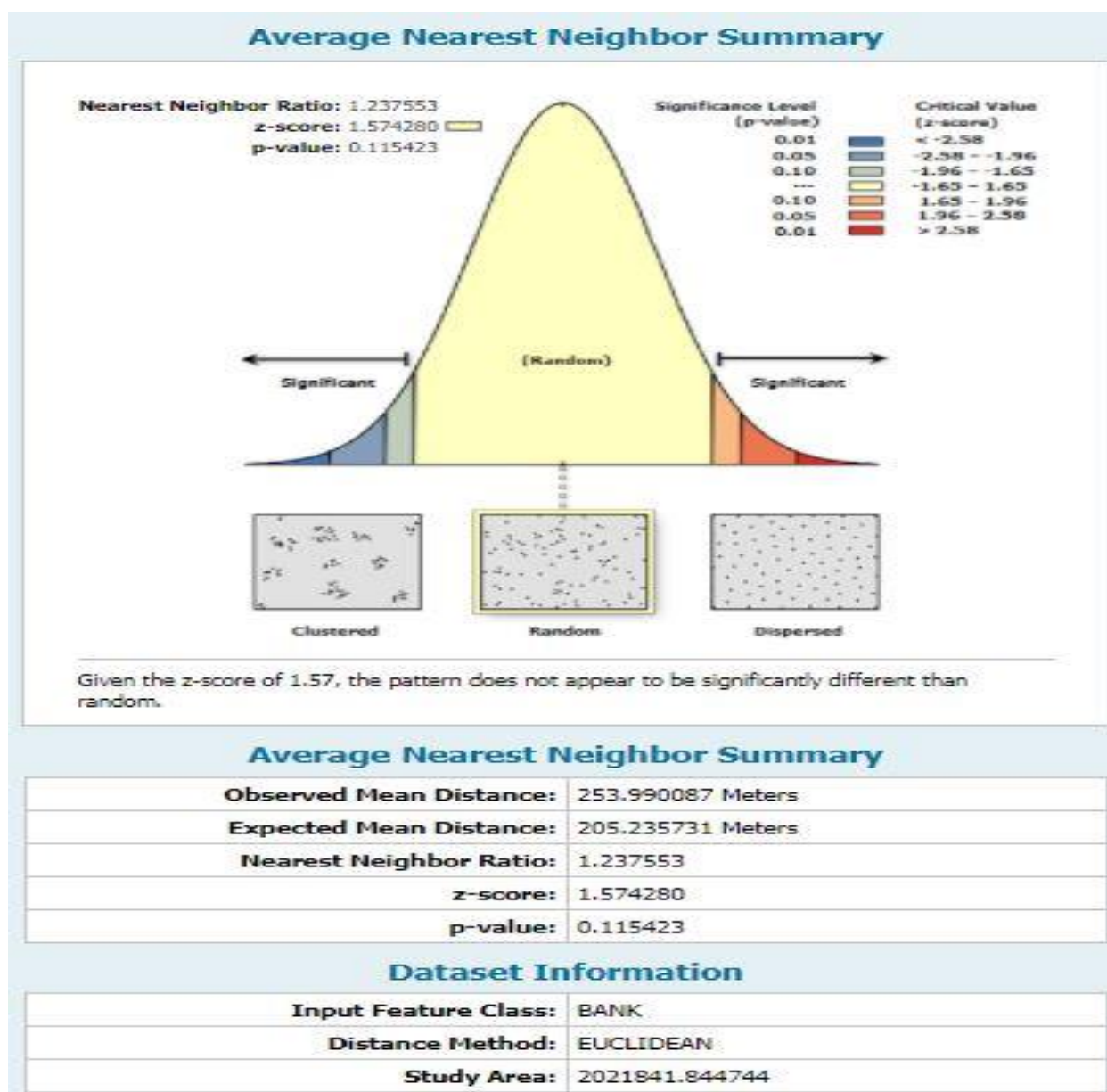


Figure 7.32: Locational Attributes of the Commercial Banks in Lafia City

Source: Author's Analysis (2021)

7.4.3.2 Markets, shops, and shopping complexes

The spatial distribution and location of the market, shops and shopping complexes were also considered in the study. The study was able to identify one international market built by the state government in the city centre, three neighbourhood markets, and four shopping complexes in the city. This was different from shops attached to buildings in complexes as the shops were attached to houses. The analysis of the locational attributes was conducted using the Likert scale results produced on the shopping infrastructure's structures, indicating that the shops attached to houses were in fair condition, the International Market in Lafia was in good

condition, and the shopping complexes were also structurally fair. Figure 7.33 shows an example of a shopping complex in the city centre, and Figure 7.34 shows the spatial distribution of the shopping malls. Table 7.9 shows the locational attributes of the city's market, shops, and shopping complexes.



Figure 7.33: First City Monument Commercial Bank in Lafia City

Source: Author's Field Survey (2021)

Table 7.9: Mean Structural Conditions of the Market Infrastructure in Lafia City

Facility	Mean Structural Condition	Remarks
International Market	3.58	Good
Shops Attached to Buildings	2.99	Fair
Shopping Complexes	3.34	Fair

Source: Author's Analysis (2021)

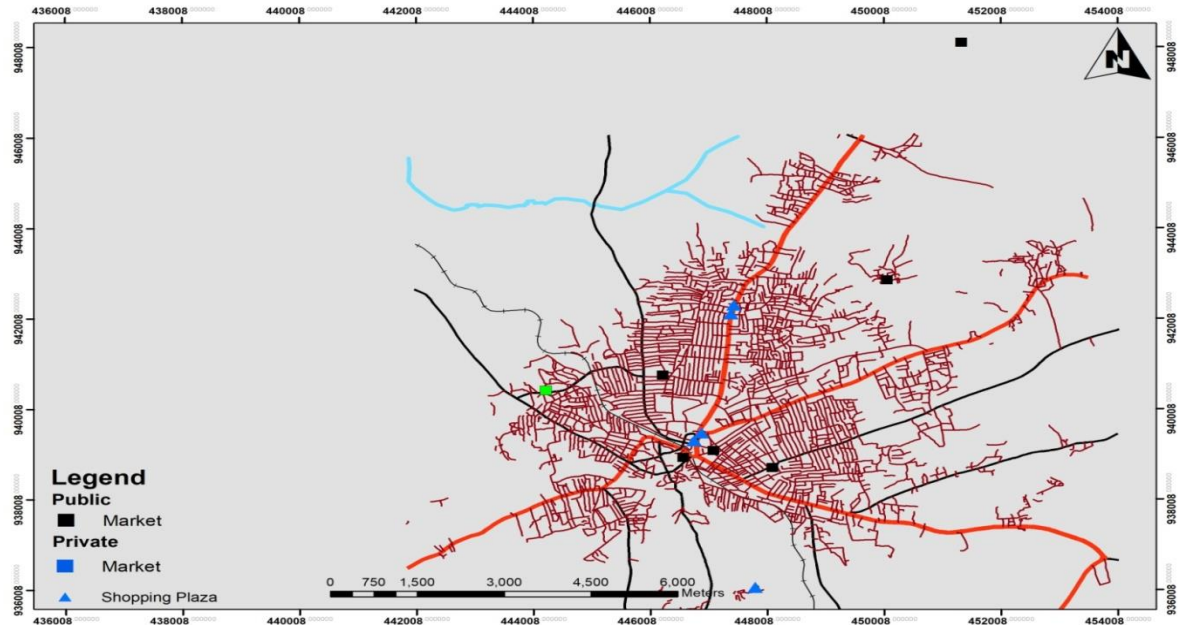


Figure 7.34: Spatial Location of the Markets and Shops in Lafia

Source: Author's Field Survey (2021)

7.4.3.3 Petrol filling stations

Analysis of the spatial distribution of the petrol filling stations in the city identified about 20 petrol filling stations (7 major distributors and 13 independent marketers). These petrol filling stations in the city provided the dwellers with easy access to the petroleum products (petrol, diesel, kerosene, and cooking gas) essential for driving vehicles, cooking, and for domestic energy appliances, and several urban functions that depend on fossil fuels for practical functions in the absence of the supply of electricity by power generating and distribution companies. Figures 7.35 and 7.36 show the spatial distribution of the petrol filling stations and an example of a filling station in the city, respectively.

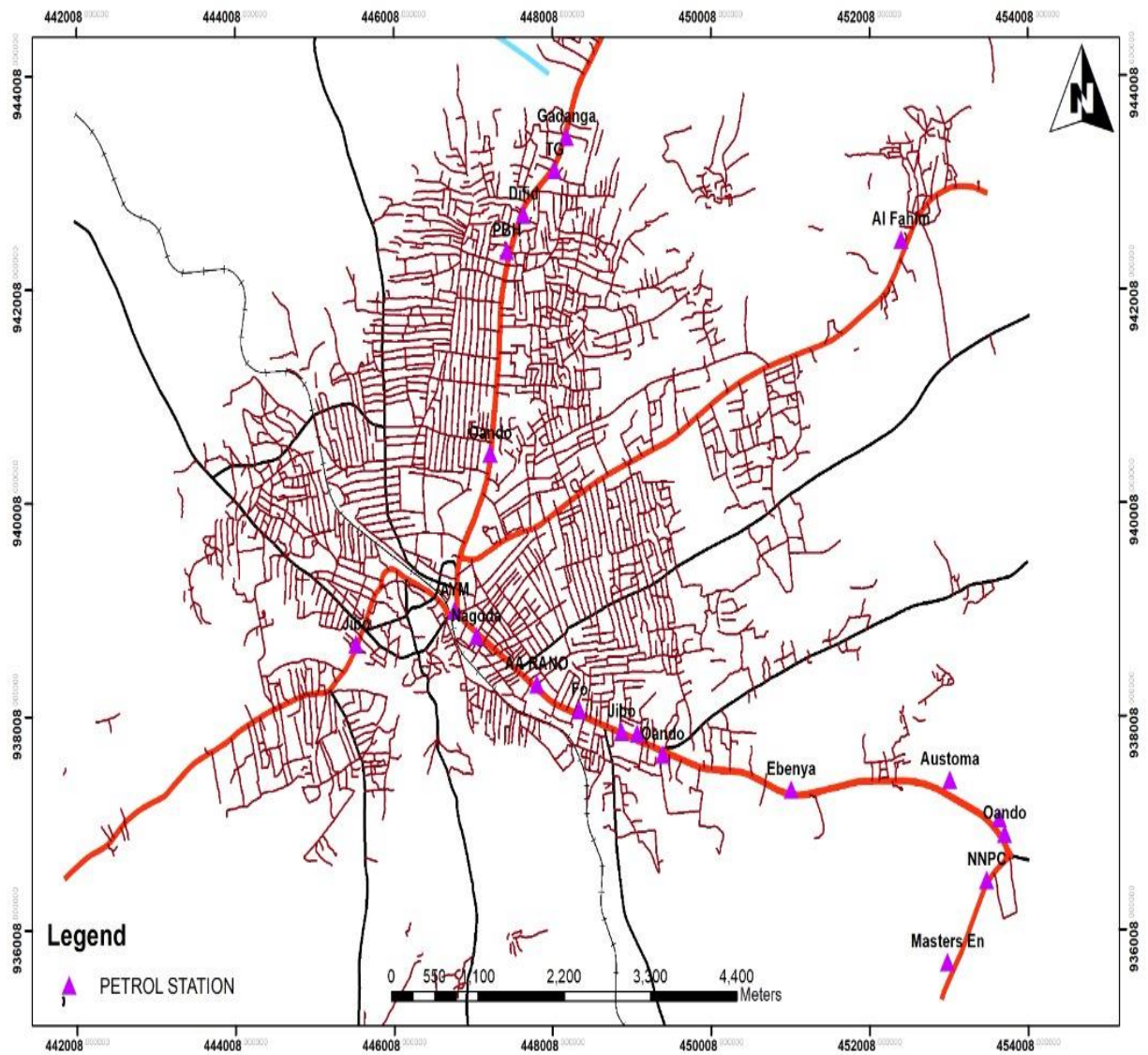


Figure 7.35: Spatial Distribution of the Petrol Filling Stations in Lafia City

Source: Author's Field Survey (2021)



Figure 7.36: Petrol Filling Station along Lafia-Makurdi Road in Lafia

Source: Author's Field Survey (2021)

The NNA analysis of the petrol filling stations in Lafia City is presented in Figure 7.37. The analysis results show that the expected mean distance between filling stations was 717.433m; the observed mean distance between them was 772.684m; the z-score value was -0.627; and the p-value was 0.531. The nearest neighbour ratio was 0.928. The z-score and p-values implied that the distribution pattern was not significantly different from a random distribution pattern.

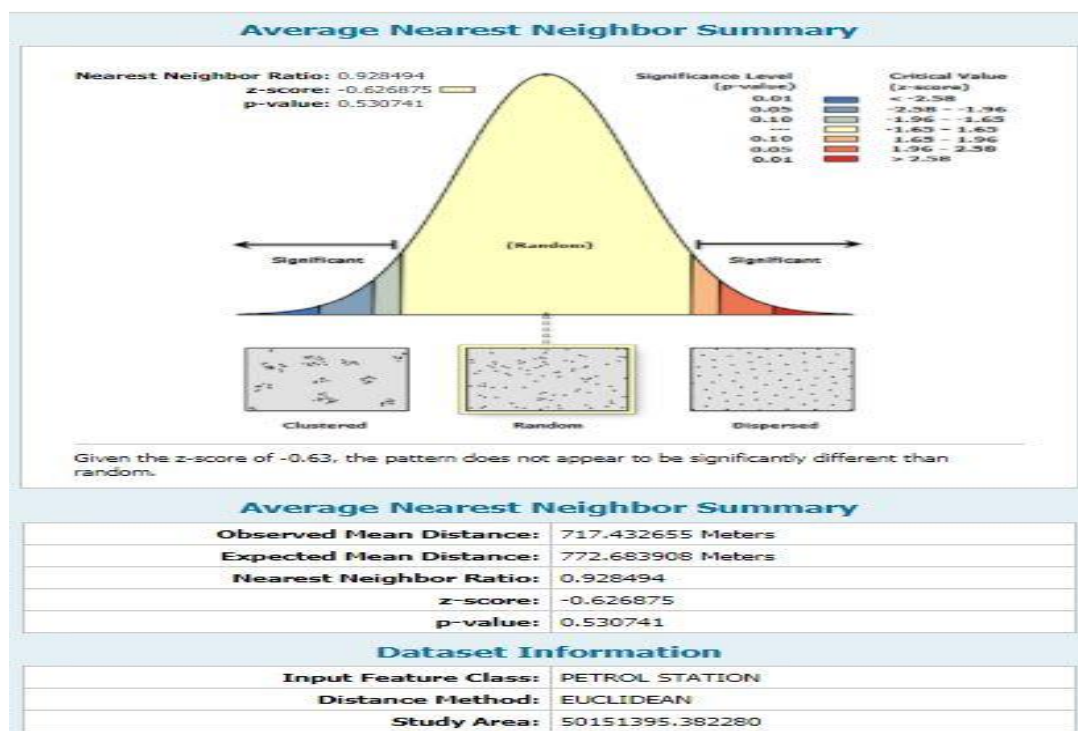


Figure 7.37: Locational Attributes of the Petrol Stations in Lafia, North-Central Nigeria

Source: Author's Analysis (2021)

7.4.4 Places of worship infrastructure in Lafia City

The places of worship infrastructure in Lafia City that were considered for the study were mainly churches and mosques. The analysis was conducted on their spatial distribution and the attributes of this infrastructure as they played a significant role in the liveability of city dwellers when communing with their God.

7.4.4.1 Churches

Analysis of the spatial distribution of the churches in the city of Lafia indicated that there were 25 different main churches in the city. Figure 7.38 shows the spatial locations of the places of Christian worship infrastructure within Lafia City. These churches added to the city's unique beauty as different sizes and shapes were employed to construct such infrastructure. Figure 7.39 shows an example of a church in the city (First Baptist Church).

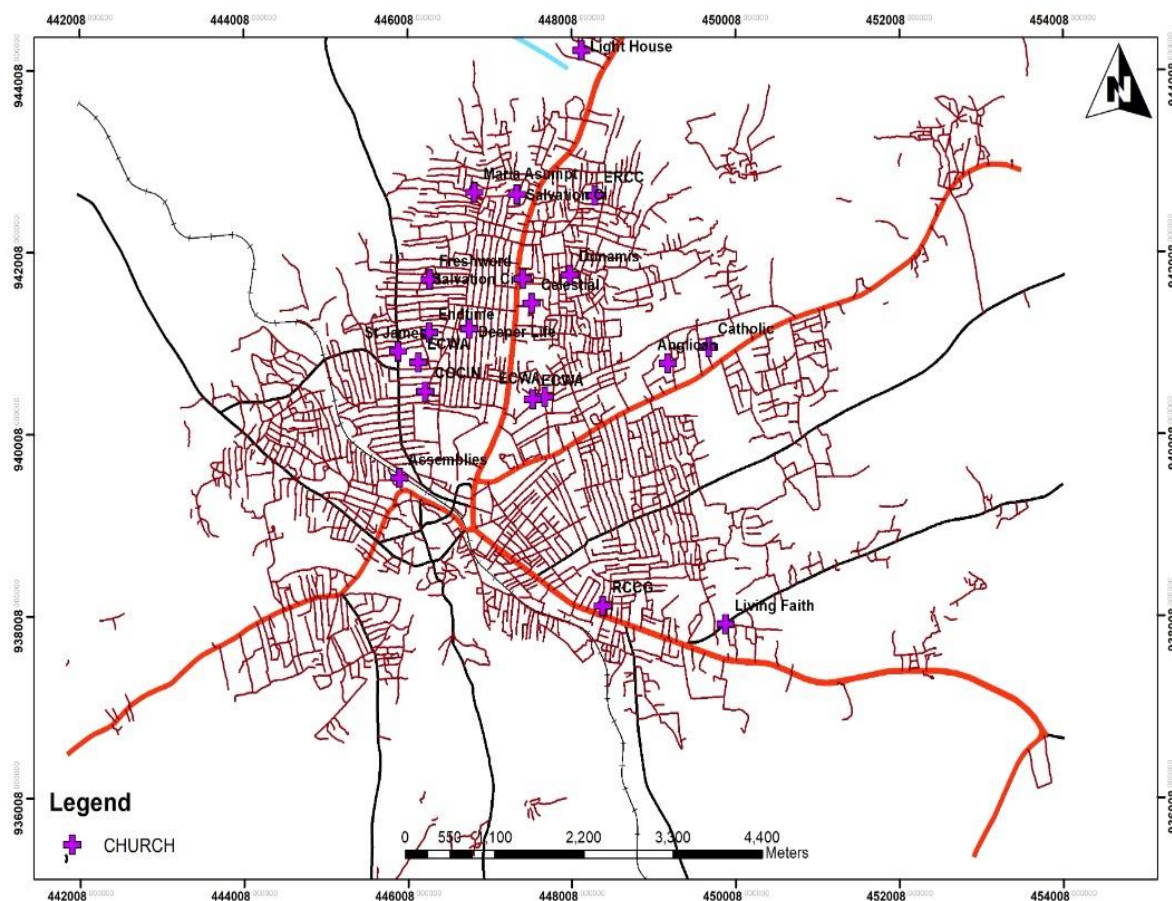


Figure 7.38: Spatial Distribution of the Church Infrastructure in Lafia City

Source: Author's Analysis (2021)



Figure 7.39: The First Baptist Church in Lafia City

Source: Author's Field Survey (2021)

7.4.4.2 Locational attributes of the church infrastructure in Lafia City

The results of the NNA showed that the observed mean distance between the churches was 596.148 m; the expected mean distance was 560.955m; the z-score value for the spatial distance was 0.563, and the p-value was 0.573. The nearest neighbour ratio was 1.063. This analysis implied that the z-score value and the p-value distribution pattern did not appear to be significantly different from what a random distribution pattern would have been. Figure 7.40 shows the locational distribution of the churches within Lafia city.

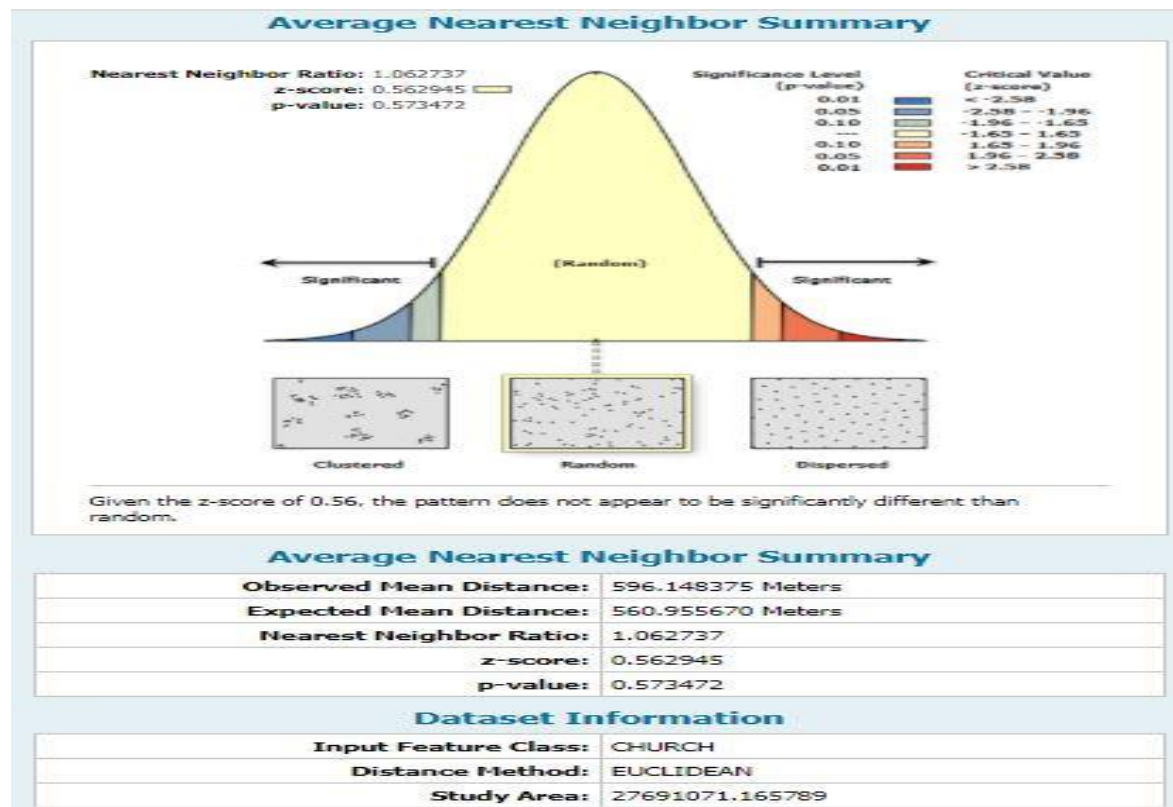


Figure 7.39: Locational Attributes of the Church Infrastructure in Lafia City

Source: Author's Analysis (2021)

7.4.4.3 Mosques

The spatial distribution of the mosques in the city showed that there were more than 15 different mosques. The proliferation of the mosques did not follow any planning principles as many individuals had decided to build mosque infrastructure in their neighbourhoods and houses themselves. Figure 7.41 shows the spatial distribution of the mosques in the city.

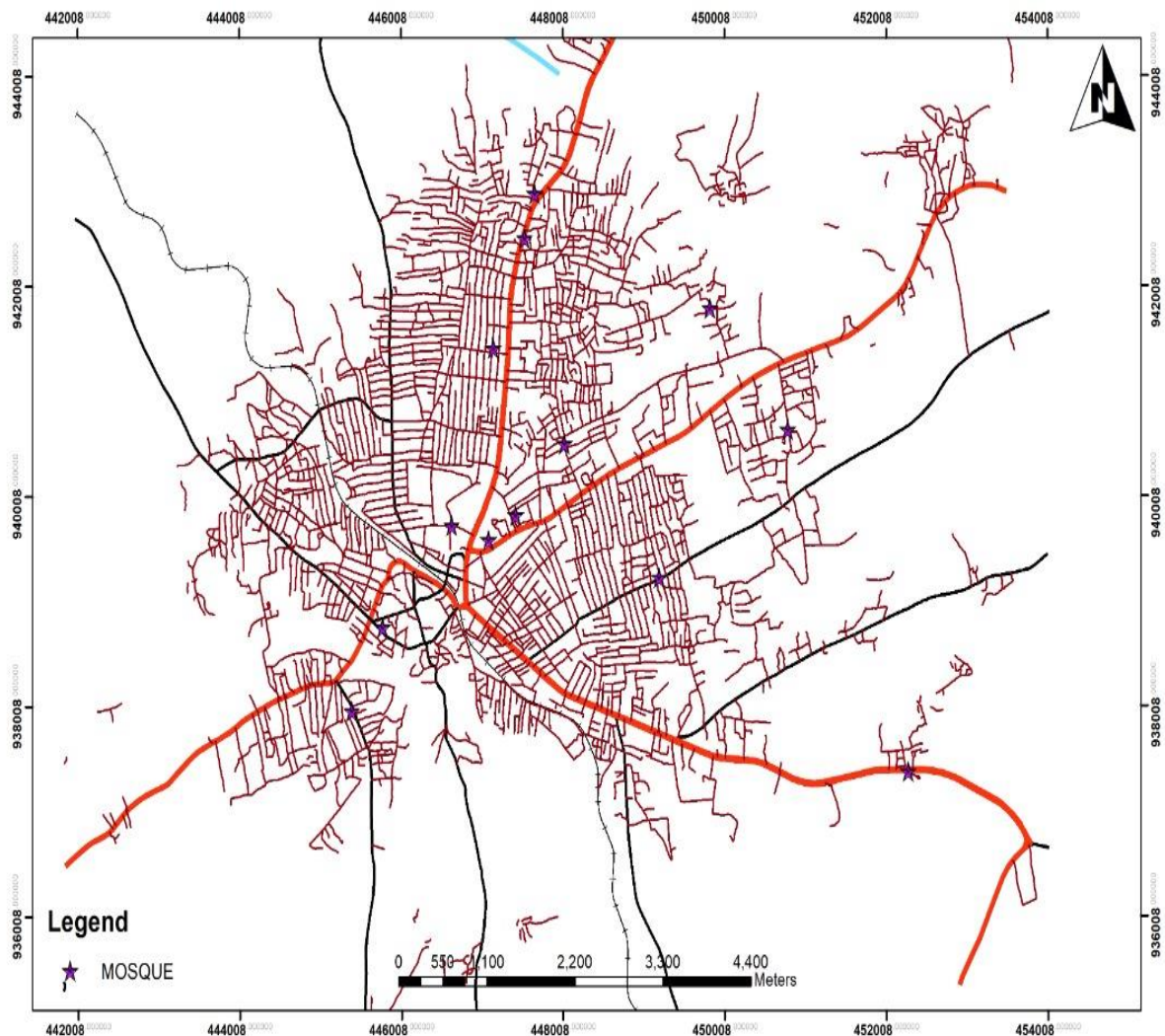


Figure 7.40: Spatial Distribution of the Mosque Infrastructure in Lafia City

Source: Author's Field Survey (2021)

7.4.4.5 Locational attributes of the mosque infrastructure in Lafia City

Analysis of the mosque infrastructure using the NNA showed that the observed mean distance between them was 1,203.360m; the expected mean distance was 951.290m; the z-score was 1.897; and the p-value was 0.058. The nearest neighbour ratio was 1.265. This implied that the

z-score and p-value had a less than 10 per cent likelihood of this infrastructure having a dispersed distribution pattern, hence location was by random chance. Therefore, it was concluded that the distribution of mosques in Lafia city was dispersed. Figure 7.42 shows the locational attributes of the mosque distribution in Lafia City.

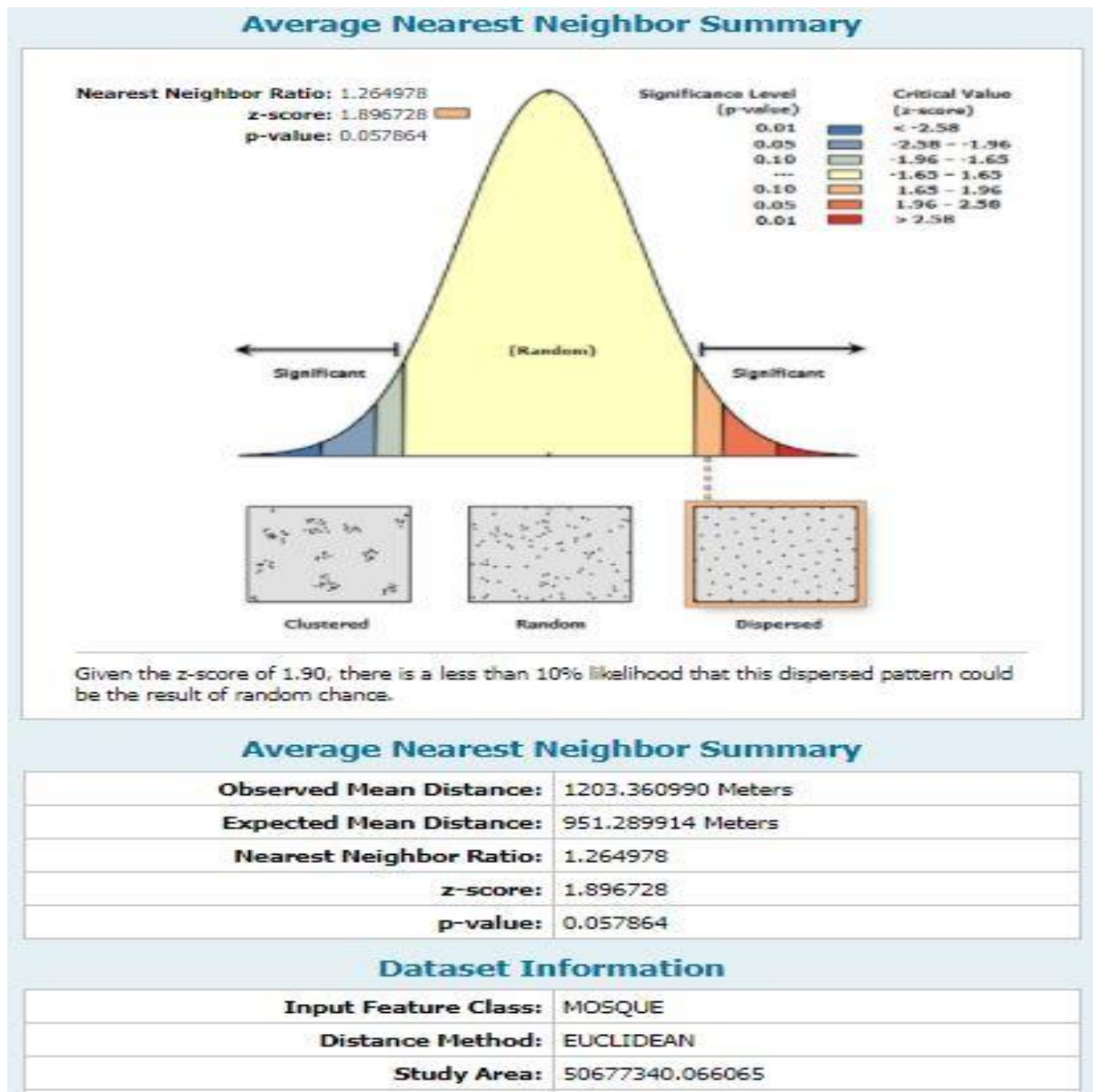


Figure 7.41: Locational Attributes of the Mosques in Lafia City

Source: Author's Analysis (2021)

7.4.5 Recreational infrastructure in Lafia City

Recreational infrastructure is one of the variables considered in a liveable city. The analysis of the recreational infrastructure in Lafia City indicated different spaces dedicated to recreation and leisure activities within the city' These various spaces' infrastructures were aimed at

helping the residents of the city. The spatial distribution of this recreational infrastructure in the city indicated 25 spaces identified for both active and passive recreation, relaxation, and sporting activities. Figure 7.43 shows the distribution of the recreational spaces for leisure, sport, hotels, and a traditional eatery in Lafia City. Figure 7.44, on the other hand, shows a modern eatery spot in the city.

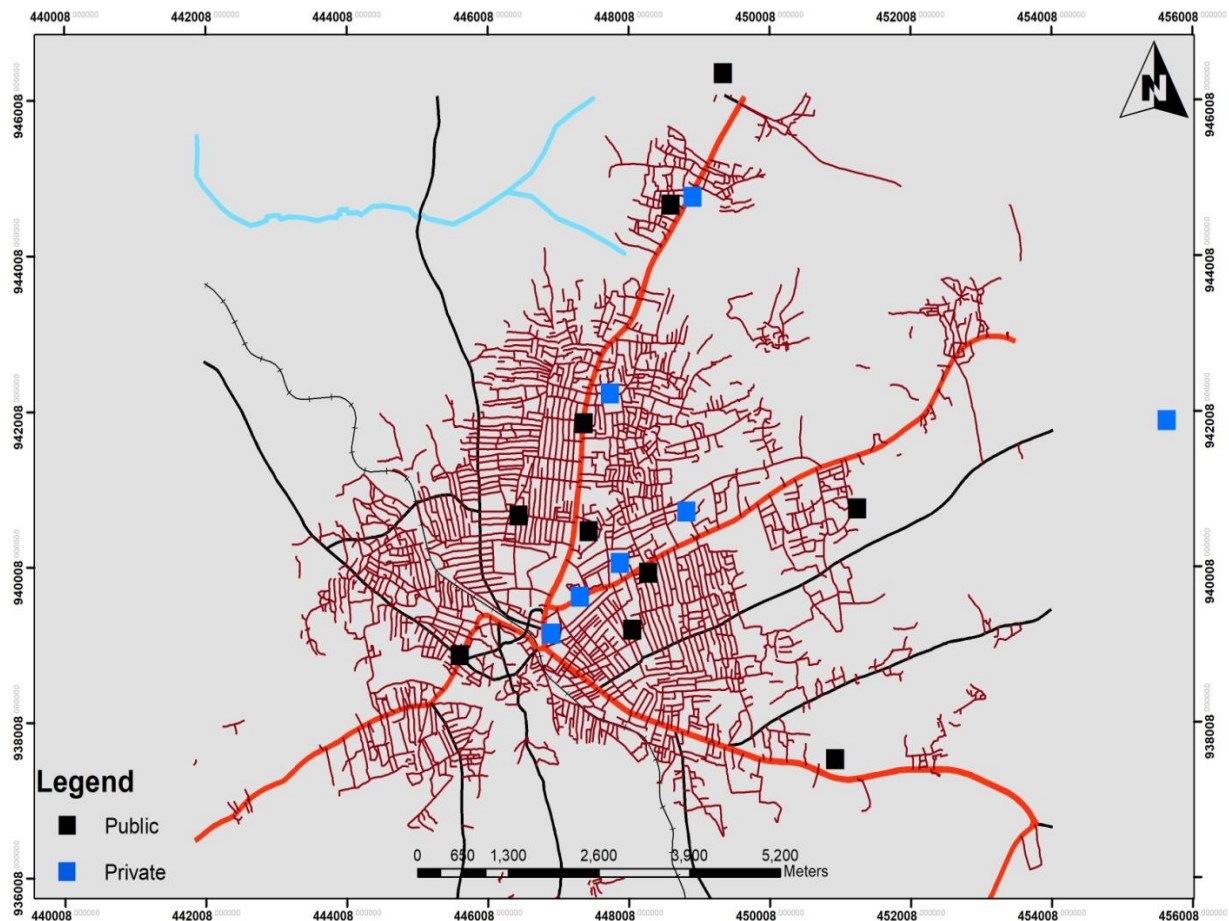


Figure 7.42: Recreational Infrastructure in Lafia, North-Central Nigeria

Source: Author's Field Survey (2021)



Figure 7.43: A Modern Leisure and Food Spot in Lafia City

Source: Author's Field Survey (2021)

7.4.5.1 Locational attributes of the recreational infrastructure in Lafia City

The analysis of the nearest neighbour analysis conducted for the recreational infrastructure in the city indicated that the expected mean distance was 1010.90m; the observed mean distance between them was 983.43m; the z-score value was -0.243; and the p-value was 0.807. The nearest neighbour ratio was 0.973. This analysis implied that the z-score value and p-value distribution pattern did not appear to be significantly different from random. Hence, the spatial distribution of the recreational infrastructure in Lafia City was random. Figures 7.45 and 7.46 depict the NNA analysis of the locational attributes of the recreational infrastructure in the city and the Lafia Township Stadium (one of the city's recreational facilities).

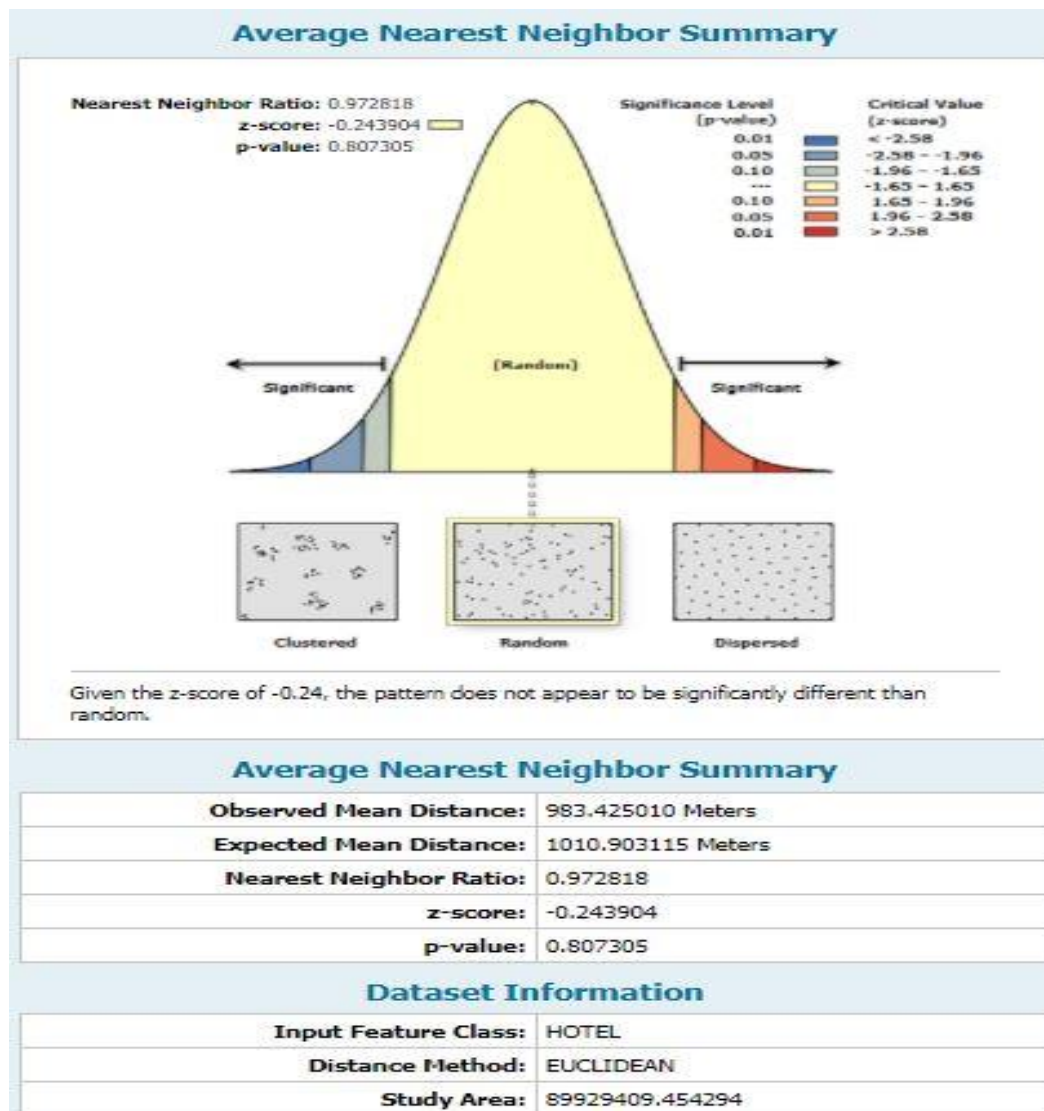


Figure 7.44: Locational Attributes the Recreational Infrastructure in Lafia City

Source: Author's Analysis (2021)



Figure 7.45: Lafia Township Stadium

Source: Author's Field Survey (2021)

7.4.6 Transport infrastructure and services

Analysis of the transport infrastructure in the city of Lafia indicated that there were three road hierarchies in the city. The primary arterial road dissected the city into four sections. From the city centre, the arterial road led to Jos City to the north; to Makurdi in the north-east; and to Awe in the east. The city was also served by a secondary road and local access roads. The transport infrastructure within the city of Lafia was such that the primary arterial and most of the secondary roads were paved, motorable, and lined with pedestrian walkways. The local access road was the one that left much to be desired. The transportation modes within the city included motorcycles, tricycles, and commercial vehicles that plied these roadways when transporting residents or goods from one location to another within the city. Figure 7.47 shows some motorcycle riders going about their business within the city.



Figure 7.46: Transport Infrastructure in Lafia City

Source: Authors Field Survey (2021)

The state government was improving upon the transport infrastructure and its fixtures in Lafia. The modes of transportation and number of vehicles within the city of Lafia also continued to grow as the demand for transportation increased with the population growth and sprawling development of the city. This harmed the transport infrastructure, especially the local access roads. These roads were emerging without proper planning, hence the infrastructure provided poor support for a sound transportation system that engendered liveability and sustainability in the city.

7.4.6.1 Locational attributes of the transportation infrastructure in Lafia City

The nearest neighbour analysis conducted for the transportation infrastructure in the city indicated that the expected mean distance was 1,196.658m; the observed mean distance was 968.884m; the z-score value was 1.854; and the p-value was 0.064. The nearest neighbour ratio was 1.235. This analysis implied that the z-score value and p-value distribution pattern were dispersed because of random chance. Hence, the spatial distribution of the transportation infrastructure in Lafia city was dispersed. Figure 7.48 depicts the NNA analysis of the locational attributes of the transportation infrastructure.

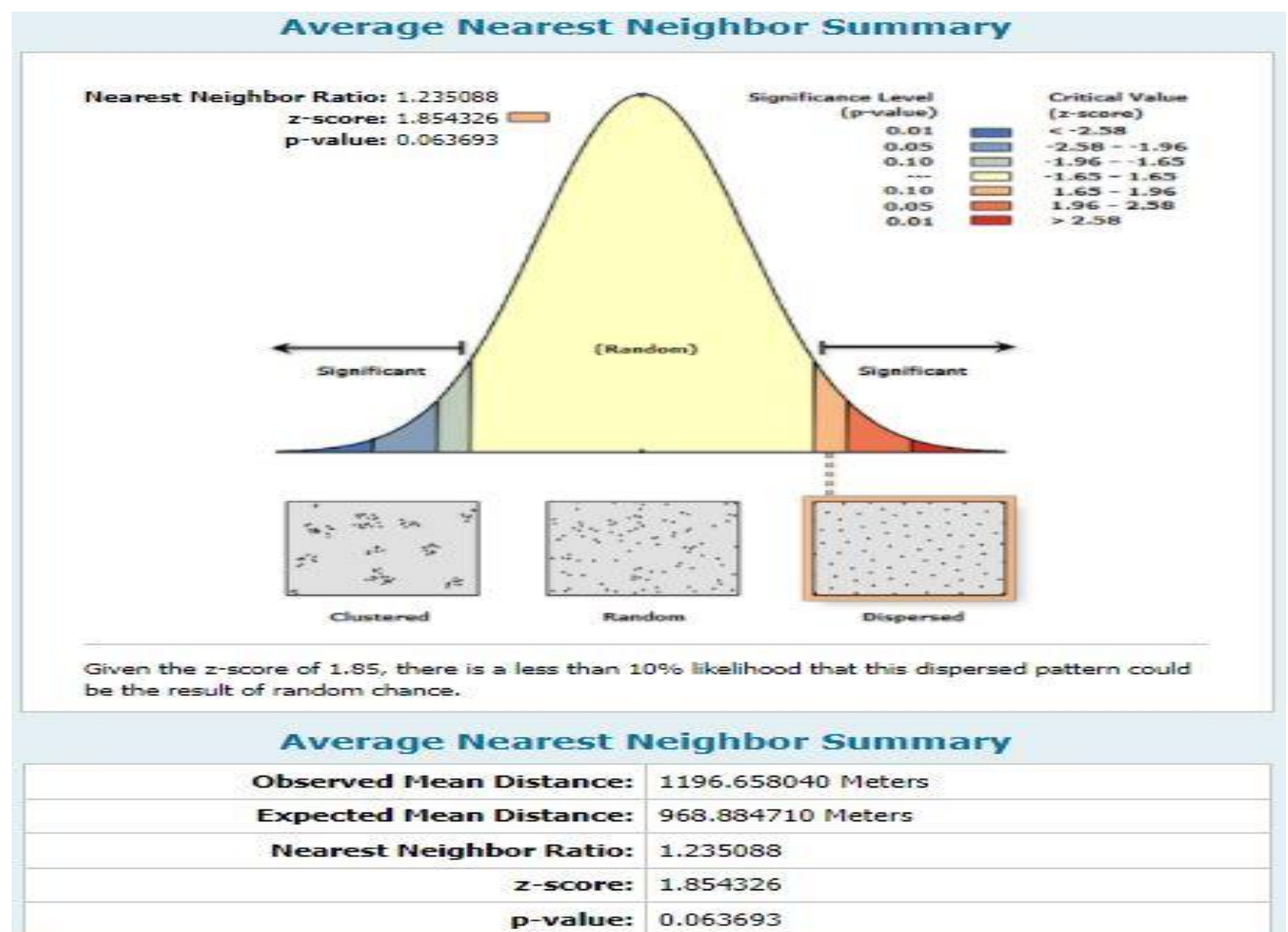


Figure 7.47: NNA Analysis for the Transportation Infrastructure in Lafia 'City

Source: Author's Analysis (2021)

7.4.7 Security infrastructure

The security infrastructure in the city of Lafia was left in the hands of the Nigerian police force, the military, and the Nigerian Security and Civil Défense Commission. These agencies were grappling with security challenges when the research was conducted. The number of personnel

was classified information that was not available to the researcher. The study of Abd' Razack and Shuaibu (2017) was relied on to determine the adequacy or otherwise of the security personnel to curb crime in the city. The Nigerian police force did not have enough personnel to police the country effectively. The study by Abd' Razack and Shuaibu (2017) found that there was only one police officer for every five thousand people, and this was a far cry from the international standard of one police officer for every six hundred people, hence the spate of crime in the cities in the country. Figure 7.49 shows the spatial location of the police stations in Lafia.

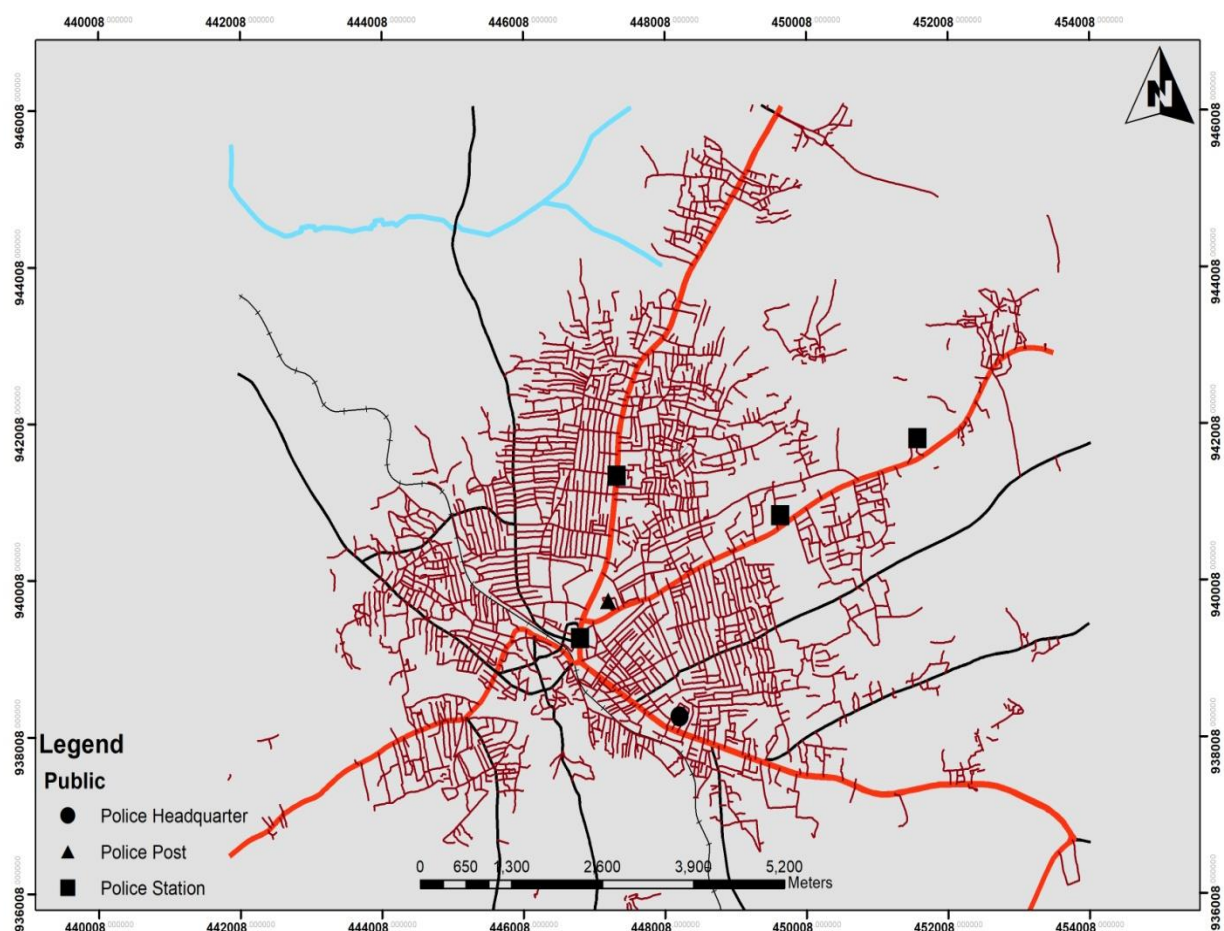


Figure 7.48: Spatial Location of the Police Stations in Lafia

Source: Author's Field Survey (2021)

7.4.7.1 Locational attributes of the security infrastructure in Lafia City

The nearest neighbour analysis conducted for the security infrastructure in the city indicated that the expected mean distance was 1,471.720m; the observed mean distance was 2,689.362m; the z-score value was 4.187; and the p-value was 0.000. The nearest neighbour ratio was 1.827.

This analysis implied that the z-score value and p-value distribution pattern appeared to be dispersed because of random chance. Hence, the spatial distribution of the security infrastructure in Lafia city was dispersed. Figure 7.50 shows the NNA analysis of the locational attributes of the security infrastructure in the city.

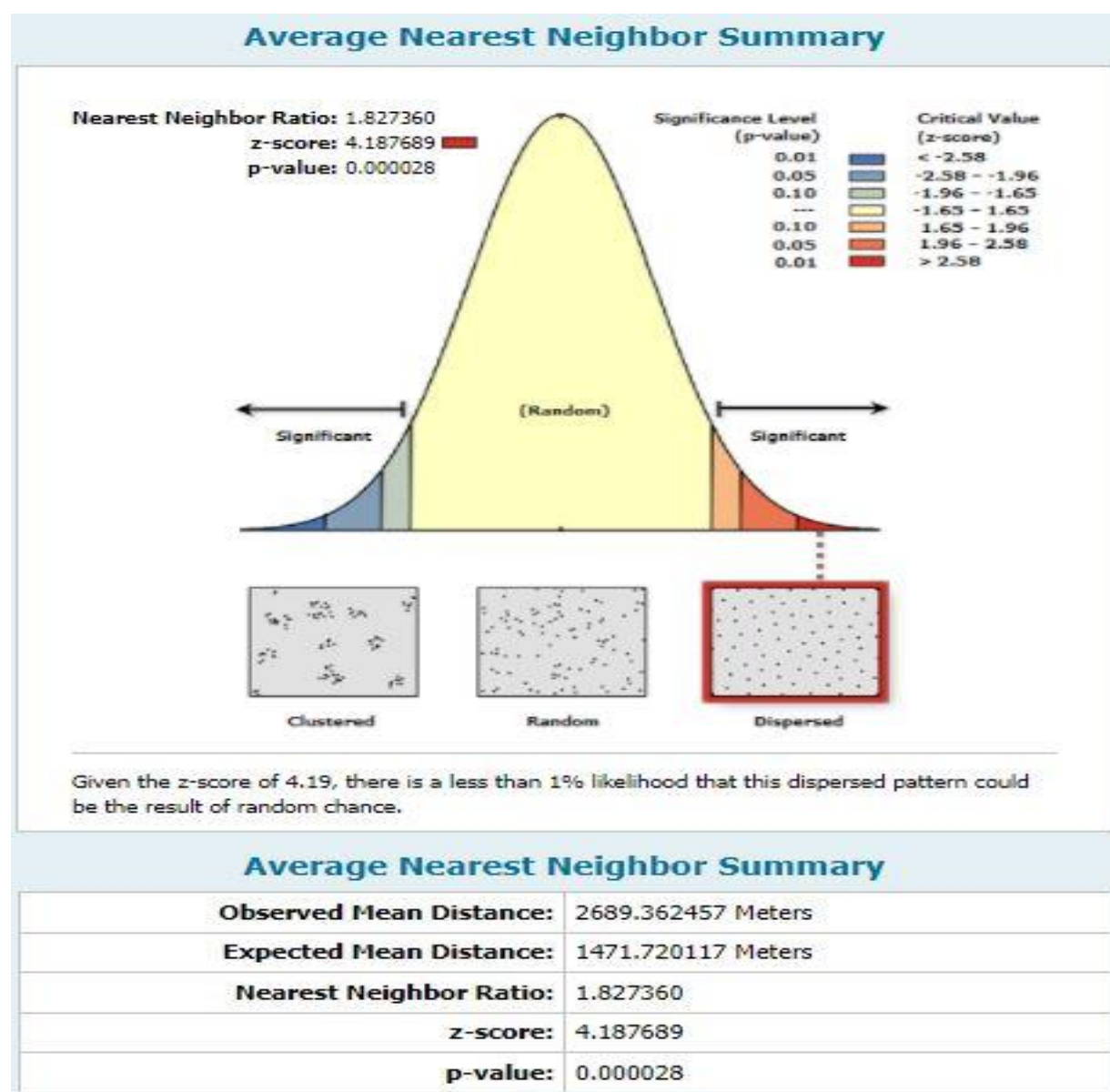


Figure 7.50: NNA Analysis of the Security Infrastructure in the City of Lafia

Source: Author's Analysis (2021)

7.4.8 Summary of the infrastructure provision in Lafia

The infrastructure provision and development in Lafia was moderate but inadequate in its current state, but it did have a better outlook compared to the Other selected City. Six critical infrastructure areas were analysed, and the analysis was presented. The infrastructure audit

carried out in Lafia looked at the health, commercial, education, transport, places of worship and security infrastructure, and revealed a deficiency of eight different infrastructures cutting across the different spheres.

This analysis showed that Lafia had a deficiency of four primary schools and secondary schools, and this infrastructure was therefore judged to be inadequate in terms of the number of facilities. This left the primary and secondary schools in Lafia inadequate to meet the needs of the city dwellers. Two tertiary institutions were available, and they were deemed adequate as they enrolled students and employed staff from beyond the boundaries of the city. Furthermore, the condition of the infrastructure analysed indicated that although the primary schools were inadequate in number compared to international standards, the majority of the primary schools were in good condition. The secondary schools were also not adequate in number, but they were also in good condition. Finally, the tertiary educational infrastructure was observed to be adequate and in very good condition, as it served the city and the areas beyond, evidenced by the student enrolment and staffing across the departments.

Considering the health infrastructure in Lafia, it was observed that there was a deficiency in the number of health care facilities available, especially secondary health care infrastructure. In terms of the transport infrastructure, the data showed that the city of Lafia had a deficiency of about 22,000Km² of asphalt surfaced roads. The infrastructure audit also showed that the majority of the communal infrastructure was largely dispersed across the city landscape.

The commercial infrastructure in the Lafia International Market was observed to be in a good condition in terms of the ancillary services available. The shopping malls were in a fair condition and the private business outfits were also observed to be in fair condition, in keeping with the mean structural conditions of the infrastructures. The security infrastructure available showed that neighbourhoods in the city were fairly well policed in terms of the location of the police stations and posts at strategic points to manage the law and order in the city. This security situation accounted for the relative peace that the residents of the city had enjoyed over the years.

7.5 Infrastructure Provision and Characteristics in the City of Minna

The third city considered in this research was Minna, the capital of Niger State. Related research was examined on the infrastructure provision to enhance the city's liveability. The characteristics and functionality of these infrastructures were observed. The infrastructure analysis had the same variables as the other cities assessed earlier. The infrastructure examined was for education, health care, commercial activities, recreational activities, places of worship, and transportation. The focus was also placed on evaluating the locational attributes and distribution patterns of these infrastructures in the city of Lafia. The analysis employed tables, photographs, maps, and graphs showing the locations and the nearest neighbour analyses.

7.5.1 Educational infrastructure in Minna City

Minna was established in the colonial era as one of the cities in North-Central Nigeria to establish railway lines from the South to the North of the country. It became the state capital of Niger State in 1976 by the military decree establishing 12 states in Nigeria (Oduko, 1987; Suberu, 1991) Analysis of the educational infrastructure looked at the presence of all the educational infrastructure in the city. They were over 50 primary schools, 30 secondary schools (both public and private), and 6 tertiary educational institutions. These were the College of Education and Health Technology, the Newgate College of Health, the College of Arts and Islamic Studies, and the Federal University of Technology. Figure 7.51 shows the spatial location of an array of educational facilities in the city. Furthermore, the city of Minna housed the headquarters of the National Examination Council and the Military Training, Doctrine, and Command Centre, an institution for military training in Nigeria.

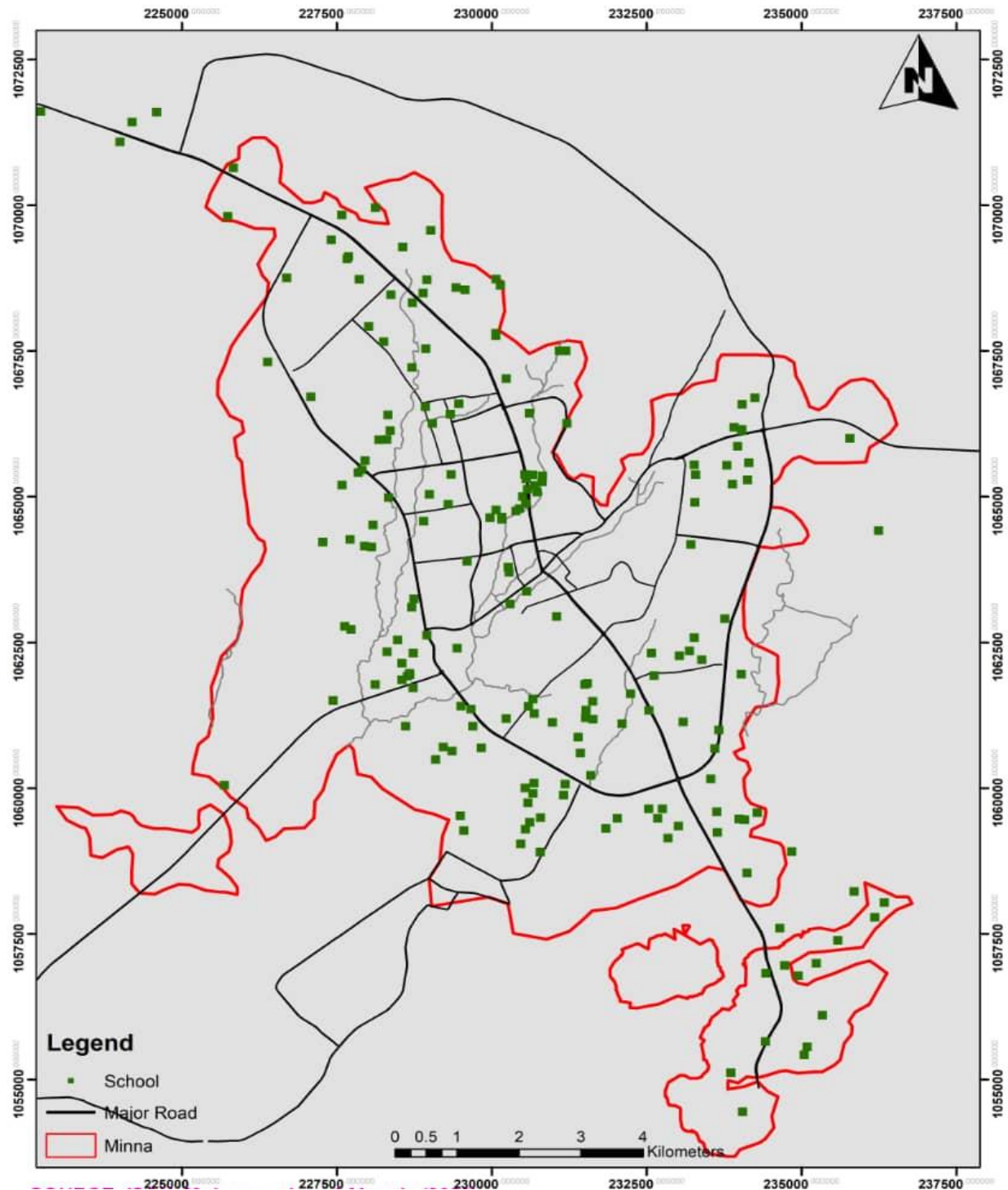


Figure 7.49: Educational Infrastructure in the City of Minna

Source: Author's Field survey (2021)

7.5.1.1 Locational attributes of the education infrastructure

The analysis of the spatial attributes of the educational infrastructure in Minna was conducted using the NNA. The NNA analysis indicated that the expected mean distance was 516.323m; the observed mean distance was 320.869m; the z-score was -10.09; and the p-value was 0.00.

The nearest neighbour ratio was 0.621. This clustered pattern implied that the z-score value and p-value of -10.09 and 0.00, respectively, had less than a 1 per cent likelihood of being a result of chance. The distribution pattern could thus have resulted from random chance. The educational infrastructure in Minna was clustered around the various residential neighbourhoods in the city. Figure 7.52 shows the NNA summary of the educational infrastructure in the city of Minna.

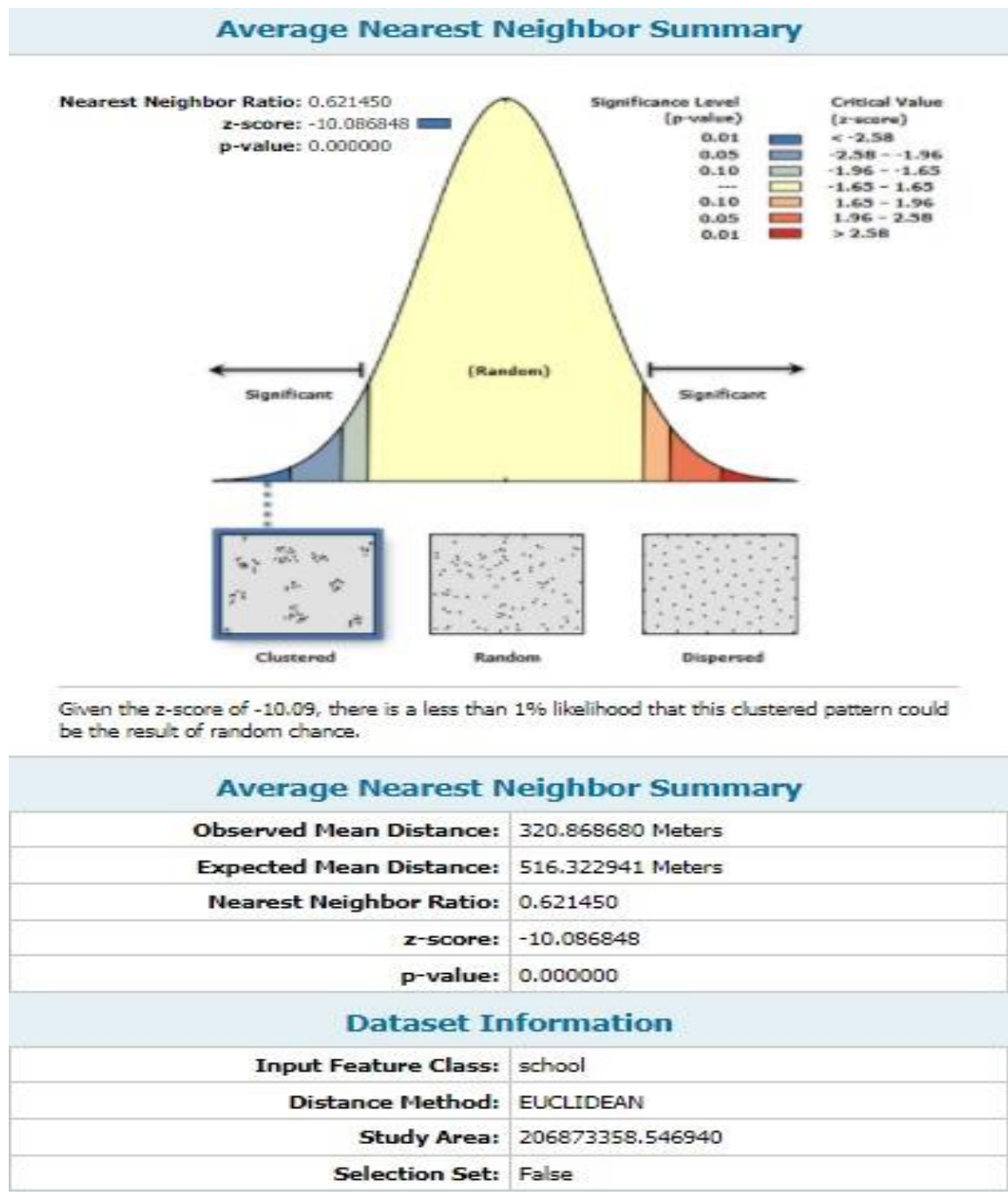


Figure 7.50: Locational Attributes of the Education Infrastructure

Source: Author's Field Survey (2021)

7.5.1.2 Mean structural conditions of the educational facilities in the city of Minna

The analysis of the observation of the educational infrastructure in Minna as one of the factors of urban livelihood indicated a variation in the structural conditions of these educational institutions. The government and private-owned higher institutions and private secondary schools were well maintained. In contrast, the public secondary and primary institutions were poorly maintained. Table 7.10 shows the mean structural conditions of the educational infrastructure in the city.

Table 7.10: Mean Structural Conditions of the Educational Infrastructure in Minna City

Facility	Mean Structural Condition	Remarks
Primary Educational Infrastructure	2.88	Fair
Secondary Educational Infrastructure	3.52	Good
Tertiary Educational Infrastructure	3.81	Good

Source: Author's Analysis (2021)

Figure 7.53 shows a government-owned secondary school under renovation in Minna. Many government schools were receiving attention for the renovation of these schools at the time of the study.



Figure 7.51: Ahmadu Bahago Secondary School' Minna

Source: Author's Field Survey (2021)

7.5.2 Health care infrastructure locations and distribution in the city of Minna

Health care is a critical component of a healthy city, so this was also examined in the city of Minna. The results of the analysis of the distribution in the spaces of the health facilities indicated 17 health care facilities in the city, ranging from PHCs to tertiary infrastructure. There were six PHCs in the city, ten secondary health care facilities, and one tertiary health care facility (IBB Specialist Hospital). Figure 7.54 shows the spatial distribution of the health care infrastructure in the city.

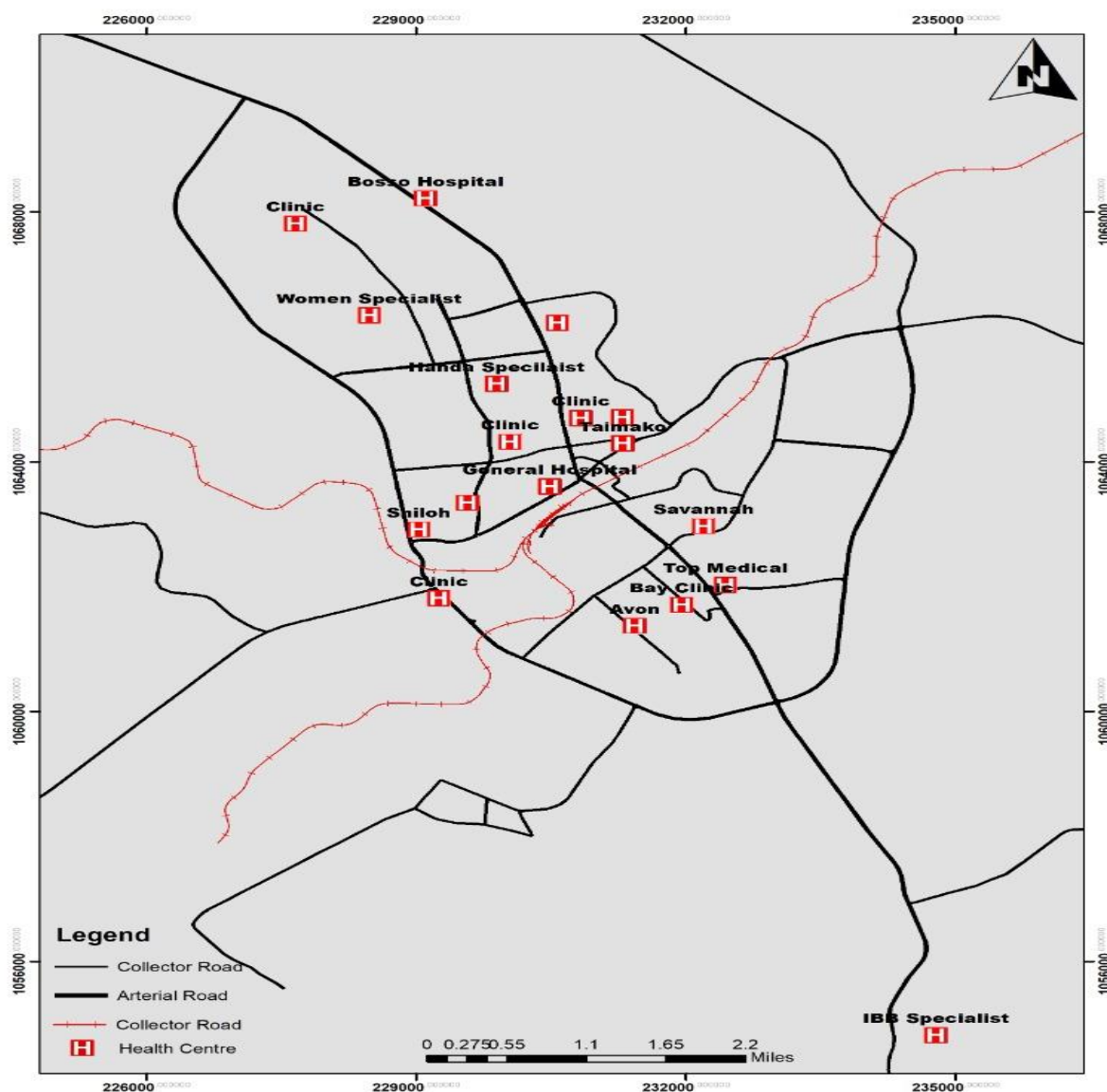


Figure 7.52: Health Care Infrastructure in Minna, North-Central Nigeria

Source: Author's Field Survey (2021)

7.5.2.1 Locational attributes of the health care infrastructure in Minna

Given the importance of health care facilities in the city space, the distribution of these facilities is also significant in measuring a city's liveability in terms of residents' health. This research, therefore, examined the locational attributes of this infrastructure within space in the city. The analysis using NNA showed that the observed mean distance between the health care facilities in the city was 1,245.467m; the expected mean distance was 798.672m; the z-score was 4.54, and the p-value was 0.000. The nearest neighbour ratio obtained was 1.56. Hence, given the z-score and the p-value of 4.54 and 0.000, respectively, it was implied that there was a less than 1 per cent likelihood of a dispersed distribution pattern resulting from random chance. Therefore, it could safely be concluded that the locational distribution of the health care infrastructure in Minna was dispersed. Figure 7.55 shows the NN' analysis of the city's health infrastructure's locational attributes.

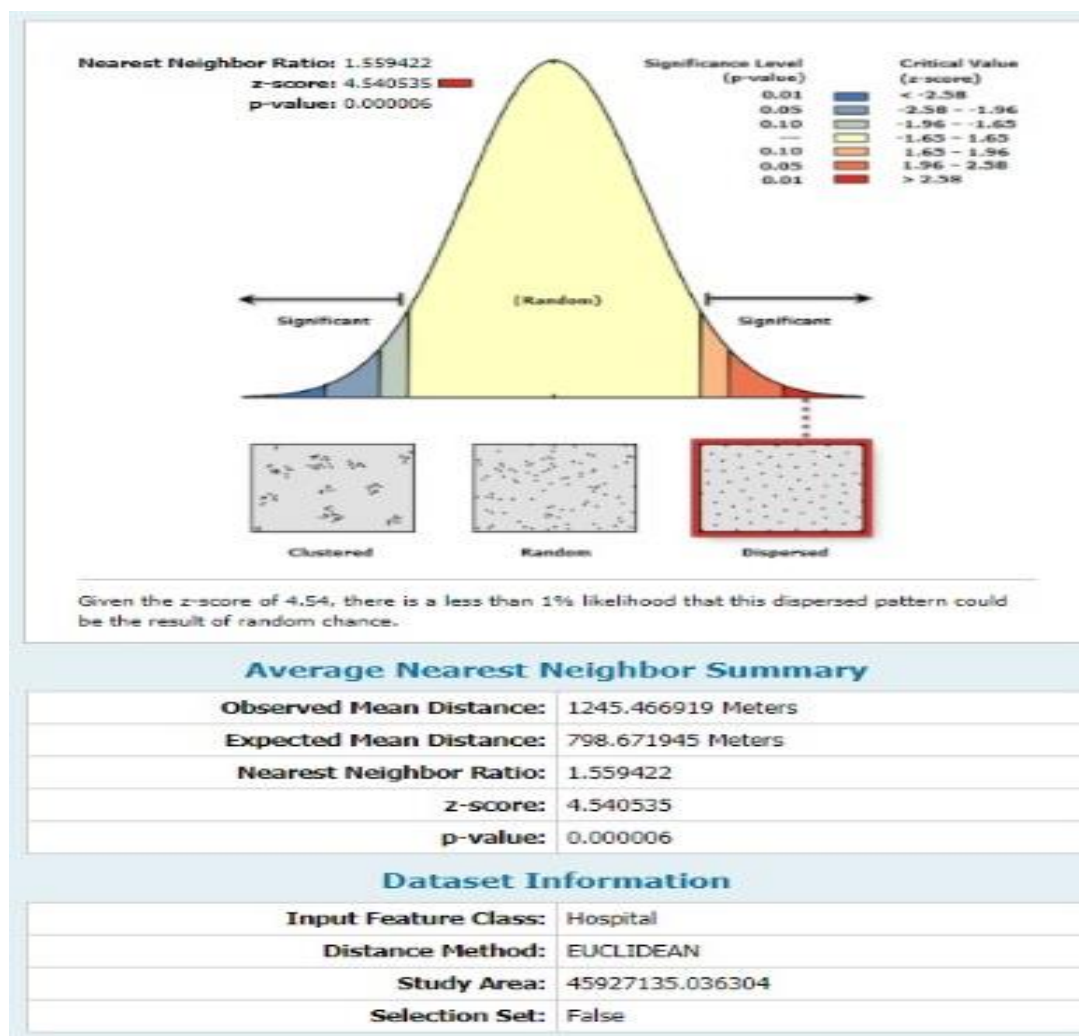


Figure 7.53: Locational Attributes of the Health Care Infrastructure in Minna

Source: Author's Analysis (2021)

7.5.2.2 Mean structural conditions of the health care facilities in the city of Minna

The observation of the health care infrastructure in Minna as one of the factors of urban livelihood indicated a fair structural condition of this health care infrastructure. The government and private-owned hospitals and clinics were in fine condition. In contrast, the public tertiary health care was in sound condition. Table 7.11 shows the mean structural conditions of the health care infrastructure in the city.

Table 7.11: Mean Structural Conditions of the Health Care Infrastructure in Minna City

Facility	Mean Structural Condition	Remarks
Primary Health Care Infrastructure	3.08	Fair
Secondary Health Care Infrastructure	3.32	Fair
Tertiary Health Care Infrastructure	3.57	Fair

Source: Author's Analysis (2021)

Figure 7.56 shows an example of the health care infrastructure and its maintenance in the city.



Figure 7.54: Example of a Primary Health Care Centre Facility in the City of Minna

Source: Author's Field Survey (2021)

7.5.3 Commercial infrastructure in the city of Minna

The analysis of the commercial infrastructure in Minna looked at the banks, petrol filling stations, markets, shops, shopping complexes, and mechanics' workshops. The analysis was carried out using spatial location and an NNA analysis. The results are presented thus:

7.5.3.1 Banks

The banks' spatial locations in Minna City indicated that all of the banks were lined up along the Tegna-Minna-Abuja highway. There were 20 banks within the city. However, some of the banks had additional branches and that increased their number of banking premises. Three banking facilities were observed in Minna. The zonal office of the Central Bank of Nigeria was located in the city, and all of the commercial banks and micro-finance banks were concentrated in the city centre, forming the hub of commercial activities, as shown in Figure 7.57.

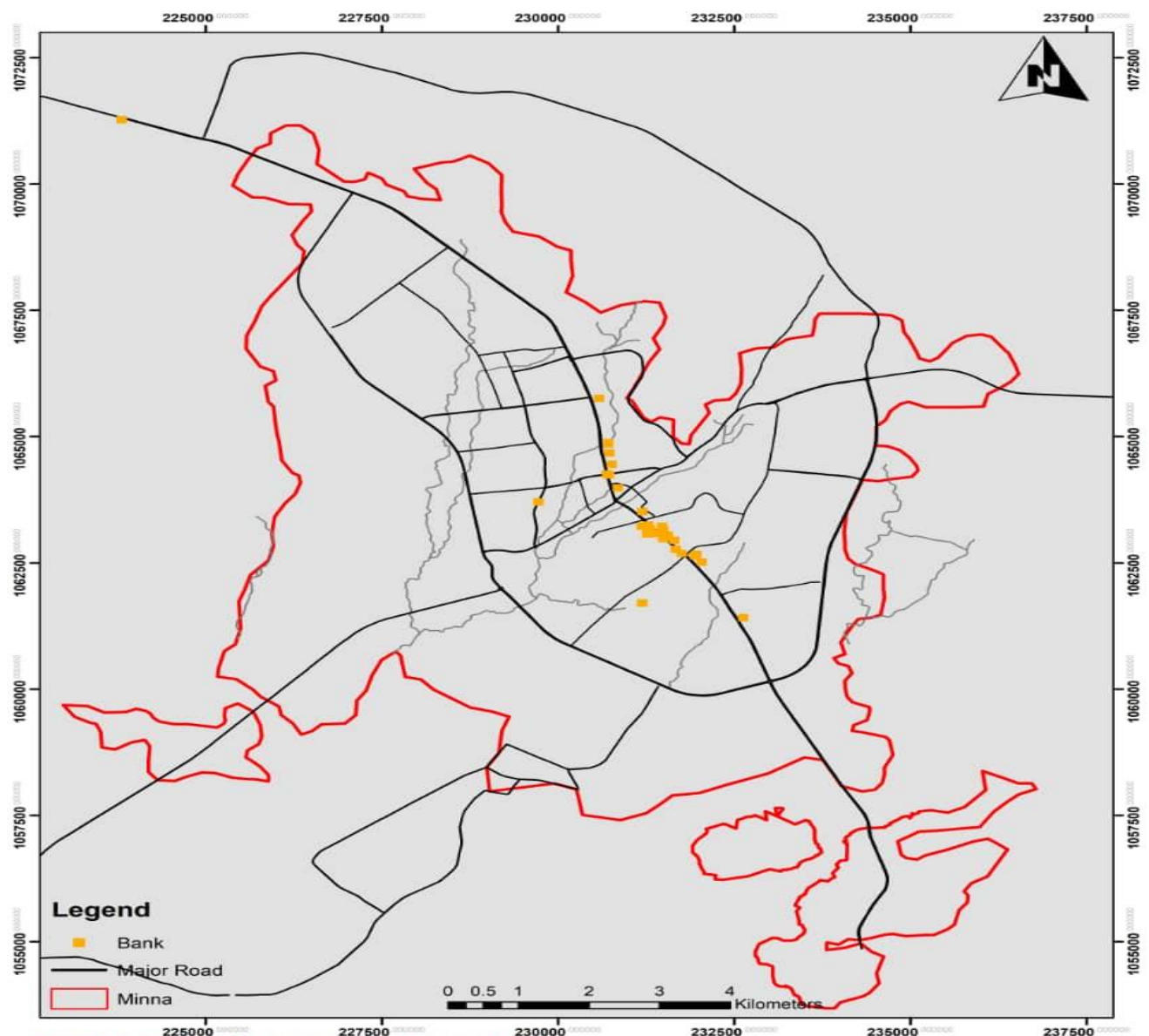


Figure 7.55: Banks in Minna, North-Central Nigeria

Source: Author's Analysis (2021)

7.5.3.2 Markets, shops, and shopping complexes

The results of the analysis conducted of the markets, shops attached to houses, and the shopping complexes that enhanced buying and selling to meet the essential needs of the city dwellers were as follows: There were two categories of market serving the people in the city, namely the Minna International Market and the local markets that served the neighbourhoods. There was one international market and six neighbourhood markets in the neighbourhoods of Chanchaga, Maitumbi, New Market, Bosso, Kpakungu, and Tunga. There were numerous small shops around the city and 20 shopping complexes lined along the major highways. Figure 7.58 shows the spatial location of the market, small shops and shopping complexes in the city of Minna.



Figure 7.56: Spatial Location of the Market, Shops and Shopping Complexes in the City of Minna

Source: Author's Field Survey (2021)

7.5.3.3 Mean structural conditions of the markets and shopping facilities in the city of Minna

The analysis of the observation of the markets and shopping complex infrastructure in Minna indicated the following: The shopping complex infrastructure in the city was well structured and in good condition. The international market was also in good condition structurally, but the conditions of the neighbourhood markets were not desirable. Some were poorly maintained, and many were meant for an open market system. Table 7.12 shows the mean structural conditions of the city's market and shopping complex facilities.

Table 7.12: Mean Structural Conditions of the Commercial Facilities in Minna City

Facility	Mean Structural Condition	Remarks
Neighbourhood Markets	2.38	Poor
International Market	3.92	Good
Shopping Complexes	3.88	Good

Source: Author's Analysis (2021)

7.5.3.4 Mechanics' workshops

The results of the analysis of the spatial distribution of the mechanics' workshops indicated that there were ten such organised locations. These locations were concentrated in the city centre and along the arterial road (Western Bypass). The workshops were not arranged correctly, and this made the premises and the activities rather rowdy. The study also revealed that spare parts sales were incorporated into these workshops, without adequate spatial arrangement of the premises. Spatial planning was also not employed when allocating these artisans their workspaces in the workshops. Figure 7.59 shows the spatial distribution of these mechanics' workshops in the city of Minna. The mean structural conditions of the workshops showed a variety of levels of maintenance of these workshops. Table 7.13 shows the mean structural conditions of the workshops.

Table 7.13: Mean Structural Conditions of the Commercial Mechanics' Facilities in Minna City

Facility	Mean Structural Conditions	Remarks
Kpakungu Mechanic Workshop	2.28	Poor
Dutse-Kura Mechanic Workshop	3.02	Fair
Oduoye-Quarters Mechanic Workshop	3.18	Fair
Eid Mechanic Workshop	2.77	Fair
Bosso Mechanic Workshop	3.05	Fair

Source: Author's Analysis (2021)

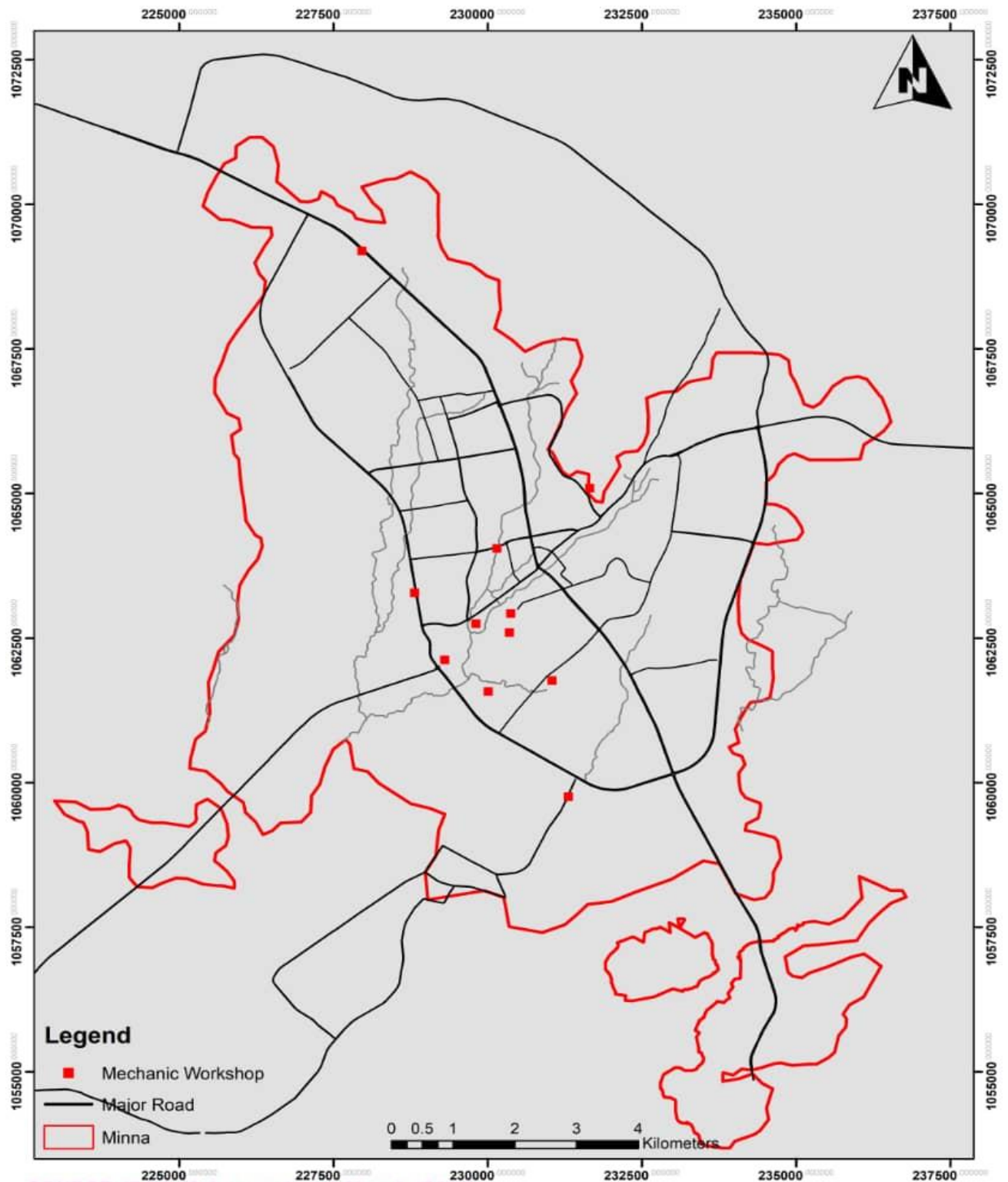


Figure 7.57: Mechanics' Workshops in Minna, North-Central Nigeria

Source: Author's Field Survey (2021)

7.5.3.5 Locational attributes of the mechanics' workshop infrastructure in Minna

The result of the NNA analysis of the mechanics' workshops showed that the observed mean distance was 1,420.67m; the expected mean distance was 1,480.80m; the z-score was -0.258; and the p-value was 0.797. The nearest neighbour ratio was 0.96. The z-score value and p-value showed that the pattern of distribution not significantly different from that of random positioning. This infrastructure was therefore distributed randomly and indiscriminately across the city. Figure 7.60 shows the NNA analysis of the mechanics' workshops and garages in the city.

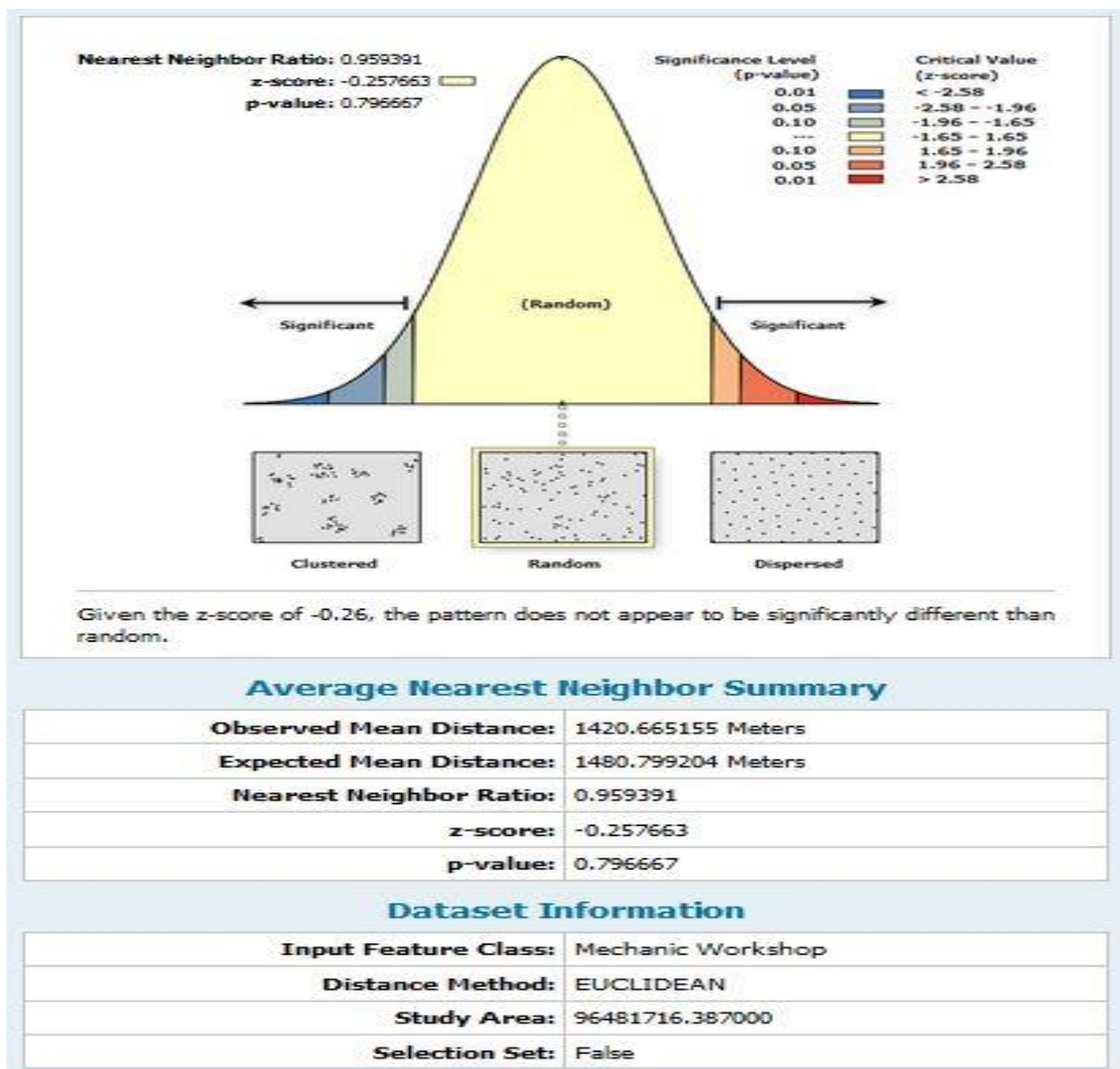


Figure 7.60: Mechanics' Workshops in the City of Minna

Source: Author's Analysis (2021)

7.5.3.6 Petrol filling stations

The spatial distribution of the petrol filling stations in Minna showed that there were over 60 filling station distributed around the city. The presence of a filling station in the city did not, however, imply a product supply. Figure 7.61 shows the spatial distribution of the filling stations in the city of Minna.

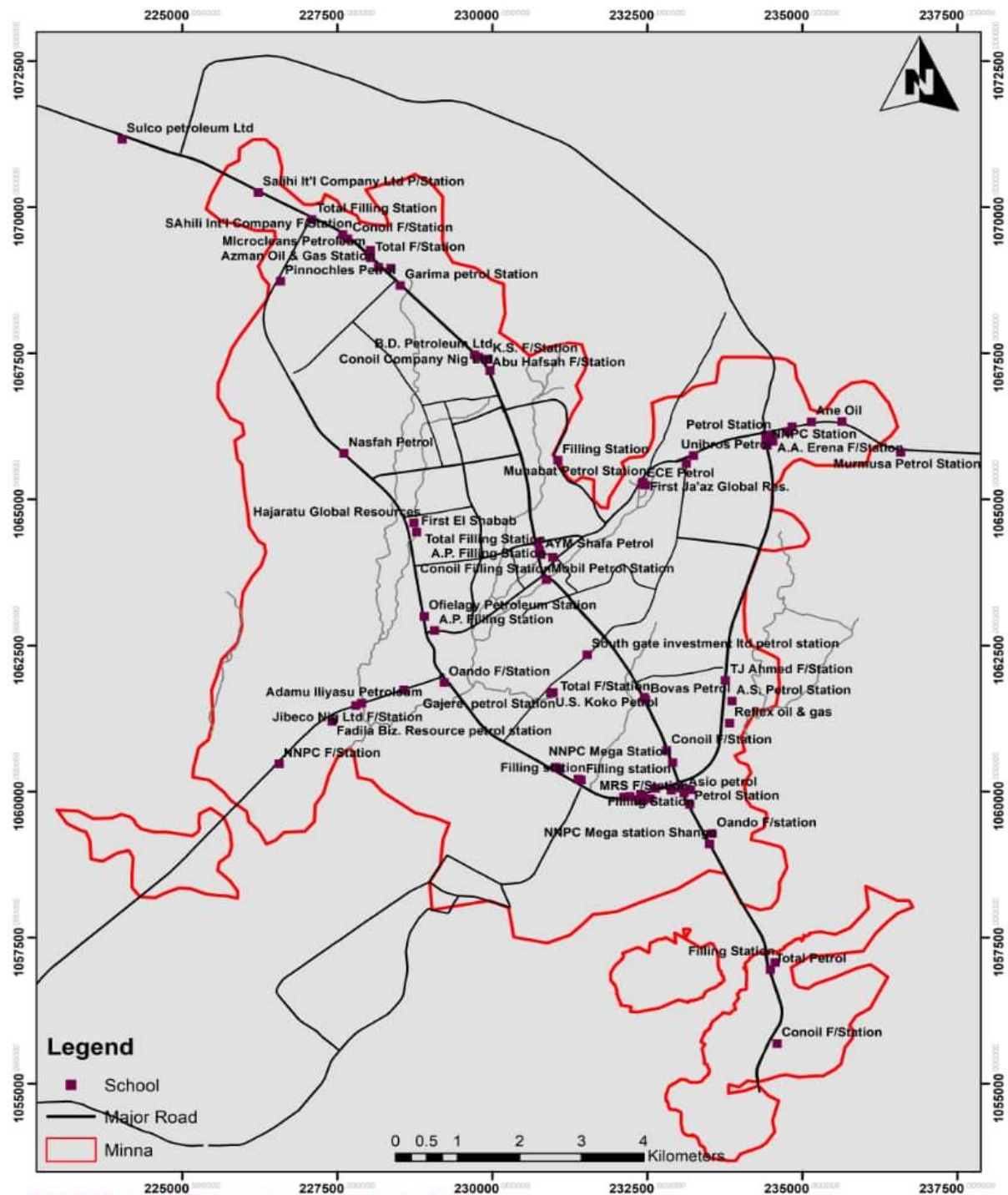
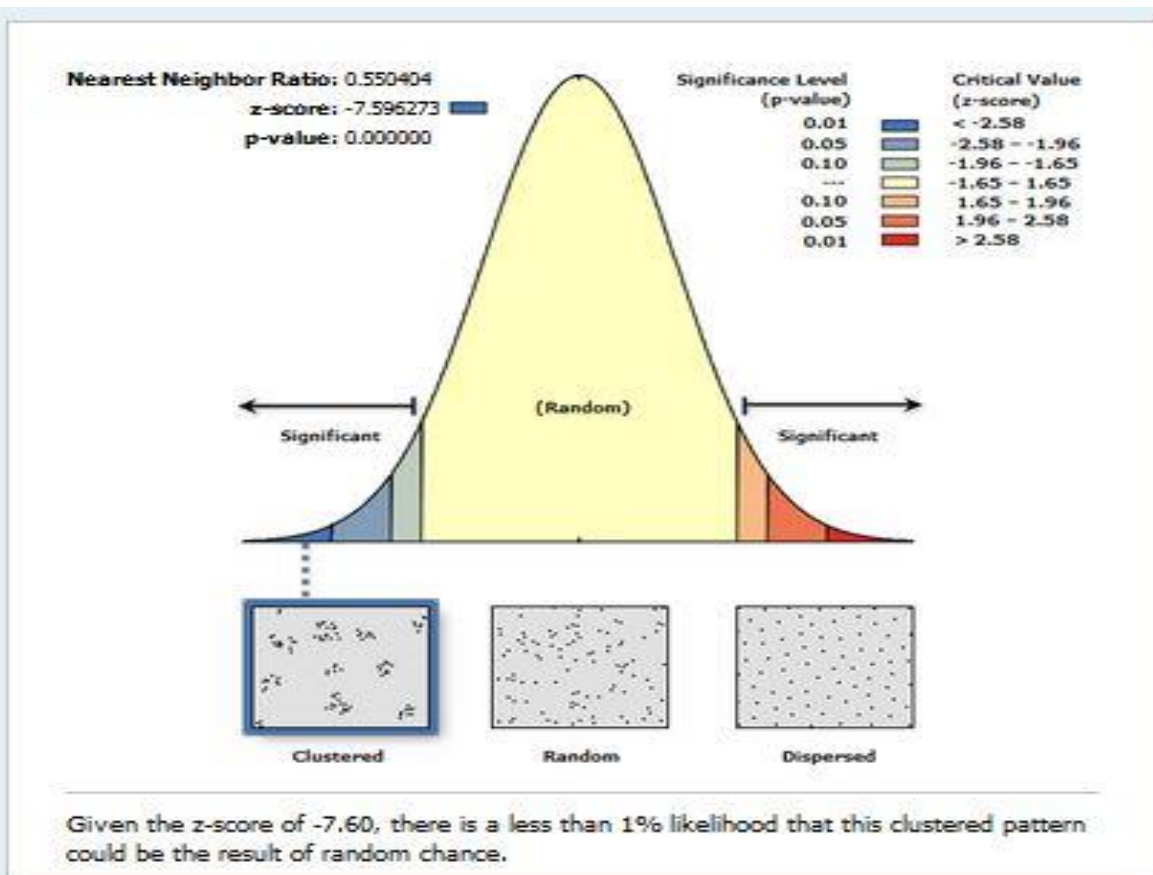


Figure 7.58: Spatial Distribution of the Petrol Stations in Minna

Source: Author's Field Survey (2021)

7.5.3.7 Locational attributes of the petrol filling station infrastructure in Minna

Critical products for meeting household energy needs were dispensed at the various petrol stations within the city. The results of the NNA analysis of the petrol stations indicated that the expected mean distance between the petrol stations was computed at 306.074m; the observed mean distance was 556.090m; the z-score value for the analysis was -7.60; and the p-value was 0.000. The nearest neighbour ratio was 0.550. Given the z-score of -7.60, there was a less than 1 per cent likelihood that this clustered pattern of infrastructure had resulted from random chance. Hence, it could be concluded that the pattern of distribution of the petrol stations in Minna was a clustered as shown in Figure 7.62.



Average Nearest Neighbor Summary

Observed Mean Distance:	306.074298 Meters
Expected Mean Distance:	556.090164 Meters
Nearest Neighbor Ratio:	0.550404
z-score:	-7.596273
p-value:	0.000000

Dataset Information

Input Feature Class:	Petrol Station
Distance Method:	EUCLIDEAN
Study Area:	96481716.387000
Selection Set:	False

Figure 7.59: Petrol Stations in Minna, North-Central Nigeria

Source: Authors Field Survey (2021)

7.5.4 Places of worship infrastructure in Minna City

Analysis of the places of worship in Minna, like in the other cities, showed the proliferation of churches and mosques. These two main religions were the basis for the analysis of this type of infrastructure. The spatial distribution result is presented thus:

7.5.4.1 Churches

The physical observation of the city's distribution of churches showed over 120 churches of different denominations and sizes. The churches were spread around the centre of the city. Figure 7.63 shows the spatial distribution of the churches in the city. The churches added beauty to the city's landscape as different designs and shapes were observed.

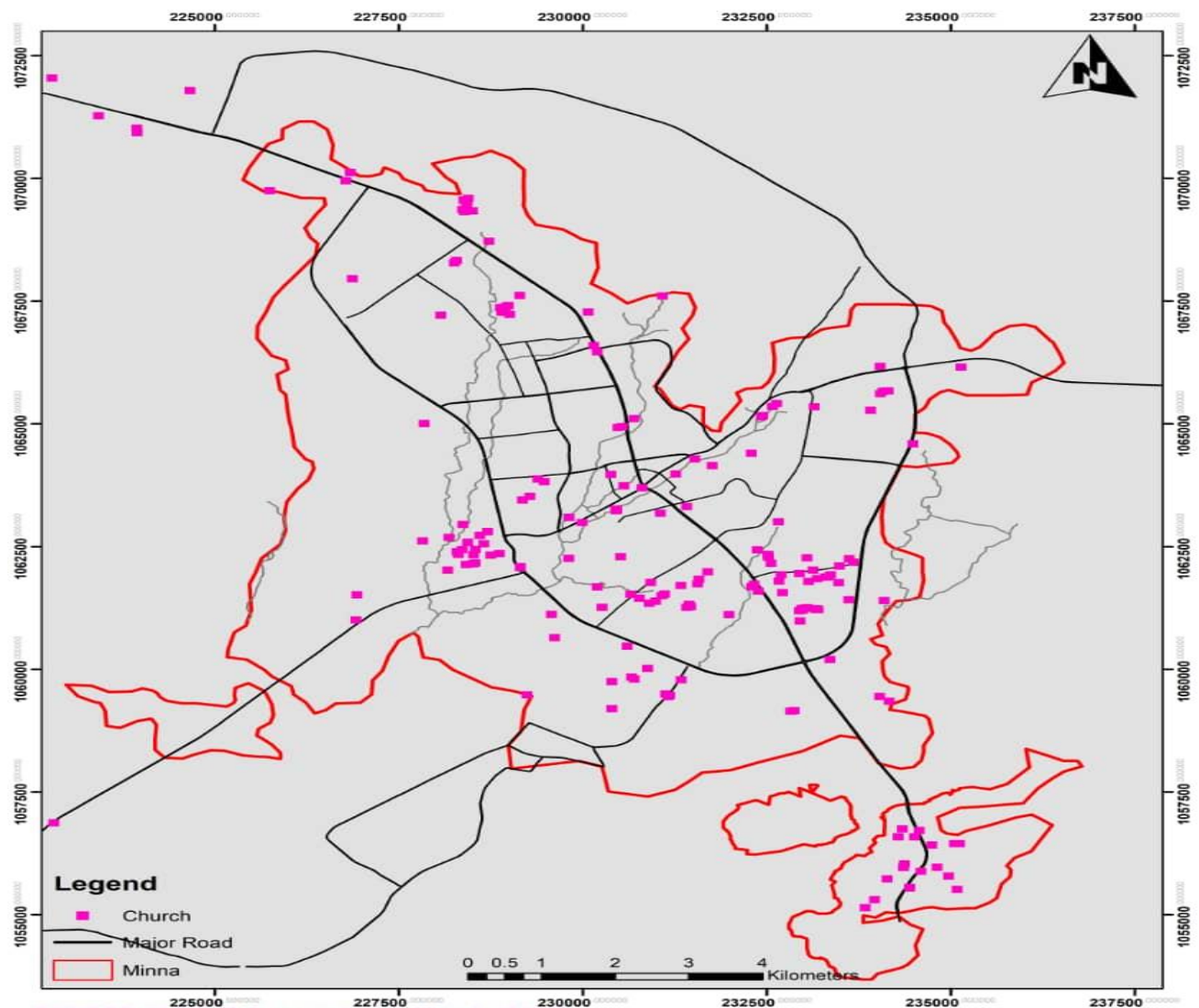


Figure 7.60: Spatial Distribution of the Churches in Minna, North-Central Nigeria

Source: Author's Analysis (2021)

7.5.4.2 Mosques

The survey of the location and distribution of mosques in Minna indicated two categories of mosques in the city: the central and the neighbourhood mosques. There were 15 central mosques and over 100 neighbourhood mosques. The proliferation of the mosques in the city had to do with the simplicity of the construction of the mosques and the willingness of

individuals to build mosques on their premises. Figure 7.64 shows the spatial distribution of the mosques in the city.

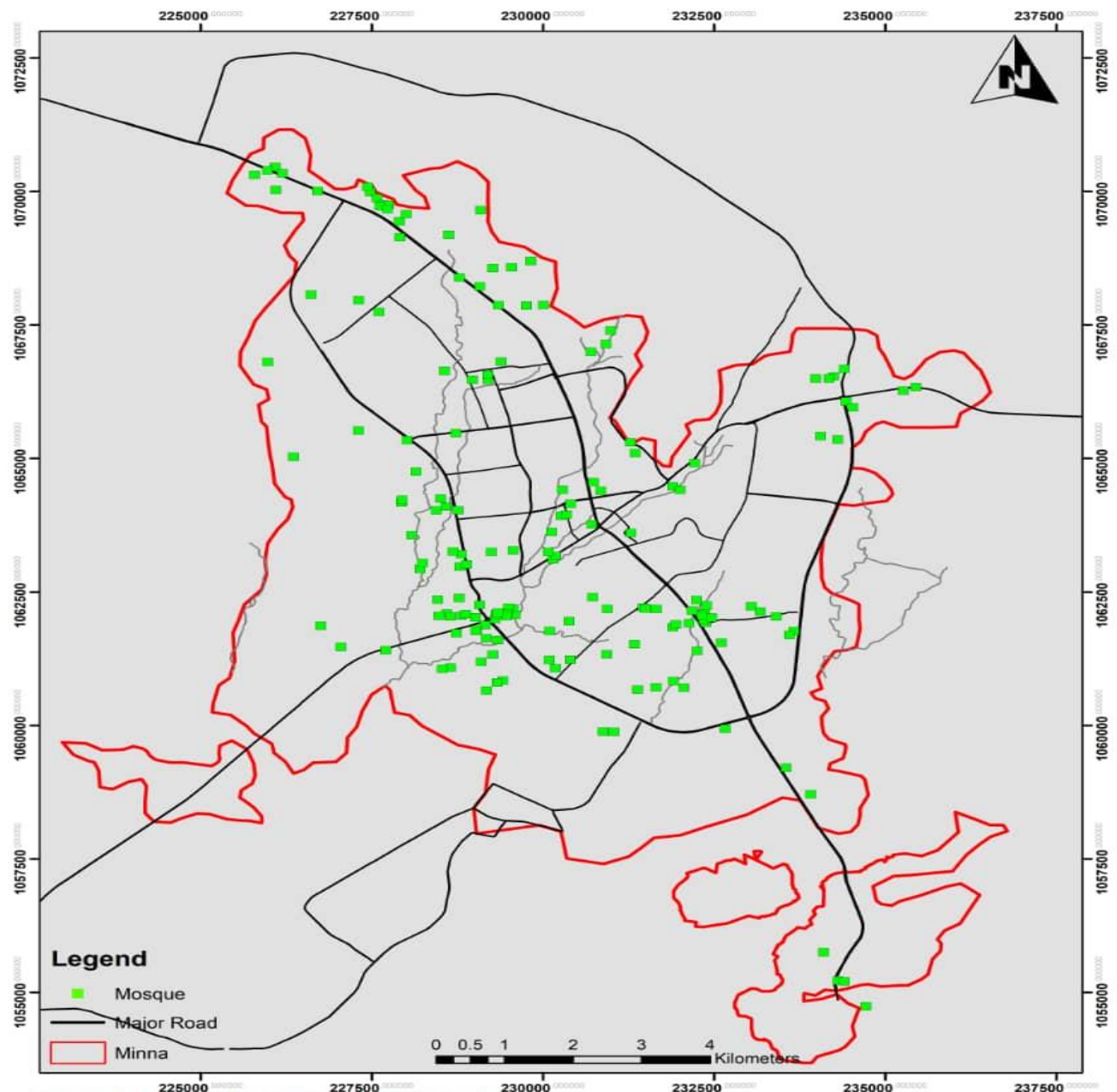


Figure 7.61: Spatial Distribution of the Mosques in Minna, North-Central Nigeria

Source: Author's Analysis (2021)

7.5.4.3 Locational attributes of the places of worship infrastructure in Minna

The results of the NNA of the places of worship in Minna showed that the observed mean distance was 311.64m; the expected mean distance was 383.50 m; the z-score value was -4.59; and the p-value was 0.000. The nearest neighbour ratio was 0.813. The z-score value and the p-value of the analysis implied that there was a less than 1 per cent likelihood that this clustered

pattern could result from random chance. Figure 7.65 shows the results of the NNA analysis of the worship infrastructure in Minna.

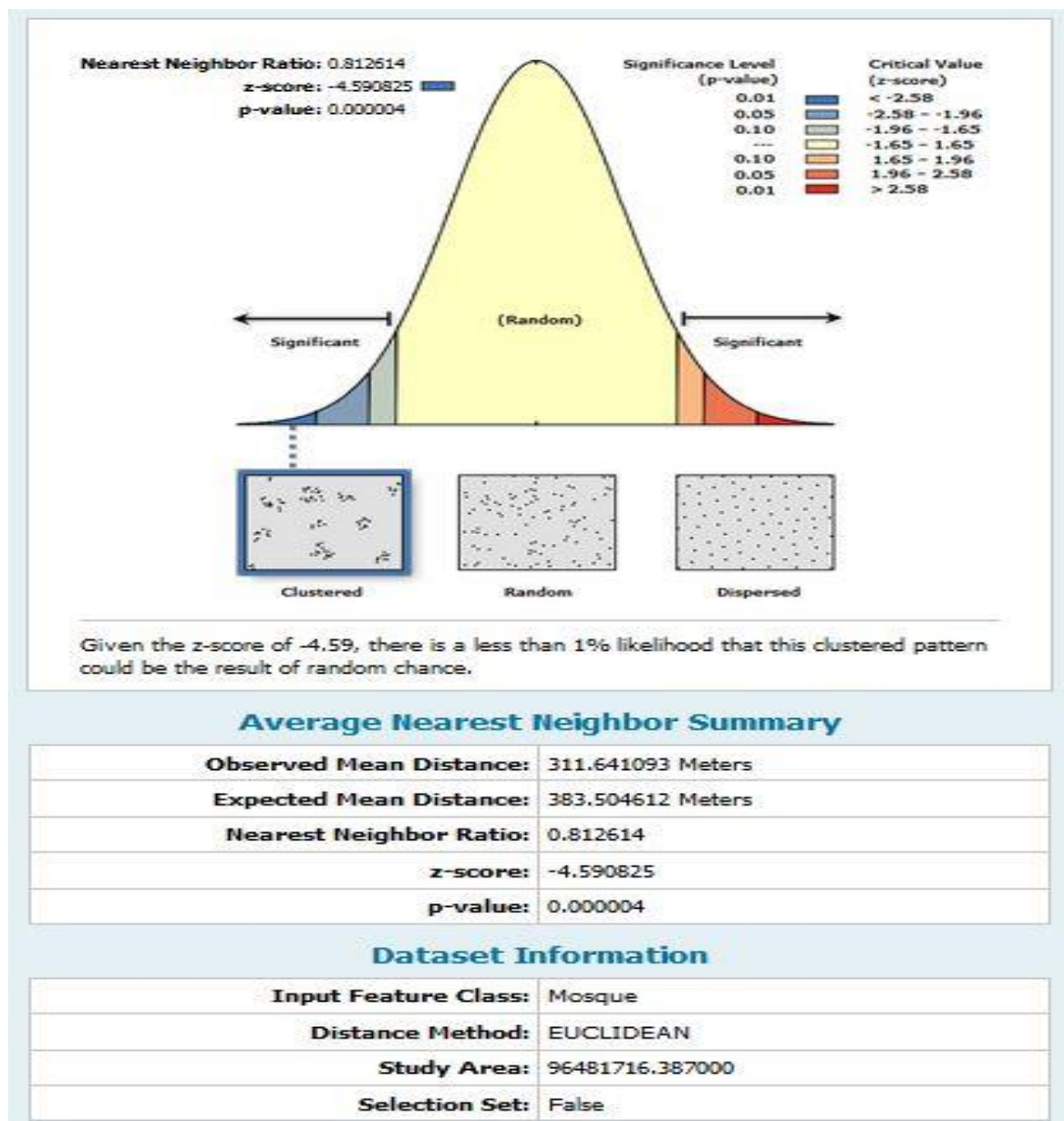


Figure 7.62: Locational Attributes of the Mosques in Minna City

Source: Authors Field Survey (2021)



Figure 7.63: Minna Central Mosque, Minna CBD

Source: Author's Field Survey (2021)

7.5.5 Security infrastructure in the city of Minna

Urban services and infrastructures are critical factors that sustain the livelihoods of urban residents. These urban services also determine the aggregate of the population in the city at any one time to a considerable extent. One of the critical urban services is security provision that enables people to have peace of mind and to live peacefully. The city of Minna, like any other city in the country, was protected by the presence of police stations and police posts in the neighbourhoods. The research analysis indicated the presence of police stations, military barracks, and a private security network in the city.

The records of the Nigerian police force (Niger State Command) indicated that 1,738 police officers were manning positions in the city of Minna (comprising two Local Government Areas). As projected by the NPC (2008), the estimated population of Minna was about 487,996. The number of police officers included all of the personnel attached to political office holders as protection officers. If those were excluded, this would leave about 1,253 personnel to maintain law and order in the city. Police officers were also attached to other establishments such as banks, supermarkets, and in response to other people's requests. Furthermore, there was a contingent of police officers tasked with the responsibility of controlling traffic, and this further reduced the numbers of police officers available to control the crime in Minna. Table 7.14 shows the records and locations of the police stations and posts in Minna.

Table 7.14: The Number of Police Divisions and Manpower Distribution in Minna

Local Government Area	Division	Police Posts	SPOs	Inspectors	Rank and File	Total
Chanchaga	“B” Department Operations	• House of Assembly	12	30	318	360
	“A” Division (Central/Stadium Road)	• London Quarters	10	24	124	158
	“B” Division (Paiko Road)	• Morris • Central Market • Gwari Market • NTA/Nitel	4	16	233	253
	GRA	• Kure Ultra-Modern Market	2	18	108	128
	Tudun Wada	• Tunga Market • State Secretariat	6	15	183	204
	Kpakungu	• Barki Sale • Gidan Kwanu • Garatu • Sabon Daga • Ungwa Kaje	4	8	106	118
	Maitumbi		3	17	67	87
	Bosso		4	13	120	137
	Maikunkele	• Airport • Beji	3	10	74	87
	Chanchaga	• Shango	5	11	190	206
Total			53	172	1,513	1,738

Source: Niger State Police Command Records (2021)

According to these records, there was about one police officer to about one thousand people, which negated the efforts of the police to curb crime. Policing the town was cumbersome, which caused the breakdown of law and order. The city was therefore not well policed, which led to many crimes being committed without any way to curb them. Inadequacy of equipment, personnel, and poor planning also made policing ineffective. Poor planning of neighbourhoods also allowed criminals to perpetrate their acts without being caught.

Postings were usually rotated so that the police officers did not stay in a particular post for too long. Table 7.14 shows that areas with a high population concentration had low numbers of police officers. For example, Minna Central, Kpakungu, Limawa, and Bosso had about 529 police officers, while Government Reserve Areas [GRA] had about 200 police officers. The implication of this was that there was no basis for the distribution of the police officers. Instead, their distribution was based on the safety of the government officials and rich men, at the expense of the ordinary citizens. The spatial distribution of the security operatives in Minna is shown in Figure 7.67.

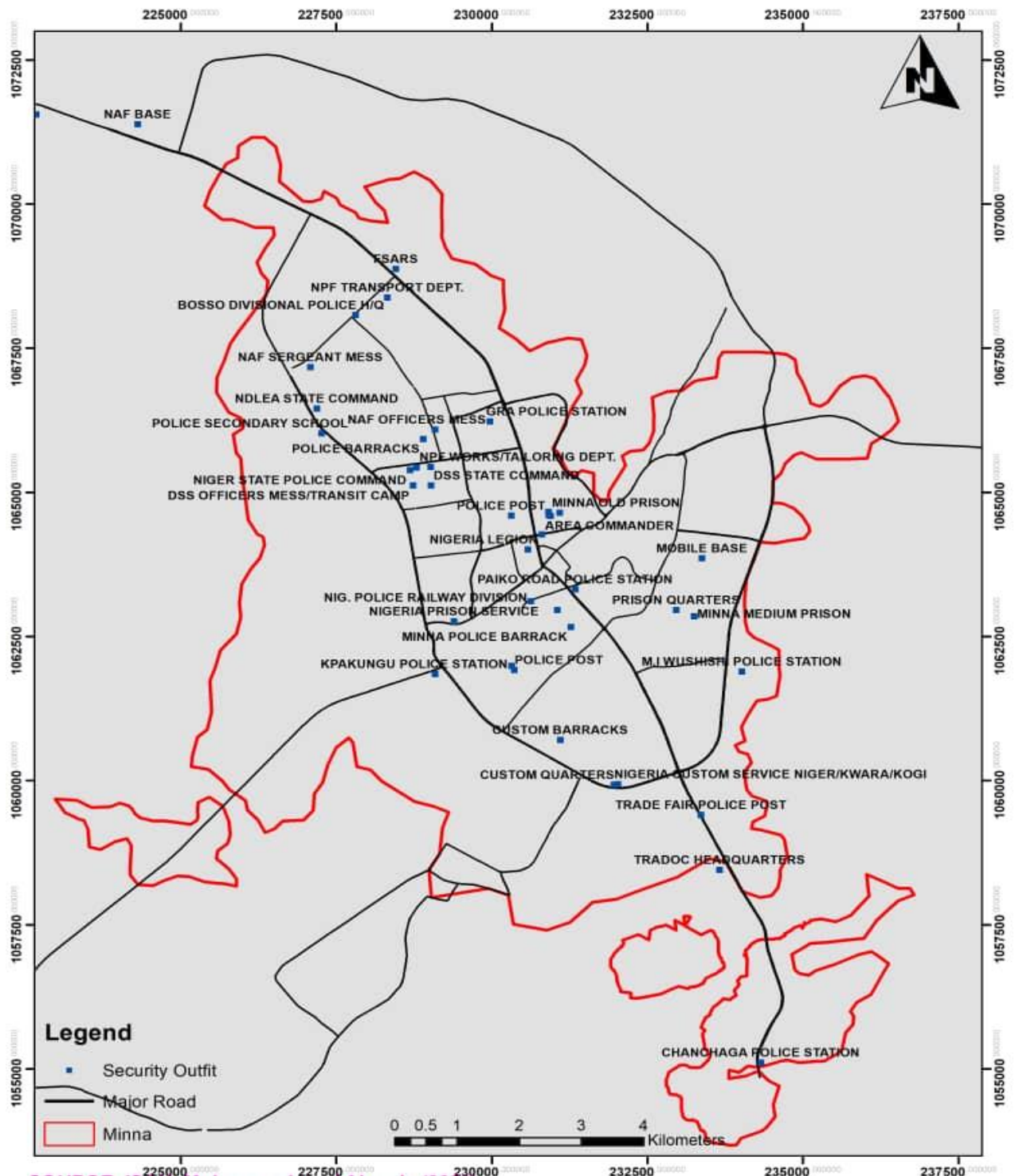


Figure 7.64: Spatial Distribution of the Security Outfits in Minna City

Source: Author's Field Survey (2021)

7.5.6 Recreational infrastructure

Recreational infrastructure is seen as one of the criteria for measuring liveable cities. This research looked at the recreational infrastructure in Minna, including places of active recreation and places of passive recreation. The spatial analysis of this infrastructure is presented in this section of the study.

7.5.6.1 Active recreational infrastructure

The active recreational infrastructure available in Minna included the Bako Kontagora Memorial Stadium, Independent Park, Democracy Garden, Murtala Park, an indoor sports hall, and open spaces within the schools' premises, such as Ahmadu Bahago, Limawa, and several other schools. The active recreational infrastructure in Minna was observed to be grossly inadequate. Figure 7.68 shows the spatial distribution of the active recreational infrastructure in Minna.

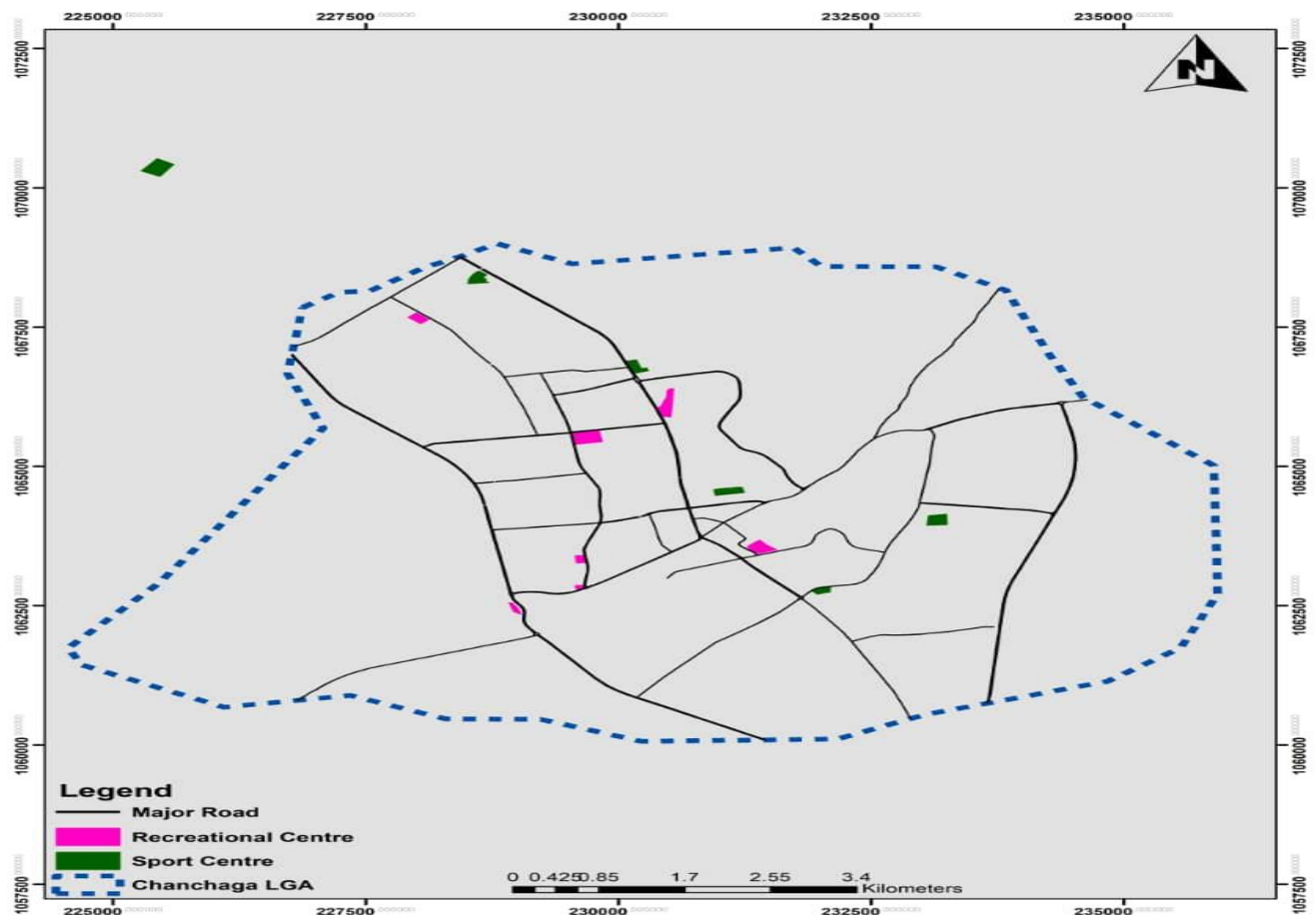


Figure 7.65: Active Recreational Centres in Minna, North-Central Nigeria

Source: Author's Field Survey (2021)

7.5.6.2 Passive recreational infrastructure

The count of the passive recreational infrastructure (mainly hotels and leisure spots) showed 25 hotels in the city. These included 3-star hotels (15), 4-star hotels (6), and 4 5-star hotels. These hotels provided leisure for people and some indoor recreational facilities. The hotels were located mainly along the Western Bypass of the city (South-Western part, as shown in Figure 7.69).

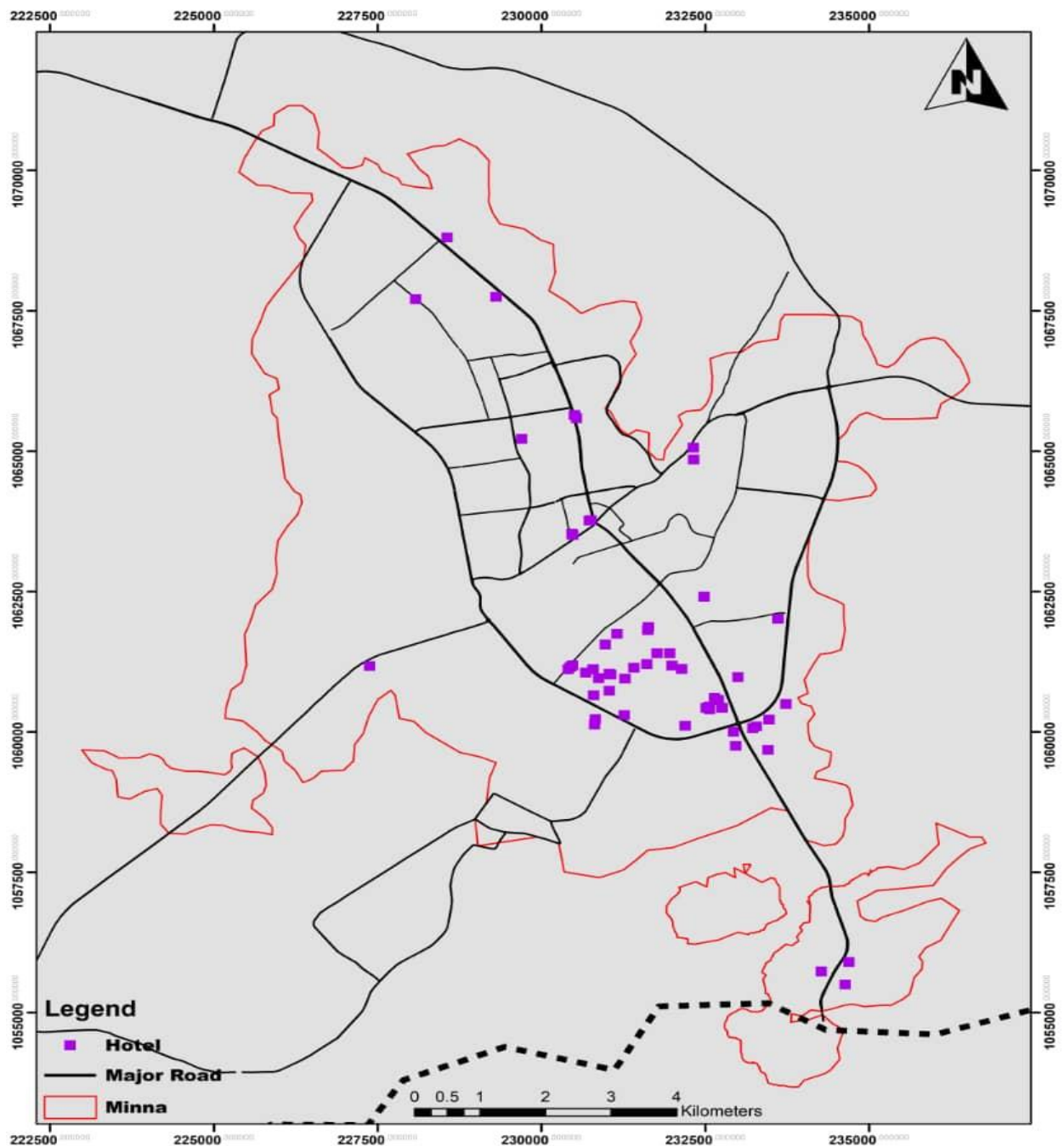


Figure 7.66: Hotels and Leisure Spots in Minna, North-Central Nigeria

Source: Author's Analysis (2021)

7.5.6.3 Locational attributes of the active recreational infrastructure in Minna

The locational attributes of the recreational infrastructure in Minna were also appraised using the NNA method. The analysis indicated that the observed mean distance was 395.418m; the expected mean distance between the infrastructure was 677.110m; they had a z-score of -3.73; and the p-value was 0.000. The nearest neighbour ratio was 0.58. This implied a less than 1 per cent likelihood of the clustered pattern being because of random chance. Hence, the distribution pattern of the recreational and leisure facilities in Minna was judged to have a clustered pattern. Figure 7.70 shows the NNA analysis of the locational attributes of the active recreational infrastructure in Minna. Figure 7.71 also shows an example of an active sporting facility in the city.

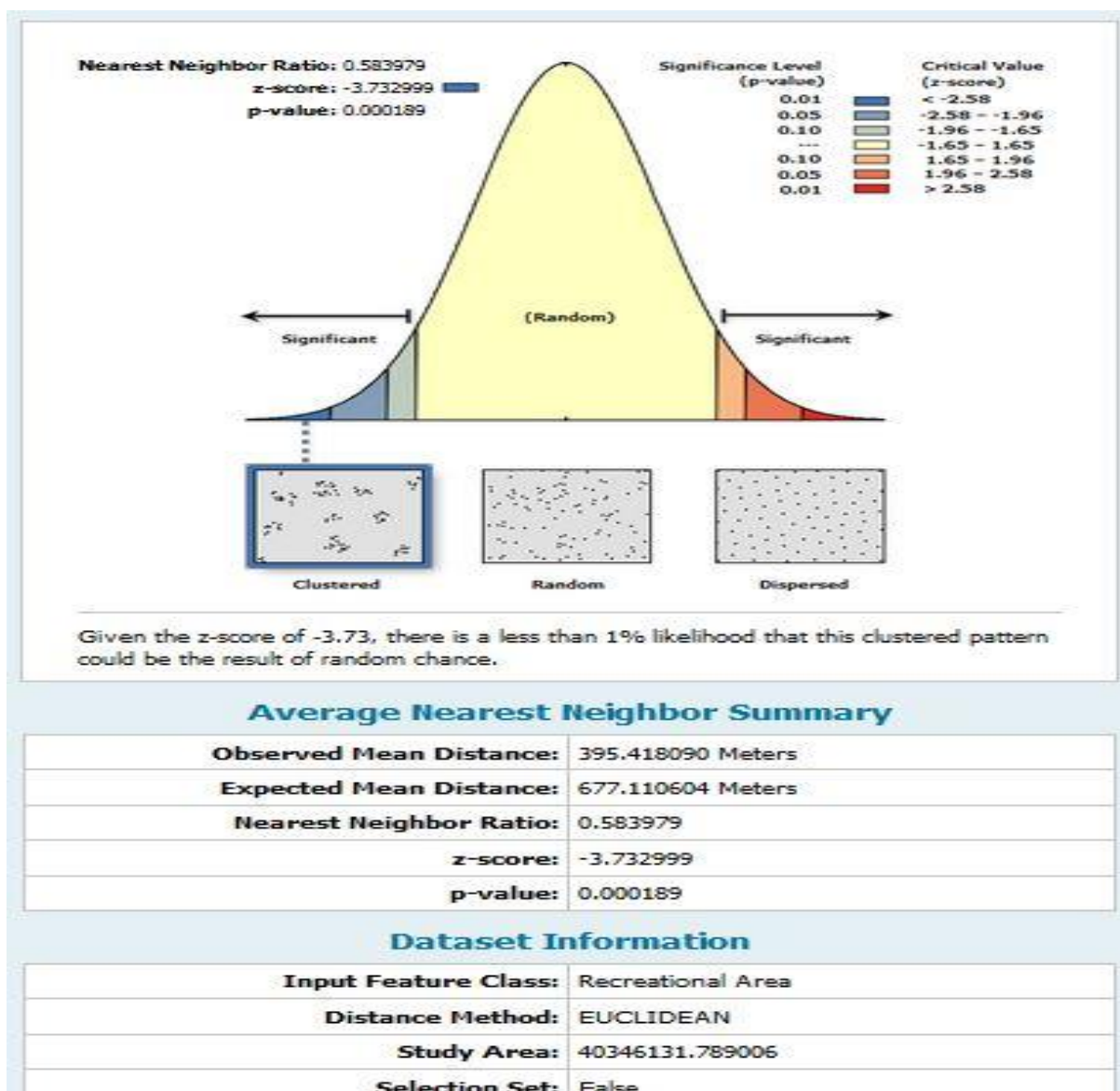


Figure 7.70: Locational Attributes of the Active Recreation and Leisure infrastructure

Source: Author's Analysis (2021)



Figure 7.67: Recreational Spots and Paved Roads in Tunga Low-cost Housing' Minna

Source: Author's Field Survey (2021)

7.5.6.4 Locational attributes of the passive recreation and leisure infrastructure in Minna

This research also examined the locational attributes of Minna's passive recreational infrastructure (hotels and leisure spots). The result indicated that the expected mean distance was 650.512m; the observed mean distance was 324.710m; the z-score was -7.23; and the p-value was 0.000. Furthermore, the nearest neighbour ratio was 0.5. The implication was that the p-value and the z-score showed clustered characteristics. Hence, there was less than a 1 per cent likelihood that this clustered pattern was the result of random chance, and so the passive recreational infrastructure in Minna had a clustered distribution pattern. Aside from the hotels and leisure facilities within the city, another recreational space available within the city was the Emir's Palace, sitting on about ten hectares of land comprising spaces for the annual Durbar Festival. This festival was often celebrated on the day after the Muslim Eid Festival. This edifice also served as a cultural and traditional relic in the city and the condition of this edifice at the time of the study is shown in Figure 7.72. Figure 7.73, on the other hand, shows the NNA generated for the passive recreational infrastructure in the city.

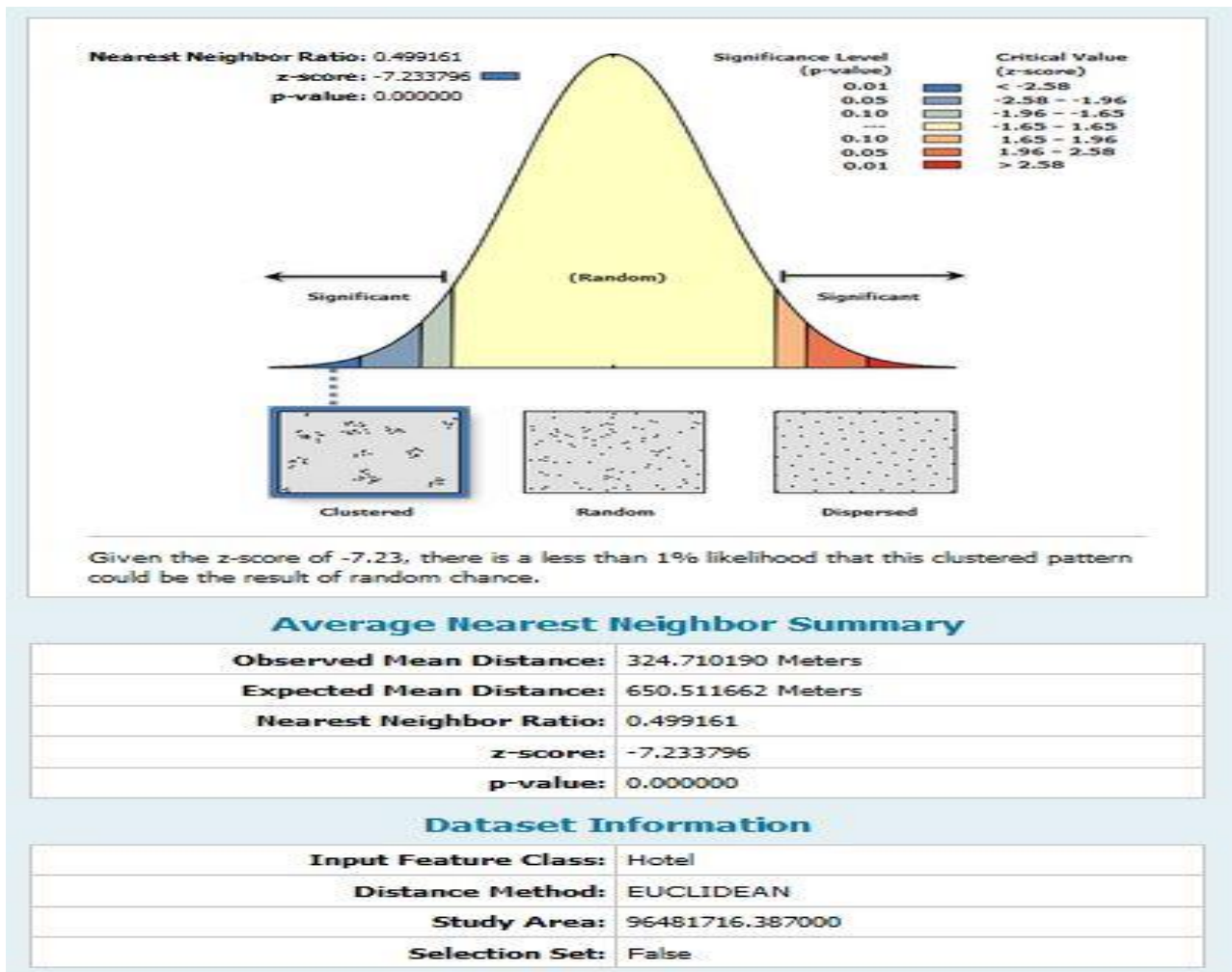


Figure 7.68: Locational Attributes of the Hotels and Leisure Infrastructure in Minna

Source: Author's Survey (2021)



Figure 7.69: Emir's Palace in Minna

Source: Author's Survey (2021)

7.5.7 Transport infrastructure and services

The transportation infrastructure analysis of the city of Minna showed that there was a good layout of roads and transport infrastructures (mostly the expressways). Most of the major roads' designated road fixtures, such as traffic signals that helped promote transport safety, were present and functional. Figure 7.74 shows Broadcasting Road in the Tunga area of the city, which had just been reconstructed with critical infrastructure such as drainage pipes, pavements, and streetlights along the median dividing the road. Also, most of the newly reconstructed roads had the necessary road fixtures. As seen in Figure 7.75, the road reconstructions were observed, as were the overhead electrical cables.



Figure 7.70: Good Transport Infrastructure and Road Fixtures in Minna

Source: Authors Field Survey (2021)

The field survey also identified some of the modes of transportation used within Minna. A ban had been placed on the use of motorcycles for public transportation in this city, so tricycles had become the predominant mode of transportation. The use of tricycles as a means of transportation is seen in Figure 7.75. A central canal for water drainage was also observed. This canal had been built in the city to provide central drainage to help prevent flooding in the city after heavy rainfall. Prior to the building of this water drainage system, the city had been

predisposed to flooding and residents had suffered the adverse impacts of flood disasters for many years. This canal is shown in Figure 7.75.



Figure 7.71: Tricycles as a Mode of Transportation and the Central Canal in Minna

Source: Authors Field Survey (2021)

7.5.8 Summary of the infrastructure provision in Minna

The supply or provision of infrastructure showed that several challenges had interfered with the effective provision of infrastructure in the city of Minna. Five critical infrastructure areas were analysed, and the analysis was presented. This analysis showed that Minna had a deficiency of 15 infrastructures. Minna was observed to be deficient of three schools, and the educational infrastructure in the city was found to be inadequate. The city also had several public educational institutions and two tertiary educational institutions which were found to be adequate as their thresholds transcended the sphere of the boundaries of the city.

The health infrastructure in Minna also presented a very interesting outlook. The analysis showed that Minna had a shortfall of six primary health care centres, but there were adequate numbers of the secondary and tertiary health care infrastructures. The analysis also indicated that the primary health care infrastructure was observed to be fair in terms of its mean structural conditions. The secondary health care facilities, though adequate in terms of the number available, were only found to be in fair condition structurally. The one tertiary health care

facility was observed to be adequate and fair in terms of its structural condition and service delivery in the city.

The commercial infrastructure analysis in Minna indicated that the open markets were in a fair condition; the shopping malls were in a good condition; and the private business enterprises were also observed to be in good condition. The mean structural condition of the all the commercial infrastructure was fair, However, there also appeared to be some commercial enterprises operating in illegal spaces, such as on footpaths and road setbacks. The transport infrastructure in the city was judged to be in poor condition and inadequate as most of the roads in the city had very poor surfaces and inadequate or a complete absence of road fixtures and ancillary road infrastructure. Minna had a deficiency of about 72,000Km² of asphalt surfaced roads within the city.

The security infrastructure in the city was also inadequate, as observed and from the analysis. While most of the security infrastructure, such as the police stations and other facilities, was observed to be in fair condition, there were gross inadequacies in terms of manpower and equipment such as patrol vehicles and other tools for combating crimes adequately. This further heightened the challenges of insecurity in the city.

7.6 Comparative Analysis of the Infrastructure Provision in the Selected Cities of North-Central Nigeria

On a comparative note, the analysis of the infrastructure provision in the selected cities in North-Central Nigeria indicated that these cities had several of the types and numbers of infrastructure required for the functioning of a city. This study was conducted because this region was assumed to be deficient in several areas of infrastructure provision. Based on the data collected and the analysis presented, the city of Lafia was observed to have fared better than the other two cities in terms of infrastructure, as it had the lowest deficit of the selected cities studied. Although the city of Lafia was observed to be inadequate in its provision of infrastructure as it suffered a deficit of about eight infrastructure facilities, this situation was observed to be better than the case in Minna, which had a deficit of fifteen infrastructure facilities across all sectors of the infrastructure spectrum. Minna City was thus also viewed as still being inadequate in terms of the infrastructure availability. Lokoja presented with the most

precarious situation in terms of infrastructure of the cities selected for the study, with a deficit of 22 facilities.

The general challenge of infrastructure provision in these cities in North-Central Nigeria showed that several issues remained unaddressed in the process of ensuring liveability and inclusivity in the region. Basically, though most of the cities were observed to be close in terms of their numbers of infrastructures based on the standard requirements for their population sizes, these cities were observed to be seriously deficient in terms of the inclusivity of their infrastructure. This situation of poor inclusivity was observable in the types of transport infrastructure provided, with no footpaths (pavements) as spaces of refuge from vehicular traffic for pedestrians and vulnerable groups. Also, most of the infrastructure, especially the transport infrastructure, did not have the proper fixtures such as traffic signals, streetlights, and warning signs, all of which are required for safety, a very critical element of inclusivity.

Table 7.155: Infrastructure Audit of the Selected Cities in North-Central Nigeria

Infrastructure	Transport		Commercial		Security		Education		Health Care		Def.	Remarks
Location	Exp.	Ava.	Exp	Ava.	Exp	Ava.	Exp	Ava.	Exp	Ava.		
Lafia	78,000Km ²	56,000Km ²	11	10	12	10	55	51	15	14	-8	Inadequate
Minna	150,000Km ²	78,000Km ²	20	17	15	15	110	98	22	16	-15	Inadequate
Lokoja	107,000sKm ²	38,000Km ²	10	12	10	6	75	60	15	10	-22	Inadequate

Source: National Bureau of Statistics [NBS], 2021)

7.7 Discussion of the Results

From the discussion above, it could be seen that from 1999 onwards there was a massive improvement in the selected cities' outlooks. This resulted from massive government expenditure and political drives to make the cities in the country more liveable. However, these cities selected for the study did not present with consistent improvements of the conditions for the urban dwellers to live sustainably. It was observed that there was a sense of the provision of enabling environments to improve the liveability statuses of the cities.

The city of Lokoja presented a scenario where development was impeded by the topography of the area, with Mount Pate and the confluence of the Niger and Benue rivers. The city's development gravitated toward the lowland area along the riverbanks. The city showed

improvement in its provision of infrastructure over time. The government modernised the market, which led to the emergence of many shopping complexes that catered to the city's commercial needs. The presence of significant players in the banking sector also improved the general outlook of the city.

The availability of road infrastructure and its fixtures also helped effect a smooth transportation network, but more was still required. Infrastructure facilities were not well maintained, and the clogging of the drains along the roadways had the potential to cause damage to the transportation infrastructure. The improved recreational infrastructure was still not adequate either, as only a few facilities were available for active recreation. The Mount Pate Park had to be improved upon to meet international standards. The educational infrastructure needed a concerted effort made to protect the learners, educators, and school properties, especially the primary school facilities that needed perimeter fencing for security purposes.

The case of Lafia City provided a similar scenario to that of Lokoja City, although Lafia City did not have the same limitations imposed on it by rivers and hills. The city had improved on its livelihood potential, but the planning or lack thereof provided a loophole in the distribution of the infrastructure.

The educational infrastructure was inadequate and poorly maintained, especially the primary schools. The transportation infrastructure also left much to be desired as the majority of the local access roads did not have proper asphalt surfaces and had developed potholes and craters over the years as a result of the poor maintenance culture in the city. Although the roads did have pavements, they lacked the auxiliary fixtures such as streetlights and traffic signals. The active recreational infrastructure present in the city was deficient as there was only one stadium available for such activities. This did not work well with the liveability potential of the city. The commercial infrastructure also indicated that improvements had been made over time, but more needed to be done by the government in that regard. Much of the commercial infrastructure was privately owned and unsuitable for the emerging city.

The city of Minna displayed better infrastructure management than the other two cities. It had excellent transportation infrastructure (good arterial roads and road fixtures), but there was room for improvement as some of the transport infrastructure needed more investments. Educational infrastructure in the city of Minna presented a paradox. The privately-owned

infrastructure was well maintained, while the public schools (mainly primary and secondary) were poorly maintained. The tertiary education infrastructure in the city was in better condition than the infrastructure in the other two cities.

The active recreational infrastructure in Minna was better organised than in the other cities, but that that did not imply that it had reached its full potential, as more could be improved upon. The availability of passive recreational facilities in the city ensured that the city's residents had better liveability potential. The health care facilities in Minna City were also in good condition, in terms of maintenance and availability. The only aspect that could be investigated was the adequacy of the staff and other ancillary variables.

7.8 Planning Implications of the Results

The analysis of the results from the three cities selected for the study indicated that proper planning and standards were not employed while providing the opportunity for liveable cities in North-Central Nigeria. The cities were providing the critical infrastructure required, but the spatial distribution was lopsided.

The provision of the educational infrastructure was left to private entrepreneurs to a large extent, as they provided better infrastructure for the residents. The effect of this was that the cost of training the youth was becoming exorbitant and made literacy unavailable for some sects of society (the urban poor). This was a sign of the non-inclusiveness and polarity of the society and reflected the liveability potential of the cities.

Improvement of the commercial infrastructure would enable the people to participate in trade and/or banking and give them the opportunity to make ends meet. This affected town planning activities as the proliferation of these commercial activities distorted the plans approved for the cities' development. Many open spaces had been converted for commercial land use and this distorted the cities' images.

CHAPTER EIGHT

STAKEHOLDERS' AND GATEKEEPERS' PERCEPTIONS OF THE RESIDENTS' INFRASTRUCTURE NEEDS AND A FRAMEWORK FOR INFRASTRUCTURE PROVISION

8.1 Introduction

Word frequency queries and close thematic coding (using NVivo 10 with the aid of MS Excel to plot the charts) were used to analyse the transcribed interviews of the stakeholders in the selected North-Central cities of Nigeria. The criteria for the word frequency queries included: synonym word matches, the 1000 most frequently used words, and two-letter minimum words.

8.2 Sustainable Infrastructure Development and Liveability Enhancement

The word 'infrastructure' was found to dominate the outcome of the word frequency queries, (having the most significant font size, relatively), followed by words that seemingly depicted the reason for provision of specific infrastructure the challenges associated with some of the infrastructure; and the gender of the people who were primarily on the receiving end of poor infrastructure. Some of the urban liveability enhancement and sustainable urban infrastructure targets within the selected cities were education infrastructure, water supply, health care, skill acquisition, and roads. Women emphasised infrastructure and their drive towards inclusivity in North-Central Nigeria (see Figure 8.1).



Figure 8.1: Urban Liveability and Sustainability Enhancement Drive in North-Central Nigeria

Source: Author's Analysis (2021)

8.3 Urban Infrastructure Development and Provision

Urban infrastructure and its production were significant aspects of this research work. It is instructive to note that the methodology adopted in providing urban infrastructure in any location determines, to a considerable extent, the level of ownership and attachment that residents will have towards the infrastructure. Based on this understanding, this research sought to investigate the methods that the stakeholders often adopted to develop and provide infrastructure, and the corresponding challenges encountered when providing the infrastructure. Interviews were conducted with the stakeholders to ascertain this information. Figure 8.2 shows the outcome of the detailed thematic analysis of the information obtained

during the interviews. It shows that four important thematic areas were identifiable, namely description, challenges, motivation, and expected outcomes.

8.3.1 Description of the urban infrastructure provided

When describing the infrastructure provided, the various stakeholders interviewed indicated that most state governors often prioritised specific developmental projects. These high-priority projects included road construction, housing, and health care infrastructure provision.

According to the Niger State Ministry of Health, represented by the Director of Planning, Research, and Statistics:

Infrastructure provisions such as health care, housing, and roads are the key elements of the legacy project instituted by successive governments in the state since the commencement of the current democratic journey in 1999.... The method of delivery, however, depends on the leadership style of the Governor as the Chief Executive Officer of the State per time (Director of Planning, Research, and Statistics, Niger State Ministry of Works and Infrastructure, 2021).

The statement below informs that the level of priority placed on a specific development project determined the extent of the actions and commitment experienced in a sector during the project's conceptualisation and implementation. This also pointed to the fact that the occupier of the Office of Governor at the time determined the description of the development project and the type of project that received the attention of the government to a large extent. Analysis of the development of the urban infrastructure in the various cities also showed that project development was often conceptualised so that it emphasised and gave women capacity in the cities. The Director of Planning, Research, and Statistics of the Niger State Ministry of Women Affairs reinforced this position that:

Over the years, administrators in the state often consider projects which have a direct impact on women and children in the city, as a result of the desire of the government to ensure equity and parity of development impact across genders.... We make a conscious push when we discovered that a project is being initiated and the interests of women and children and other vulnerable groups are not considered.... These efforts have

changed the tide in favour of women in the city over the years (The Director General, Women's Right Advancement and Protection Agency [WRAPA], 2021).

The critical notion created by these descriptions of urban infrastructure development and provision in the various cities was that advancing women's empowerment and capacity building for women was also considered a significant part in the infrastructure drive within the cities. This also reaffirmed the belief that conscious efforts were being made to ensure that vulnerable groups like women, children, the aged, and people living with disabilities were being considered, as the patriarchal ideology in the African setting still held a powerful place within the cities.

8.3.2 Challenges associated with infrastructure provision

The process of urban infrastructure development in North-Central Nigeria was associated with several challenges. As observed from the interview, the challenges included the breaking of agreements in various public-private partnership projects or developments. The General Manager of the Niger State Urban Development Board had the following to say, and this and was corroborated by the Director of the Kogi State One-Stop-Shop Land Bureau:

Let me give you a typical example of the challenges of the state as it concerns PPP project development. The 500 units Talba Housing Estate along Bida Road was a PPP project; however, the private partner, instead of coming up with their counterpart funds as agreed, decided to play a smart one on the government, and this has been the challenge with most PPP projects that have been initiated in the state. For Kogi State, we have decided that since we discovered that most private partnership projects initiated by the government are often skewed in favour of the private organisation, against the government and the public whom the projects are targeted, we have decided to initiate and source for funding for implementation as a government (General Manager of the Niger State Urban Development Board, 2021).

This statement above indicated that PPP arrangements for infrastructure provision and development had failed in most parts of North-Central Nigeria, especially in the cities where these partnerships had been attempted. The challenges associated with PPP infrastructure provision arrangements in North-Central Nigeria related to finance. Most private sector

participants did not earnestly want to invest in physical infrastructure projects. This reluctance to invest in infrastructure development was connected to fears related to returns on their investments. One of the respondents sampled from the Nasarawa State Ministry of Works and Infrastructure noted the following:

The issues around the PPP projects are utterly due to the fear of investors, especially in the private sector. Most of these private sector investors noted that after projects are fully implemented, how do these people regain their capital and make a profit without over-burdening the residents or people whom these infrastructures are made for? (Representative from the Nasarawa State Ministry of Works and Infrastructure, 2021).

Another one of the challenges of urban infrastructure development and provision in North-Central Nigeria was the overstretching or wear and tear of the infrastructure due to intensive overuse of it. One of the respondents interviewed noted that:

How do you expect infrastructure or facilities provided within the city to last long when a facility that is provided with a specific population size, but because of poor provision across space or complete lack in certain instances, these infrastructures often become overused? (Representative from the Kogi State One-Stop-Shop for Land Administration, 2021).

Overstretching or intensified/excessive use of the infrastructure was considered a significant challenge over the years, and this played a prominent role in the general perception of the infrastructure development challenges and provision. The statement above implied that in order for the region to surmount this challenge, the government had to make conscious efforts to ensure that infrastructure planning and the infrastructure provided were designed such that they were adequate for the number of people that they serviced. This would ensure that they were used optimally and within their design thresholds, and thus stem the tide of overstretching and damaging of the facilities.

Furthermore, the challenge of overstretching or overuse of the infrastructure was closely related to the infrastructure deficit due to poor funding. Judging from the budgets of the selected cities from 2000 to 2020, their capital budget allocations for infrastructure provision were 30 per cent below the total yearly costs of the various infrastructure projects planned for (NBS, 2021). The

implications of the poor budgetary allocations for infrastructure developments underpinned the challenge of the overstretching/overuse of the urban infrastructure in the selected cities, as there were simply not enough facilities for the sizes of the populations. The challenge of poor funding for urban infrastructure was attributable to the poor financial conditions in most of the states where the selected cities were located. According to the Ministry of Works and Infrastructure in the Niger State:

You see, over the years, the allocations to the state have continued to dwindle, and with very poor internally generated revenue.... These issues have been seriously exacerbated by the fact that the general economy of the country lately has been disappearing, so you expect that this will either directly or indirectly affect the provision of infrastructure in the city (Representative from the Niger State Ministry of Works and Infrastructure, 2021).

From the statement above, finance and funding were clearly critical factors in urban infrastructure provision and development. Sustainable infrastructure provision was seriously affected by the insufficient budgetary allocations as most of the infrastructure that ensured sustainability came with a tremendous financial commitment on the part of the decision-makers within the city.

8.3.3 Motivation for infrastructure provision

Another area that emerged from the thematic analysis of the data regarding urban infrastructure development and provision (presented in Figure 8.2) was the motivation for infrastructure provision in the region.

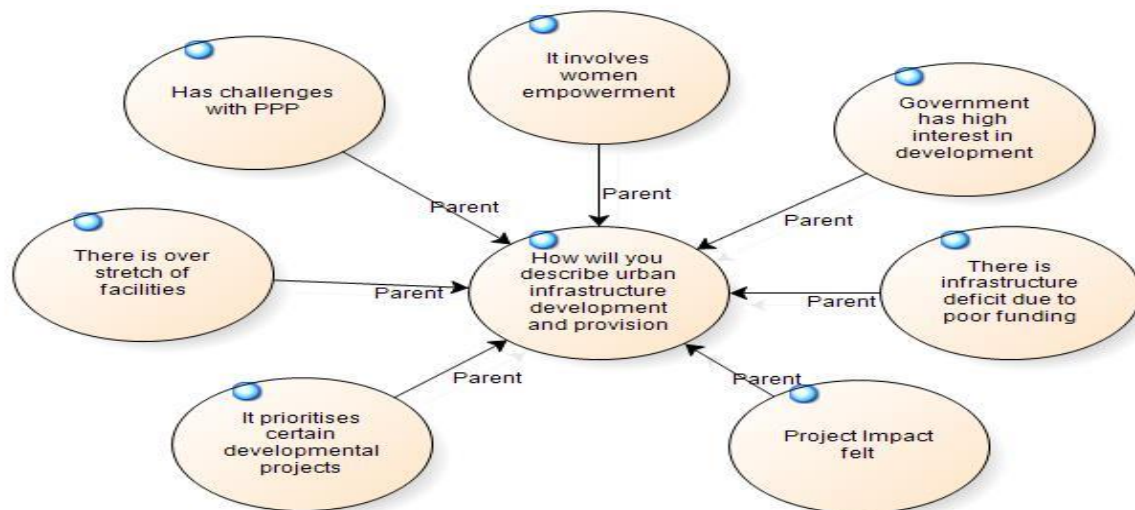


Figure 8.2: Thematic Analysis of the Urban Infrastructure Development and Provision in North-Central Nigeria

Source: Author's Analysis (2021)

The biggest motivation for the urban infrastructure development and provision, sincerely or otherwise, was the desire to continue with the infrastructure provided by the previous governments in these cities of North-Central Nigeria. This motivation, as opined by the various stakeholders interviewed in the selected cities, was the only hope for city dwellers as the passage of time continued to bring a renewed hope that the government would continue to place priority attention on infrastructure development and provision as this was the primary scorecard for politicians in these cities and as in most developing countries.

8.3.4 Expected outcomes of the infrastructure development and provision

The overall outcome of all urban infrastructure development and provision is the ability of such infrastructure to meet the demands of the present day and to remain useable over time. This is one of the time-tested desires of sustainable urban development (Rees & Wackernagel, 2008). In the final analysis of the conceptualised urban infrastructure development and provision, the development projects should be seen to be impacting the people they target in a significant manner. This fact was also determined from the interviews' analyses as all stakeholders unanimously agreed that the impact of urban infrastructure development was a significant factor in the appraisal of the urban infrastructure development and provision in North-Central Nigeria.

8.4 Challenges of Urban Infrastructure Development

A significant issue mentioned earlier was the challenges associated with infrastructure development in North-Central Nigeria. The analysis of the challenges is shown in Figure 8.3, which indicates that nine critical factors come to mind when appraising the urban infrastructure challenges in North-Central Nigeria. The analysis showed that these factors were: illegal developments that often took over sites reserved for infrastructure; funding; vandalism; and project continuity. Other challenges were public participation; bulk demands; poor monitoring and evaluation; uncoordinated urban growth, and substandard projects. According to the stakeholders interviewed, the most critical among these challenges was funding in the region for urban infrastructure.

Several factors constitute challenges for urban infrastructure development and provision in this part of Africa. However, poor funding of infrastructure provision is the most critical of all these factors (Representative from the Niger State Ministry of Health, 2021).

This statement from the stakeholder/representative from the Ministry of Health in Niger State touched on the cardinal role of adequate funding when discussing urban infrastructure development. The stakeholders/representatives from the Ministries of Health in Kogi and Nasarawa States further reinforced this position:

My brother, the major problem we face in this part of the country is the continuous reduction in the available funds for infrastructure provision, and this has had a severe impact on our ability to provide as many services to our people as they may desire or deserve (Representative from the Kogi State Ministry of Health, 2021).

We have come to a level now where we must decide as a people if we need infrastructure, and if we do... we must be willing to pay for them through tax and contributions for us to have them. However, if we continue in the current way, we will not get anywhere regarding infrastructure provision (Representative from the Nasarawa State Ministry of Health, 2021).

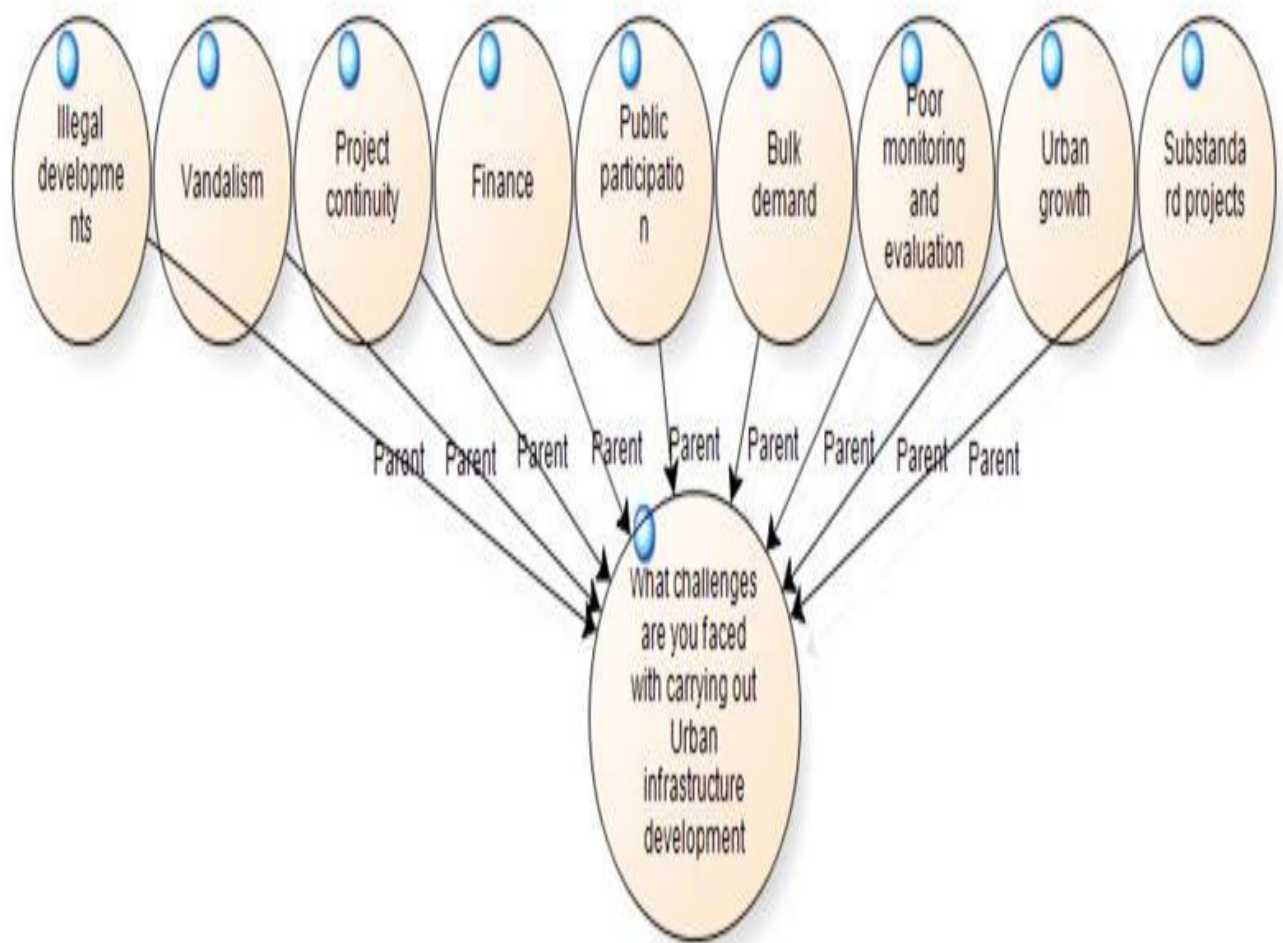


Figure 8.3: Thematic Analysis of the Challenges of Urban Infrastructure Development and Provision in North-Central Nigeria

Source: Author's Analysis (2021)

A careful analysis of the different statements from the senior staff members representing the various ministries showed that all other challenges of urban infrastructure provision could be addressed when the challenge of funding was adequately addressed (see Figure 8.3). This showed that most of the challenges were either directly or indirectly linked to funding, and this was opined by one of the respondents who noted thus:

You see, we can address all the other challenges of infrastructure development and provision within our cities, even the issue of public participation, as it also requires funding for mobilisation and logistics for stakeholders who will be involved in talks

about infrastructure development... if funding challenges are adequately addressed (Representative from the WRAPPA, 2021).

Another stakeholder interacted with noted that:

When a man does not have money, his ideas and actions are often viewed as the ranting of an empty vessel (Representative from the Rayuwa Sexual Assault Legal Referral Centre [SALC], 2021).

The deduction made from the statements above was that the challenge of funding for urban infrastructure provision was a significant factor in the analysis of infrastructure development. This did not minimise the other challenges identified relating to urban infrastructure development, but this challenge had to be addressed appropriately for infrastructure to be available for residents. Also, residents understood the evident importance of funding for people to get bulk infrastructure, be involved, and to be adequately represented in decision-making regarding urban infrastructure development and provision.

8.5 Efforts by the Department/Ministry to Promote Infrastructure Provision

Several efforts have been put in place by the various sectors of the government ministries in the selected cities to address the challenges of infrastructure in North-Central Nigeria. These efforts put in place by the various ministries representing the different facets of governance included increased public participation, public education, and awareness, continued infrastructure provision, and grants by the supranational, national, and subnational governments (federal, state, and local governments). Other efforts included improved access to infrastructure, skill acquisition, and leveraging existing donor agencies and partners (See Figure 8.4).

The various stakeholders interacted with noted that the first effort put in place to address the challenges related to infrastructure provision was developing a model for public participation that would reinforce the commitment of urban residents to utilising infrastructure correctly and recommend appropriate and desired infrastructure that would be acceptable to all. This was noted in a response by one of the stakeholders from the Ministry of Works who posited that:

The secret to a successful project in terms of implementation and utilisation is to get the right people to whom the project is targeted to recommend the project of their choice and get involved in ensuring appropriate implementation (Director of Planning, research and statistics Niger State Ministry of Works).

This statement implied that public participation was a critical effort that helped address the issues around poor infrastructure and development activities. As analysed, another measure to deal with the infrastructure deficit in North-Central Nigeria was public awareness and education. Most of the stakeholders interviewed opined that public infrastructure was often overstretched and overused because of use by too many people who did not even need such infrastructure and only desired to use it because it was available. An interviewee in the Ministry of Health in Niger State opined that:

Our people have this sense of entitlement which often drives the rich and the poor to think that all must freely use public infrastructure...including health, as they were meant to cater to all (Project Manager, Niger State Ministry of Health).

This statement showed that even residents who were economically well to do still preferred to contest for the use of public infrastructure such as health care facilities and depriving the poor residents who are supposed to be the rightful beneficiaries of such infrastructure. As such, conducting public education and awareness would help to better inform the people about the need to use alternative infrastructure instead of everyone trying to use the same centrally located infrastructure at the same time and over-stretching the facilities.

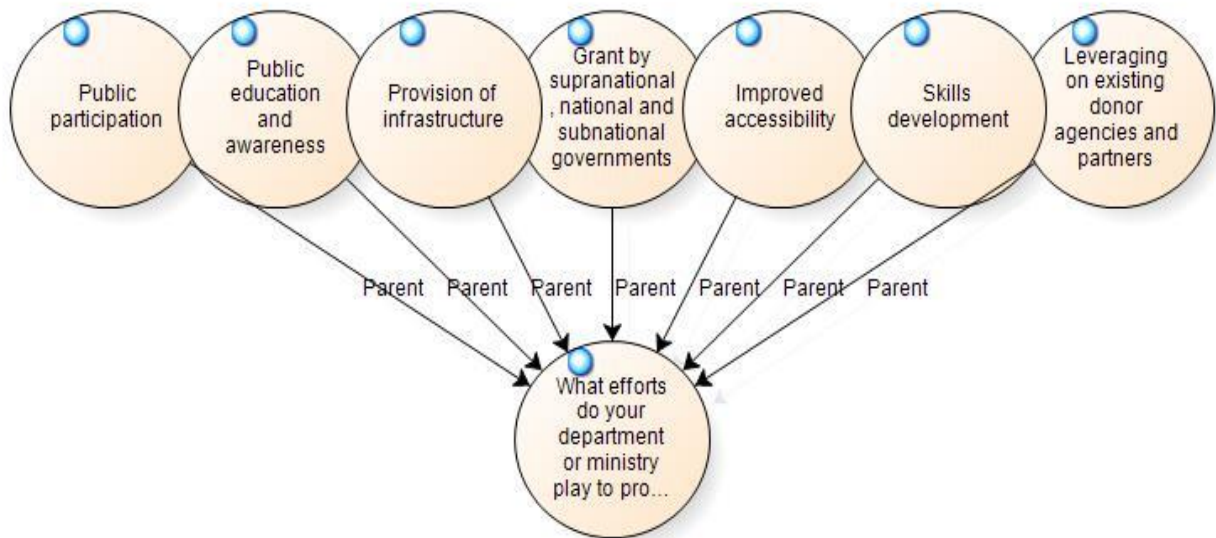


Figure 8.4: Thematic Analysis of the Efforts by Stakeholders to Manage the Demand for Urban Infrastructure Development and Provision in North-Central Nigeria

Source: Author's Analysis (2021)

The stakeholders interviewed also identified three critical efforts often employed to manage the challenges associated with the infrastructure deficit in North-Central Nigeria. These efforts, they opined, included the conscious provision of critical infrastructure, accessing various types of grants, and leveraging donor agencies. They believed that all of these efforts had definitely helped to improve urban residents' accessibility to infrastructure. They also noted that among the efforts made to address the infrastructure deficit in the region were the efforts towards improving skill acquisition. The stakeholders interviewed believed that all of these efforts made helped to address the challenges associated with the urban infrastructure deficits in North-Central Nigeria.

8.6 Availability of Development/Master Plans for the Cities

The use of plans as instruments for development has been emphasised over the years. This research also examined the availability of master plans for monitoring and guiding developments within the cities and as the cities expanded. The findings implied that a considerable percentage of the stakeholders and the state governments in North-Central Nigeria still lacked development plans, which were a critical tool for development (Comfort, 2019). Comfort (2019) posited that among the many problems that hampered the implementation of community and social development projects in North Central Nigeria, there were corrupt

development officials and community elites, and rural elites heading projects as an avenue for self-enrichment and political gains while ignoring the need for plan preparation and adherence to plans, and this often ended with negative outcomes for the residents.

As development took place on the urban peripheries, planners had to be aware of potential conflict between farmers and herdsmen, as conflict in these areas was problematic. Avoidance of conflict required meticulous planning in conjunction with consultation with those affected by further infrastructure provision. Adisa (2011) recommended the creation of three-tier conflict management committees to help reduce potential conflicts. Adisa (2011) recommended that these committees review the planners' extension plans periodically to ensure increased awareness and compliance with agreed upon stock routes and farming areas, so that crop farmers and herders could be accommodated and kept apart to ensure their harmonious coexistence while also meeting the needs of the growing urban population. Adisa (2011) suggested training of the workers building the infrastructure and clients on how to deal with conflict's psychological and social impacts.

8.7 Master Plan/Development Plan Updates

After establishing the availability of development plans in the selected cities in North-Central Nigeria, the research then further interrogated some of the stakeholders' claims of the availability of master plans for the developments in the selected cities by confirming the life spans of the master plans in place and when these plans had last been updated. Figure 8.6 shows that 40 per cent of the stakeholders interviewed noted that the plans available had not been updated since they were designed. An example was the case in Minna, where the General Manager of the Niger State Urban Development Board noted the following:

Please let us be clear about this; Maslock developed the available masterplan in 1979, and this is the same plan that we have been using. Government has made several efforts to update this plan, but my view is that it is entirely outdated, and we deserve an utterly new master plan as Minna had extended beyond the 1979 limit when that plan was designed (General Manager, Niger State Urban Development Board, 2021).

The statement above was the submission by the representative of the planning board that was saddled with the responsibilities of physical planning and development in the city of Minna in

Niger State. The One-Stop-Shop Land Bureau's Director-General in Lokoja in Kogi State made another profound statement when he claimed the following:

The issue of a master plan is not applicable in Lokoja city space because we have made several efforts to commission people to design a master plan for the city, not just now but a long time ago, even when we still operated the urban board, but all these efforts ended in severe conflict (The Director-General, One-Stop-Shop Land Bureau Lokoja, Kogi State).

The Lafia State Urban Development Board's representative noted the following:

Successive governments in this state, since its establishment in 1996, have not even given any thought to preparing a master plan as the state is so poor in its city capital and the significant revenue urban centres are those places like Karo and Nyanyan that are near Abuja.... So, they will instead use the money to provide infrastructure in those areas that invest in a master plan that may never be implementable (General Manager, Nassarawa State urban Development Board).

These three statements pointed out that the selected cities in North-Central Nigeria lacked the required development plans and blueprints that could help monitor and guide spatial development. This finding, therefore, implied that attaining urban liveability and sustainability in these cities would be very difficult if these attitudes towards spatial development plans were sustained. However, this also provided policymakers with an excellent opportunity to catch up with development requirements if efforts could be implemented to provide a broad-based inclusive plan for each city that guaranteed liveability for all.

Lloyd et al. (2016) believed that public engagement opportunities should be considered in light of the actual environmental conditions and distinct political and cultural dynamics in place where such engagement was required. These five environmental issues were at the heart of their debate: 1) nature and biodiversity protection; 2) local pollution control; 3) green company image construction; 4) sustainable household practices; and 5) participation in international conventions and treaties. Their context analysis examined civil actors' (potential) roles in each of these five environmental issues. Government policymakers often used a functional (objective) definition of liveability to guide their decisions. An analysis of crucial arguments

in the literature explored the particular challenges that politicians, urban planners, and developers faced in supplying the social (subjective) dimensions of liveability, linked to the community, social interaction, and social cohesiveness. As a result of their findings, the authors said that there was a need to understand better how people constructed their sense of liveability in modern cities.

8.8 The Applicability of State Planning Standards in these Urban Areas

Given the challenges observed with the critical instruments of plans and blueprints for guiding the spatial development in the selected cities, this analysis further investigated the applicability of planning standards in these cities since there was an almost complete absence of master plans and up-to-date master plans. The major planning organisations agreed that planning standards were applicable to spatial development. One of the respondents interviewed gave a somewhat sarcastic response when he noted the following:

Oga nawa for you ooo... (Boss, you are hilarious, in the Nigerian pidgin English). How you expect to make state planning standard work wey the master plan wey we for use no dey ground? (How do you expect state planning standards to work when we do not have a plan in the first place?) (General Manager, Nassarawa State urban Development Board).

This statement showed that the stakeholders in these cities acknowledged and understood the efficacy of having a master plan for infrastructure development, however, the development of such plans was handicapped by several hindrances, which ranged from a lack of adequate finance, poor awareness on the part of the political class of the need for such plans, and the lack of political will to make sacrifices, as some believed that preparing master plans would cause crises. The stakeholder representing the Ministry of Women Affairs in Niger State stated the following:

Please do not allow us in Minna to enter the crisis they had in Abuja some years back when a former minister decided to implement the Abuja Master Plan. I am sure you know the number of houses they demolished and the kind of social crisis that created (Representative of the Ministry of Women Affairs in Niger State).

The above statement showed that much bias existed towards a master plan as a tool for development. This line of argument would ensure that master plans were either not designed for cities at all, or if they had been designed, they would not be updated, let alone followed. The assumption that master plans were a source of conflict in these regions made sense, as the stakeholders involved in the processes would have conflicting interests and motivations. According to Alexander (2013), the history and beliefs regarding what constituted an excellent city shape have not followed a single route. Ideas for new urban forms, such as wide diagonal boulevards, curving residential streets, garden cities, pedestrian-only neighbourhoods and high-rise buildings appear, make an impact, and then fade away, only to reappear in another form or vanish altogether. In order to create ideas for the future, urban designers must have a thorough understanding of the theoretical foundations of the many distinct forms of cities that exist now. They must also grasp the origins and impacts of each of these forms. While city marketing involves more than just the promotion of location, it has been utilised in some cities to rebuild and redefine their image in tandem with a strategy of targeting specific sorts of activities that both reflect and reinforce their image, according to Paddison (1993). Looking at what happened in Glasgow, the social and political ramifications of such marketing strategies tend to be underestimated. However, such changes and improvements can only be achieved effectively with meticulous planning and strict commitment to the results.

8.9 Reasons for the Poor State Planning Standards in North-Central Nigeria

Judging from the assertions made by the stakeholders interviewed, some of them were of the view that state planning standards were not applicable in the selected cities in North-Central Nigeria. This group represented about 11 per cent of the total number of stakeholders interviewed, while another 33 per cent reported not having any idea about what planning standards were used for and how they operated, as indicated in Figure 8.6. This research further interrogated the issues that had predisposed these cities to poor planning standards. The issues or reasons for the poor planning standards in the cities included logistical problems, a lack of political will, a lack of finance, and the lack of practical implementation frameworks. The factors accumulated to constitute the reasons advanced by the stakeholders interviewed for the poor state of the planning standards in the region, and these are shown in Figure 8.7. From the submissions by the stakeholders, the challenge of finance was a significant factor that drove all

of the other factors that predisposed these cities to poor planning standards. One of the stakeholders argued the following:

Finance is a critical component of any developmental stride. Permit me even to state here, if allowed, that even in the religious parlance, money is the chariot upon which the gospel rides. So, if you observe when the challenges of finance are adequately addressed, these will provide appropriate logistics to monitor planning and plans and ensure accurate implementation of plans (The Director-General, One-Stop-Shop Land Bureau Lokoja, Kogi State).

The assertion above, however, was at variance with that of the General Manager of the Niger State Urban Development Board, who argued:

The argument about finance, logistics, and implementation is neither here nor there until we have addressed the challenges associated with the political will of the government to foster a better planning space for the society (General Manager, Niger State Urban Development Board).

The statements above clearly showed that two vital factors played a significant role when interrogating the factors causing the poor planning standards in the selected cities. These stakeholders advanced that finance and politics were essential factors that had to be dealt with in order for state planning standards to be practical and for planning and planners to take their rightful place as urban gatekeepers/city managers in North-Central Nigeria. Umeokafor (2017) found that religion, cultural institutions, and the culture surrounding money had a role to play in the broader social and cultural context of planning. The political context elements were governmental inaction, political influence, and poor health and safety policies.

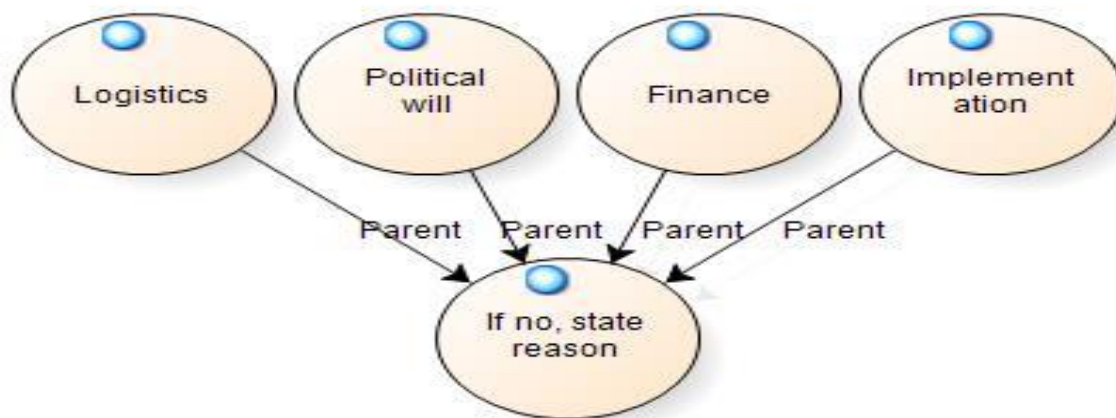


Figure 8.5: Reasons for the Poor State of the Planning Standards in the Selected Cities in North-Central Nigeria

Source: Author's Analysis (2021)

8.10 Stages of Involvement of the Urban Residents in Projects and Planning in North-Central Nigeria

Further to the investigation of infrastructure provision and planning, the research also sought to establish the extent of the inclusion of the urban residents in the region in projects and planning. This research established from the responses of the stakeholders interviewed that they involved urban residents at one point or another during the life cycle of a development project. This was further investigated to understand at what point of a project's life the residents were involved, and some of the stakeholders revealed that residents were involved in several stages of a project's life cycle, such as at the monitoring and evaluation stage, during public sensitisation, and at the decision-making stage. Others noted that residents were involved in the planning and implementation stages. The breakdown of the stakeholders' responses is revealed in Figure 8.8. The stakeholders believed that residents were mostly involved in the monitoring and evaluation stages, followed by the public sensitisation stage, then the decision-making, closely followed by the planning and implementation stages. The various stakeholders argued these positions to support the public's inclusivity in project development and planning in North-Central Nigeria.

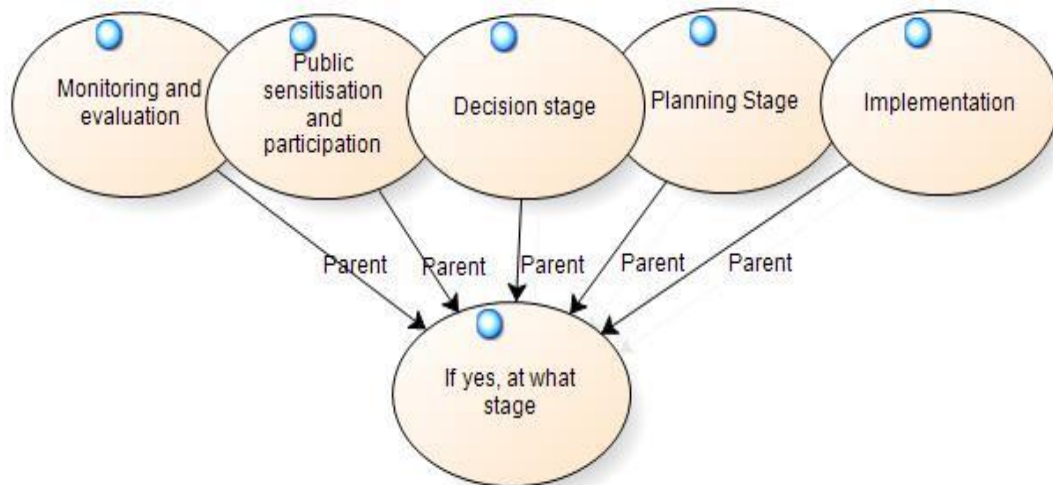


Figure 8.6: Stages of Urban Residents' Involvement in Projects and Planning in North-Central Nigeria

Source: Author's Analysis (2021)

8.11 Recent Community Engagement Efforts and the Project's Focus

Since most of the stakeholders involved urban residents in project development and planning, as observed in Figure 8.6, the research further interrogated their last or most recent engagement in project development and planning. The responses are presented in Figure 8.7. The analysis showed that most of the stakeholders interviewed understood the importance of community engagement in infrastructure development in the region. They also noted that several community engagements had occurred between 2020 and 2021 when these interviews were conducted, with some noting that the community's engagement was sought for varied purposes. These included the need to provide primary health care infrastructure, raising health care awareness in the era of the current health challenges, the provision of urban infrastructure such as roads and drainage, and sensitisation of the urban residents to the impacts of proposed or commissioned projects in the region. However, one statement from the General Manager of the Niger State Urban Development Board encapsulated the nature of the community's engagement that most of these stakeholders had adopted with the urban residents when he asserted the following:

My brother, let me not deceive you. No single state in this region sits for a comprehensive debate with the residents on the planning of urban projects. What you will discover is that the most city managers in this region do is mobilise traditional rulers and community leaders on chosen projects which have been decided at the State Executive Council. In a nutshell, what we do is to inform the residents of our plans (General Manager, Niger State Urban Development Board).

This statement resonated across North-Central Nigeria, judging from the stakeholders' statements. This put the level of the citizen participation adopted for infrastructure development in the region of the informing rung of Einstein's Ladder of Participation (Fainstein & Lubinsky, 2020; Tebes & Thai, 2018). This was at variance with the ideological views of the current paradigm in participatory planning, according to Bahreldin (2016), who noted that the quest to find a context-sensitive, yet efficient community participation evaluation framework was at the frontline of the challenges faced by planning practitioners, researchers, and policymakers since the participatory turn in planning. The policies were directed to benefit who are the urban residents, raising the tension between policymakers and the people.

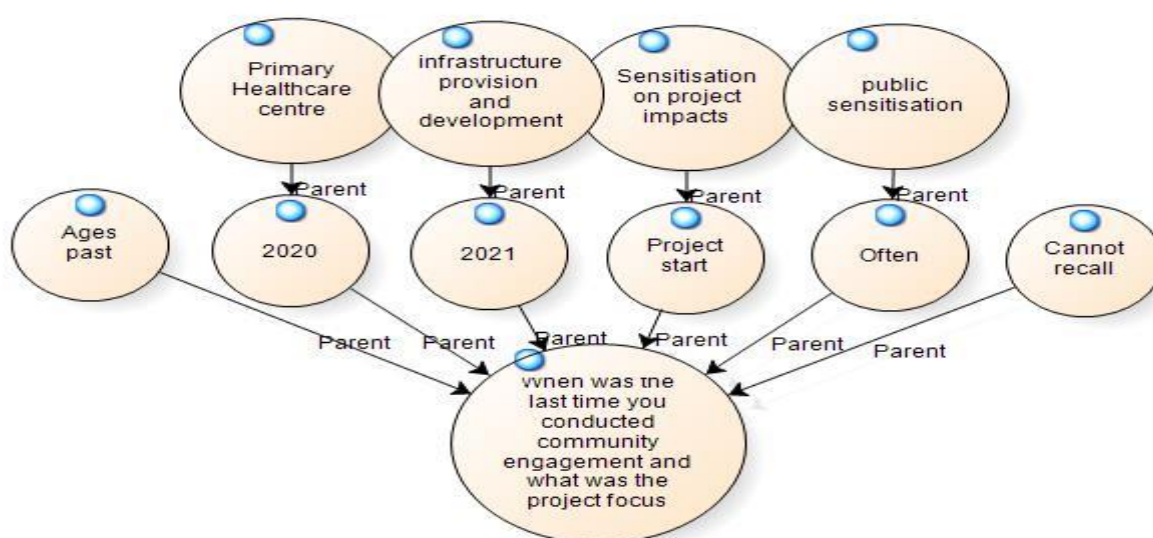


Figure 8.7: Recent Community Engagement in Urban Projects and Planning in North-Central Nigeria

Source: Author's Analysis (2021)

8.12 Factors that Determine a Facility's Location in the City

The location of the urban infrastructure within the spaces of the selected cities was another concrete issue that the research unveiled. Figure 8.8 shows the various factors that drove the location of specific urban infrastructure in the selected cities. These factors included political motivations, public-private partnership arrangements, population counts, and inclusivity. Others were residents' needs, planning decisions, and centrality. However, the stakeholders agreed that political motivation and population counts played the most significant roles in the region's urban infrastructure or project development. This position was reinforced by the statement credited to one of the stakeholders, who noted that:

Projects are situated within the city, bearing in mind two critical factors; political motivation and the population which the infrastructure will serve (Director of Planning Research and Statistics, Niger State Ministry of Health).

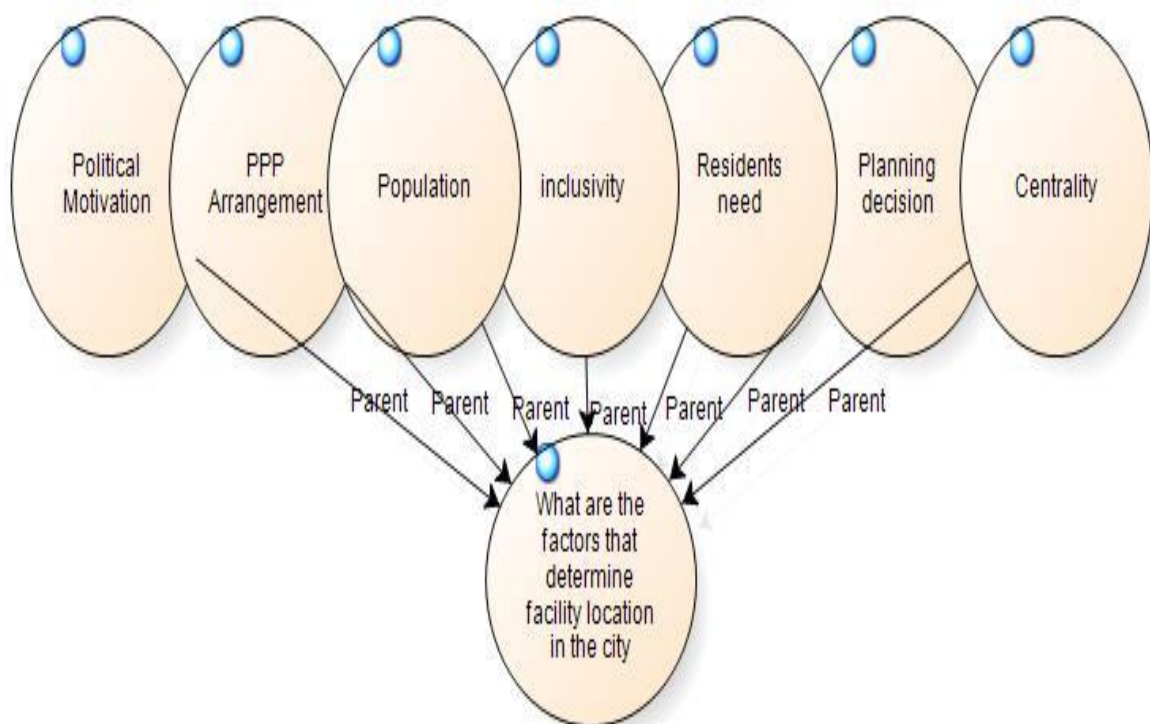


Figure 8.8: Factors that Determine Urban Infrastructure Location in North-Central Nigeria

Source: Author's Analysis (2021)

The position advanced by the stakeholders under this heading was that politicians played a pivotal role in the siting of urban infrastructure. This was also found by Ranganathan (2014); and Shin (2009). They noted that critical factors of optimal utilisation, directly linked to the states' threshold population and financial capacity, played a significant role in the production and provision of public infrastructure. Hence, public infrastructure was provided based on political interest and absorptive capacity.

The factor of the population size was also closely tied to these political motivations as most politicians preferred their projects to favour areas with higher populations, to the detriment of areas with sparse populations, as they all preferred locations that provided them with advantages in terms of votes: higher population numbers translated into more votes during elections. The notion that a greater population size attracted infrastructure was also posited by Ismagilova et al. (2019). The citizens and their interactions were an essential dimension in the operational effectiveness of intelligent cities.

Studies investigated the adoption of technology, citizens' engagement with services, crowdsourcing, and social interactions within the smart cities' context. Success was deemed dependent on the creation of services that would advance and improve citizens' quality of living, and that were reliant on the level of adoption of intelligent services. Studies covering this specific theme focused on factors such as their perceived ease of use, their perceived value, and their perceived efficiency (Belanche-Gracia et al., 2015; Chatterjee et al., 2018; Chong et al., 2018; El-Haddadeh et al., 2018; Yeh 2017). However, the studies generally failed to test for the moderating effects of age, gender, level of education, and knowledge and use of technologies. Future studies were encouraged to conduct research that included these aspects to consider the generational and educational impacts of interacting with intelligent city infrastructure.

8.13 Opinions of the Urban Gatekeepers on Infrastructure Maintenance

As shown in Figure 8.9, a word frequency query performed on the transcribed results of the interviews with the stakeholders in the selected North-Central Nigerian cities to learn their thoughts on infrastructure maintenance revealed that such maintenance was generally poor throughout the region. Over a ten-year period from 2014 to 2024, the Nigerian population was

expected to grow, and the country's infrastructure needs were expected to rise as well, requiring a total of US\$100 billion in investment in infrastructure development (Omisore, 2014). Omisore (2014) noted that the Central Bank of Nigeria estimated that the Federal Government of Nigeria would require US\$14 billion for road maintenance and development investment in Nigeria.

The stakeholders claimed that the urban water supply, education infrastructure, and health care facilities were some of the infrastructures that suffered the most from maintenance neglect. It was clear to see the current state of these structures. Resilience in ecological, economic, physical infrastructure, social, and governance systems was examined by Rogers et al. (2012). An in-depth examination of the factors that influenced resilience and the various techniques that needed to be used when modelling infrastructure at the local level was essential. In a time of austerity and limited financial means for infrastructure maintenance, the goal was to establish a solid evidence base to build resilience into various infrastructures.

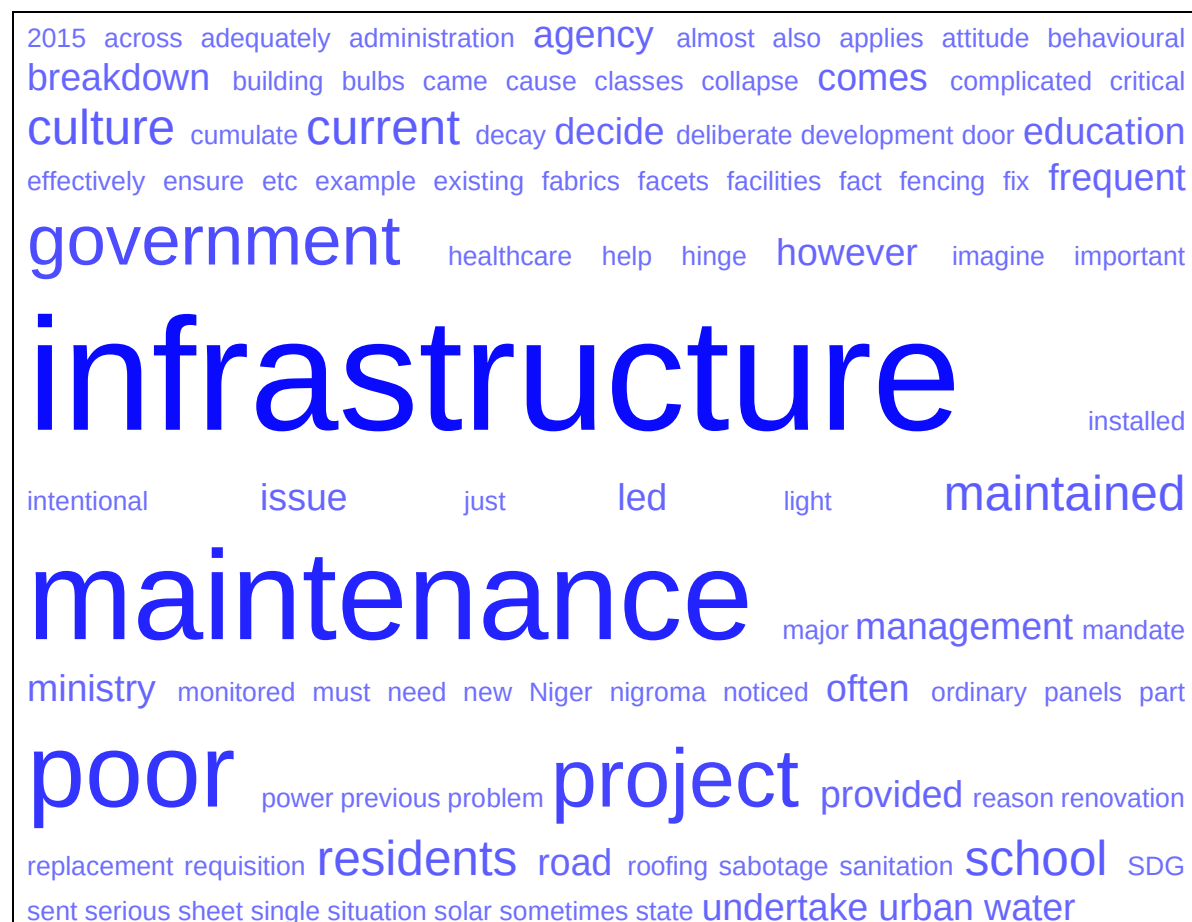


Figure 8.9: Opinions of the Urban Gatekeepers on Infrastructure Maintenance in North-Central Nigeria

Source: Author's Analysis (2021)

8.14 Examples of Community Infrastructure Provision

A word frequency query was run on the transcribed interviews with the stakeholders from the selected North-Central cities. The communal infrastructure identified centred around the water supply, with boreholes and upgrading of the various urban water supply systems. Road infrastructure was also a critical communal infrastructure identified by the stakeholders interviewed. The word frequency query outcome is shown in Figure 8.10.



Figure 8.10: Samples of Communally Provided Infrastructure in North-Central Nigeria

Source: Author's Analysis (2021)

8.15 Urban Infrastructure Priorities in North-Central Nigeria

A word frequency query deployed on the transcribed interviews with the stakeholders to determine the emphasis of the urban stakeholders regarding priority projects in the region showed that a water supply was the most significant need of the residents, and this was closely followed by road and health care facilities, as shown in Figure 8.11. The analysis also indicated that a power supply, alongside women's and youth empowerment, occupied a critical layer of the urban strata.



Figure 8.11: Urban Infrastructure Priorities in North-Central Nigeria

Source: Author's Analysis (2021)

8.16 Discussion of the Findings

The process of urban infrastructure development in North-Central Nigeria was associated with several challenges. Some of the urban liveability enhancement and sustainable urban infrastructure targets in the selected cities were education infrastructure, a reliable and clean water supply, improved health care, skill acquisition, and roads infrastructure. Most of North-Central Nigeria had failed the PPP arrangements for infrastructure provision and development. Overstretching or intensified use of the infrastructure was considered a significant challenge over the years, and this played a prominent role in the general perception of the infrastructure development challenges and provision. Poor budgetary allocation for infrastructure development underpinned the challenges of overstretching and overuse of the urban infrastructure in the cities studied.

Illegal developments often overtook sites reserved for infrastructure, and a lack of funding, vandalism, and poor project continuity were also challenges faced. Others were inadequate public participation, bulk demands, poor monitoring and evaluation, uncoordinated urban growth, and substandard projects. The funding for urban infrastructure provision was a significant factor in the analysis of the infrastructure development. The various stakeholders interviewed noted that public infrastructure was often overstretched and overused because of pressure from too many people using the infrastructure, despite the fact that some of the people did not even need to use the facilities. They simply used them because they were free public facilities. This research also examined the availability of a master plan to monitor and guide the infrastructure provision.

According to the findings of a recent study, stakeholders and even the states in North-Central Nigeria still lacked development plans. As a result, if the attitudes regarding spatial development plans were maintained, it would be impossible to achieve urban liveability and sustainability in these places. There were either no development master plans at all or outdated plans in the cities studied. If efforts were made to establish a broad-based inclusive strategy that ensured liveability, policymakers would have an excellent opportunity to catch up with development. Knowing and understanding the origins and implications of the diverse shapes that made up today's cities was essential for urban designers.

According to Paddison (1993), the concept of city marketing went beyond simply promoting the location itself. This could only be established firmly via meticulous planning and strict commitment. For Nigeria's North-Central region to meet the requirements of international state planning standards, the areas of finance and politics had to be nurtured. This study found that urban dwellers were involved throughout the development process from those interviewed, and project development and planning were further examined as part of this study.

Politicians had a significant impact on the location of the urban infrastructure in the cities studied in Nigeria's North-Central area. The stakeholders interviewed also acknowledged that population thresholds and financial capacity played a crucial role in the construction and provision of public infrastructure. In the research by Ismagilova et al. (2019), populations attracting infrastructure was a vital aspect of the operational efficacy of intelligent cities. An in-depth examination of the factors that influenced resilience and the various techniques that

needed to be used when modelling infrastructure at the local level was essential. As a result, new information about enhancing the adaptability of local infrastructure had to be gathered.

CHAPTER NINE

DEVELOPING INDICATORS FOR SUSTAINABLE DEVELOPMENT, URBAN LIVEABILITY, AND INCLUSIVE PHYSICAL DEVELOPMENT IN NORTH-CENTRAL NIGERIA

9.1 Introduction

This chapter aimed to develop indices or indicators for measuring the sustainable urban infrastructure development, urban liveability, and inclusive physical development in the three cities studied in North-Central Nigeria. These indices or indicators formed the basis for the model that this research sought to develop, in accordance with the literature. The indices were measured and tested using the questions in the research instrument, which was the questionnaire. The questionnaire was administered, the results were analysed, and the outcomes were measured against the Human Development Index (HDI) with a 4-point measuring scale from 0.0 to 1.0 (Watkins, 2006). This scale and the measuring label are shown once again in Table 9.1.

Table 9.2: Four-Point Likert HDI Ranking for Indicator Development

Index	Label
0.0-0.29	Very Low
0.3-0.49	Low
0.5-0.75	High
0.76-1.0	Very High

Source: UNDP (2006)

9.2 Analysis of the Measuring Indicators of the *Hangwurian* City Development Model in North-Central Nigeria

The model for sustainable urban development, urban liveability, and inclusive physical development also known as the *Hangwurian* City Development that this research sought to establish was required to explore the intricate strengths observed within these three important urban development concepts and to prescribe a new urban development paradigm in North-Central Nigeria. The starting point in this model's development was to establish the indicators to measure the five primary constructs: sustainable urban infrastructure development, urban

liveability, inclusive physical development, urban governance, and the *Hangwurian* city development indicator. The first of the constructs considered with the indices evaluated and presented was “sustainable infrastructure development”, which was predicated on three sub-constructs which were economic prosperity, social factors/society, and environmental considerations (Angelakoglou et al., 2020; Göçer & Tuğrul, 2015; Su et al., 2013; Wakernagel & Rees, 1997). The second construct, “inclusive physical development”, consists of three sub-constructs of equity and a justice indicator, a safety indicator, and a building resilience indicator. The third construct, “urban liveability”, also consists of three sub-constructs: quality of life, a liveable community indicator, and a place shaping indicator. The fourth construct, “environmental awareness”, includes motivation, values, and environmental knowledge. The fifth construct, “urban governance”, consists of four sub-constructs: a population management Indicator, a credit facilities indicator, a hospital network system indicator, and a family planning indicator. The sixth construct, the “*Hangwurian* city development indicator”, comprises of two sub-constructs, namely accessibility to the city and equity indicators. These six constructs were used to measure the significant constructs of the sustainable infrastructure development in North-Central Nigeria.

9.2.1 Measuring the indicators for the model in Lafia, North-Central Nigeria

The analysis of the contributions of the six constructs for *Hangwurian* development in Lafia city is presented in Table 9.2. The analysis indicated that these variables contributed to the sustainable infrastructure development available in the city at different rates.

Table 9.2: Lafia Sustainable Infrastructure Development Indicators

		Indicator	Mean		Rank	Group
Indicator Label		Code	Value	Index		Rank
Sustainable Urban Infrastructure Development	Economic Prosperity Indicator	ECP	3.167	0.633	5 th	2 rd
	Social Dimension Indicator	SOC	3.25	0.634	4 th	
	Environmental Consideration Indicator	ENV	3.153	0.636	3 rd	
Inclusive Physical Development	Equity/Justice Indicator	EQJ	2.932	0.586	7 th	5 th
	Safety Indicator	SAF	2.899	0.581	9 th	
	Building Resilience Indicator	RES	2.796	0.560	16 th	
Urban Liveability	Quality-of-Life Indicator	QoL	2.907	0.583	8 th	4 th
	Liveable Community Indicator	LVC	2.848	0.569	13 th	
	Place Shaping Indicator	PLS	2.881	0.577	10 th	
Environmental Awareness	Motivations and Value	MVA	3.654	0.731	1 st	1 st
	Environmental Knowledge	ENVK	3.352	0.671	2 nd	
Urban Governance	Population Management Indicator	POP	2.860	0.572	11 th	3 rd
	Credit Facilities (CRF) Indicator	CRF	2.853	0.570	12 th	
	Hospital Network System Indicator	HNS	2.812	0.563	15 th	
	Family Planning Indicator	FAMP	3.108	0.623	6 th	
The <i>Hangwurian</i> City Development Indicator	Indicator of Consumption Patterns	CSP	2.695	0.539	18 th	6 th
	Accessibility to the City (ATC)	ATC	2.723	0.545	17 th	
	Equity Indicator	EQY	2.856	0.569	13 th	
Mean Sustainable Development Indicator			2.986	0.597		

Source: Author's Computation (2021)

Analysis of the sub-constructs/variables used for the sustainable urban infrastructure development analysis indicated that the mean for the economic prosperity indicator was 0.633 (high). This implied that the economic indices provided for advancement of the economic activities in the city. The mean of the social dimension indicator was 0.634 (high). This implied that the social dimension indices improved the social interactions and brotherliness among the city dwellers. The mean for the environmental consideration indicator was 0.636 (high). This implied that the environmental consideration indices provided advancement of the residents' valuing of the environmental variables.

Analysis of the sub-constructs/variables used for the analysis of the inclusive physical development indicated that the mean of the equity/justice indicator was 0.586 (high). This implied that the equity/justice indicator indices provided advancement of the residents' valuing of the equity and justice variables. The mean for the safety indicator was 0.586 (high). This

implied that the safety indicator's indices provided advancement in the residents' valuation of the safety variables in Lafia City. The mean for the building resilience indicator's analysis was 0.56 (high). This implied that the building resilience indicator's indices provided credence to the residents' adaptation to climate change as their building was resilient to the effects of climate change, although at a lower level of adaptation.

Analysis of the sub-constructs/variables used for the analysis of urban liveability indicated that the mean for the quality-of-life indicator was 0.583 (high). This implied that the quality of life in Lafia City provided for advancement in the residents' way of living (economically, socially, and environmentally). The mean of the liveable community indicator was 0.569 (high). This implied that the liveable community in Lafia city provided advancement in the residents' way of living. The mean for the place shaping indicator was 0.577 (high). This implied that the place shaping in Lafia City enabled advancement of the residents' way of living.

Analysis the sub-constructs/variables used for the analysis of the residents' environmental awareness indicated that the mean motivation and value indicator was 0.731 (high), which implied that the residents in Lafia City's motivations and values advanced their way of living. The mean for the environmental knowledge indicator was 0.671 (high). This implied that the environmental knowledge of the people of Lafia City enabled advancement in the way that they managed their environment.

Analysis of the sub-constructs/variables used for the analysis of the urban governance showed that the mean of the population management indicator was 0.572 (high). This implied that awareness of population matters by the people of Lafia City provided for advancement in their management of their family sizes. The mean of the credit facility indicator was 0.570 (high), which implied adequate credit facilities were available to the people, from formal and informal credit lenders such as banks, to community contributions and cooperatives, etc. The mean for the hospital network system indicator was 0.563 (high). This implied that there were adequate hospital/health care facilities available to the people, especially secondary and tertiary health care facilities. The mean for the family planning indicator was 0.623 (high). This implied adequate awareness of the family planning options available to people, mainly because of the economic reality of having a large family.

Analysis of the sub-constructs/variables used for the *Hangwurian* city development indicator analysis showed that the mean consumption pattern indicator was 0.539 (high). This implied adequate awareness of the consumption of resources due to the escalating cost of obtaining the items to be consumed at home. The economic reality did not favour excessive consumption and wasting of resources. The mean score for the accessibility to the city was 0.545 (high). This implied adequate awareness of the cost of transportation and equal access to the city by the residents of Lafia City. The mean equity score was 0.569 (high). This implied fair equity in the distribution of infrastructure amongst and within the different neighbourhoods in Lafia.

9.2.1.1 Research findings and discussions on the Hangwurian city development indicators in Lafia City

The analysis showed that the best indicator for measuring the *Hangwurian* city development indicators in Lafia City was environmental awareness, followed by sustainable urban infrastructure. The least important indicator was the *Hangwurian* city development indicator. This was so because the residents showed little interest in the way and pattern of their food consumption, as they had few or no records of it. Equity was not viewed in terms of the distribution of resources according to need but rather from an equality point of view. This was apparent in how the city was zoned, with high-density neighbourhoods being overcrowded and low-density neighbourhoods being provided with more facilities. The analysis showed that the mean sustainable development indicator for Lafia City was 0.597 (slightly higher). This indicated that the city of Lafia only had the potential for slight sustainability.

9.2.2 Measuring the indicators for the model in Lokoja, North-Central Nigeria

The analysis of the contribution of the six constructs for a *Hangwurian* City in Lokoja City is presented in Table 9.3. The analysis indicated that these variables contributed to the sustainable infrastructure development available in the city at different rates. The constructs were analysed based on the perceptions of the residents of Lokoja.

Analysis of the constructs/variables of sustainable urban infrastructure development indicated that the mean for the economic prosperity indicator was 0.666 (high). This implied that the economic indices provided for advancement of the economic activities in the city. The mean for the social dimension indicator was 0.789 (very high). This implied that the social dimension

indices improved the social interactions and brotherliness amongst the city's dwellers. The mean for the environmental considerations indicator was 0.666 (high). This implied that the environmental considerations indices provided advancement of the residents' valuing of the environmental variables.

Table 9.3: Lokoja's Hangwurian City Development Indicators

Model			Mean		Rank	Group
Constructs	Indicators Label	Indicator Code	Value	Index		Rank
Sustainable Urban Infrastructure Development	Economic Prosperity Indicator	ECP	3.327	0.666	4 th	2 nd
	Social Dimension Indicator	SOC	3.943	0.789	2 nd	
	Environmental Considerations Indicator	ENV	3.335	0.666	4 th	
Inclusive Physical Development	Equity/Justice Indicator	EQJ	2.707	0.536	7 th	3 rd
	Safety Indicator	SAF	2.480	0.490	12 th	
	Building Resilience Indicator	RES	2.285	0.457	16 th	
Urban Liveability	Quality of Life Indicator	QoL	2.537	0.508	8 th	4 th
	Liveable Community Indicator	LVC	2.543	0.508	8 th	
	Place Shaping Indicator	PLS	2.532	0.507	11 th	
Environmental Awareness	Motivations and Value	MVA	4.304	0.861	1 st	1 st
	Environmental Knowledge	ENVK	3.857	0.772	3 rd	
Urban Governance	Population Management Indicator	POP	2.538	0.508	8 th	5 th
	Credit Facilities (CRF) Indicator	CRF	2.168	0.434	18 th	
	Hospital Network System Indicator	HNS	2.365	0.475	15 th	
	Family Planning Indicator	FAMP	3.153	0.630	6 th	
The Hangwurian City Development Indicator	Indicator of Consumption Pattern	CSP	2.425	0.485	14 th	6 th
	Accessibility to the City (ATC)	ATC	2.283	0.457	16 th	
	Equity Indicator	EQY	2.429	0.486	13 th	
Mean Sustainable Development Indicator			2.854	0.569		

Source: Author's Computation (2021)

Analysis of the inclusive physical development indicated that the mean of the equity/justice indicator was 0.536 (high). This implied that the equity/justice indicator's indices provided advancement in the residents' valuing of the equity and justice variables. The mean of the safety indicator was 0.490 (low). This implied that the safety indicator's indices did not provide advancement of the residents' appreciation of the safety variables in Lokoja City as they lived in fear. The mean for the building resilience indicator was 0.470 (low). This implied that the building resilience indicator was inappropriate in Lokoja City because residents still built their structures at low levels near the river and were therefore vulnerable to flooding. The adaptation strategies employed to combat climate change were unsuitable as they did not have a meaningful impact on climate change.

Analysis of the urban liveability indicated that the mean for the quality of life indicator was 0.508 (high). This implied that the quality of life in Lokoja city only slightly ensured that the residents could improve on their way of living in terms of their economic, social, and environmental quality. The mean of the liveable community indicator was 0.508 (high). This implied that the liveable community in Lokoja City provided for advancement in the residents' way of living. The mean of the place shaping indicator was 0.507 (high). This implied that the place shaping in Lokoja City provided for advancement in the residents' way of living.

Analysis of the constructs/variables for environmental awareness indicated that the mean for the motivation and value indicator was 0.861 (very high). This implied that the motivation and value in Lokoja City provided for advancement of the residents in terms of their way of living. The mean of the environmental knowledge indicator was 0.772 (very high). This implied that the environmental knowledge of the people of Lokoja City provided for advancement in their managing of their environment due to their proximity to the River Niger and the high susceptibility of their environment to flooding.

Analysis of the constructs/variables for urban governance showed that the mean of the population management indicator was 0.508 (high). This implied that the awareness of population matters of the people of Lokoja City provided for advancement in their family size management. The mean of the credit facility indicator was 0.434 (low). Did this imply that the credit facilities available to people from formal and informal credit lenders such as banks and

community contribution schemes and cooperatives were inadequate? The mean for the hospital network system indicator was 0.475 (low). This implied that the hospital facilities available to the people were inadequate, especially the primary health care facilities. The mean for the family planning indicator was 0.630 (high). This implied adequate awareness of family planning issues on the part of the people, primarily because of the economic reality of having a large family.

Analysis of the constructs/variables for the *Hangwurian* city development indicator showed that the mean of the consumption pattern indicator was 0.485 (low). This implied inadequate awareness of the consumption of resources due to the escalating cost of obtaining items to be consumed at home. The economic reality did not favour excessive consumption and waste of resources, thereby aggravating poverty. The mean for the indicator for accessibility to the city was 0.457 (low). This implied inadequate awareness of the cost of transportation and equal access to the city by the residents of Lokoja City. The mean for the equity indicator was 0.486 (low). This implied unfair equity in the distribution of infrastructure amongst and within the different neighbourhoods in the city of Lokoja.

9.2.2.1 Research findings and discussions on Hangwurian city development indicators in Lokoja City

The analysis showed that the best indicator for measuring the sustainable infrastructure development indicator in Lokoja City was environmental awareness, followed by sustainable urban infrastructure in the second position. Inclusive physical development came third, while the *Hangwurian* city development indicator was a minor contributor to the sustainable development indicator. This was so because the residents showed little interest in the pattern of their food consumption, as they had little or no records of them. Equity was viewed not from the point of the distribution of resources according to need, but rather from an equality point of view. This was evident in how the city was zoned, with high-density neighbourhoods being overcrowded and low-density neighbourhoods being provided with more facilities. The analysis showed that the mean for the sustainable development indicator for Lokoja city was 0.597 (slightly higher). This indicated that there was slight sustainability potential for the city of Lokoja.

9.2.3 Measuring the indicators for Hangwurian City development in Minna City

The analysis of the contribution of the six constructs for the Hangwurian City development in Minna City is presented in Table 9.4. The analysis indicated that these variables contributed to the sustainable infrastructure development available in the city at different rates. The constructs were analysed based on the perceptions of the residents of Minna.

Table 9.4: Minna Hangwurian City Development Indicators

Model				Mean		Rank	Group
Constructs	Indicators Label	Indicator Code	Value	Index			Rank
Sustainable Urban Infrastructure Development	Economic Prosperity Indicator	ECP	3.213	0.643	4 th		
	Social Dimension Indicator	SOC	3.368	0.673	1 st		1 st
	Environmental Consideration Indicator	ENV	3.204	0.641	5 th		
Inclusive Physical Development	Equity/Justice Indicator	EQJ	2.970	0.594	9 th		
	Safety Indicator	SAF	2.884	0.578	13 th		5 th
	Building Resilience Indicator	RES	2.858	0.572	16 th		
Urban Liveability	Quality of Life Indicator	QoL	2.849	0.570	18 th		
	Liveable Community Indicator	LVC	2.836	0.568	10 th		6 th
	Place Shaping Indicator	PLS	2.858	0.573	14 th		
Environmental Awareness	Motivations and Value	MVA	3.338	0.669	2 nd		
	Environmental Knowledge	ENVK	3.223	0.645	3 rd		2 nd
Urban Governance	Population Management Indicator	POP	2.890	0.577	14 th		
	Credit Facilities (CRF) Indicator	CRF	2.926	0.586	8 th		
	Hospital Network System Indicator	HNS	2.907	0.583	11 th		3 rd
	Family Planning Indicator	FAMP	3.070	0.613	7 th		
The Hangwurian City Development Indicator	Indicator of Consumption Pattern	CSP	2.858	0.573	15 th		4 th
	Accessibility to the City (ATC)	ATC	2.863	0.572	17 th		
	Equity Indicator	EQY	2.900	0.581	10 th		
Mean Sustainable Development Indicator			3.000	0.606			

Source: Author's Computation (2021)

Analysis of the constructs/variables of sustainable urban infrastructure development in Minna indicated that the mean of the economic prosperity indicator was 0.643 (high). This implied that the economic indices provided for advancement in the economic activities in the city. The mean of the social dimension indicator was 0.673 (high). This implied that the social dimension indices improved social interaction and brotherliness amongst the city dwellers. The mean for

the environmental consideration indicator was 0.641 (high). This implied that the environmental consideration's indices provided advancement of the residents' valuing of the environmental variables.

Analysis of the inclusive physical development indicator in the city of Minna showed that the mean of the equity/justice indicator was 0.594 (high). This implied that the equity/justice indicator's indices provided advancement of the residents' valuing of the equity and justice variables. The mean for the safety indicator was 0.578 (high). This implied that the safety indicator's indices provided advancement of the residents' valuing of the safety variables in Minna as the people lived in fear. The mean for the building resilience indicator's analysis was 0.572 (high). This implied that the building resilience indicator was slightly appropriate in Minna because the residents-built structures with materials that could withstand the heat and winds. The adaptation strategies employed to combat climate change were unsuitable for providing a meaningful effect on climate change.

Analysis of the urban liveability indicated that the mean for the quality-of-life indicator was 0.570 (high). This implied that the quality of life in Minna City slightly ensured the residents' way of living (economic, social, and environmental quality). The mean for the liveable community indicator was 0.568 (high). This implied that the liveable community in the city of Minna provided for advancement of the residents' way of living. The mean of the place shaping indicator was 0.573 (high). This implied that the place shaping in the city of Minna provided for advancement of the residents' way of living.

Analysis of the constructs/variables for environmental awareness indicated that the mean of the motivation and value indicator was 0.669 (high). This implied that the motivation and value in the city of Minna provided for advancement of the residents' way of living. The mean of the environmental knowledge indicator was 0.645 (high). This implied that the environmental knowledge of the people of the city of Minna provided for advancement of their way of environmental management.

Analysis of the constructs/variables for urban governance showed that the mean for the population management indicator was 0.577 (high). This implied that their awareness of the population matters of the people of the city of Minna provided for advancement in the management of their family sizes. The mean for the credit facility indicator was 0.586 (high).

This implied that adequate credit facilities were available to the people, from formal and informal credit lenders such as banks, community contributions, and cooperatives, etc. The mean for the hospital network system indicator was 0.583 (high). This implied adequate hospital facilities available to people, especially in terms of primary health care facilities. The mean for the family planning indicator was 0.613 (high). This implied adequate awareness of the family planning options available to people, primarily because of the economic reality of having a large family.

Analysis of the constructs/variables for the *Hangwurian* city development indicator showed that the mean for the consumption pattern indicator was 0.573 (high). This implied adequate awareness of the consumption of resources due to the escalating cost of obtaining the items to be consumed at home. The economic reality did not favour excessive consumption and wasting of resources, thereby aggravating poverty. The mean for the indicator of accessibility to the city was 0.572 (high). This implied inadequate awareness of the cost of transportation and equal access to the city by the residents of Minna. The mean for equity was 0.581 (high). This implied fair equity in the distribution of infrastructure amongst the different and within the different neighbourhoods of the city of Minna.

9.2.3.1 Research findings and discussions on the Hangwurian city development indicators in the city of Minna

The analysis showed that the best indicator for measuring the sustainable infrastructure development indicator in the city of Minna was sustainable urban infrastructure, followed by environmental awareness in the second position, urban governance in the third position, and the *Hangwurian* city development indicator in the fourth position. At the same time, urban liveability was a minor contributor to the sustainable development indicator. This was so because the residents showed little interest in the pattern of their food consumption and that influenced their quality of life, liveability community, and place shaping indicators. The analysis showed that the mean of the sustainable development indicator for the city of Minna was 0.606 (higher). This indicated that there was a high sustainability potential for the city of Minna.

9.3 Indicator Assessment and Development of the Indices for the Proposed Model in North-Central Nigeria

The performance of indicators at the city level must be adjudged to be at variance with their observed performance at the regional level. This requirement has been established in extant literature (Kwatra et al., 2016). The performance of indicators determines, to a considerable extent, how the indicator loadings will perform in a proposed model. This research, therefore, combined the results from the selected cities and obtained the mean performance of the six constructs of the *Hangwurian* city development indicator. The results of the analysis are presented in Table 9.5.

Table 9.5: Sustainable Infrastructure Development Indicators in North-Central Nigeria

Model			Mean		Rank	Group
Constructs	Indicators Label	Indicator Code	Value	Index		Rank
Sustainable Urban Infrastructure Development	Economic Prosperity Indicator	ECP	3.326	0.647	5 th	
	Social Dimension Indicator	SOC	3.520	0.699	2 nd	2 nd
	Environmental Consideration Indicator	ENV	3.231	0.648	4 th	
Inclusive Physical Development	Equity/Justice Indicator	EQJ	2.870	0.572	7 th	
	Safety Indicator	SAF	2.783	0.546	12 th	4 th
	Building Resilience Indicator	RES	2.646	0.509	18 th	
Urban Liveability	Quality of Life Indicator	QoL	2.764	0.554	8 th	
	Liveable Community Indicator	LVC	2.742	0.548	11 th	3 rd
	Place Shaping Indicator	PLS	2.757	0.552	9 th	
Environmental Awareness	Motivations and Value	MVA	3.765	0.754	1 st	1 st
	Environmental Knowledge	ENVK	3.477	0.696	3 rd	
Urban Governance	Population management indicator	POP	2.763	0.552	9 th	
	Credit Facilities (CRF) Indicator	CRF	2.649	0.530	16 th	
	Hospital Network System Indicator	HNS	2.695	0.540	14 th	5 th
	Family Planning Indicator	FAMP	3.110	0.622	6 th	
The <i>Hangwurian</i> City Development Indicator	Indicator of Consumption Pattern	CSP	2.659	0.533	15 th	
	Accessibility to the City (ATC)	ATC	2.623	0.525	17 th	6 th
	Equity Indicator	EQY	2.728	0.545	13 th	
Mean Sustainable Development Indicator			2.947	0.591		

Source: Author's Computation (2021)

Analysis of the construct of Hangwurian development in North-Central Nigeria showed that the mean for the economic prosperity indicator was 0.647 (high). This implied that the

economic indices provided for improvement in economic activities in the region. This could be seen because of the centralisation of government expenditure in the state capitals, enabling the cities to grow exponentially. The mean of the social dimension indicator was 0.699 (high). This implied that the social dimension indices provided advancement in social interaction and brotherliness amongst the city dwellers in North-Central Nigeria. The mean for the environmental consideration indicator was 0.648 (high). This implied that the environmental consideration indices provided progression in the residents' valuing of the environmental variables in North-Central Nigeria.

Analysis of the inclusive physical development indicator in North-Central Nigeria showed that the mean for the equity/justice indicator was 0.574 (high). This implied that the equity/justice indicator indices provided innovation in the residents' valuing of the equity and justice variables. The mean for the safety indicator in North-Central Nigeria was estimated to be 0.546 (high). This implied that the safety indicator's indices advanced the residents' valuing/appreciation of the safety variables in North-Central Nigeria. The mean of the building resilience indicator's analysis was 0.509 (high). This implied that the building resilience indicator was slightly appropriate in North-Central Nigeria because the residents-built structures with materials that could withstand heat and wind. The adaptation strategies employed to combat climate change were not sufficient to have a meaningful effect on climate change

Analysis of the urban liveability in North-Central Nigeria showed that the mean of the quality-of-life indicator was 0.554 (high). This implied that the quality of life in North-Central Nigeria slightly ensured the residents' way of living (economic, social, and environmental quality). The mean of the liveable community indicator was 0.548 (high). This implied that the liveability of the communities in North-Central Nigeria provided for advancement of the residents' way of living. The mean for the place shaping indicator was 0.552 (high). This implied that the place shaping in North-Central Nigeria provided advancement to the residents in terms of their way of living.

Analysis of the constructs for environmental awareness in North-Central Nigeria indicated that the mean for the motivation and value indicator was 0.754 (very high). This implied that the motivation and values in North-Central Nigeria provided advancement of the residents in their way of living. The mean for the environmental knowledge indicator was 0.696 (high). This

implied that the environmental knowledge of the people of North-Central Nigeria provided for advancement in their knowledge and thus their way of managing their environment.

Analysis of the constructs/variables for urban governance in North-Central Nigeria showed that the mean for the population management indicator was 0.552 (High). This implied that the awareness of the population matters of the people of North-Central Nigeria provided advancement in their knowledge of family size management. The mean for the credit facility indicator was 0.530 (high). This implied adequate credit facilities available for the people from formal and informal credit lenders such as banks, community contributions and cooperatives, etc. The mean for the hospital network system indicator was 0.540 (high). This implied that there were adequate health care facilities available for the people, especially primary health care facilities. The mean for the family planning indicator was 0.622 (high). This implied that there was adequate awareness of the various family planning options available to people, primarily because of the economic implications of having very large families.

Analysis of the construct for the *Hangwurian* city development indicator in North-Central Nigeria showed that the mean for the consumption pattern indicator was 0.533 (high). This implied adequate awareness of the consumption of resources due to the escalating cost of obtaining the items for home consumption. The economic reality did not favour excessive consumption and wasting of resources, thereby aggravating poverty. The mean for the accessibility to the city was 0.525 (high). This implied that there was inadequate awareness of the cost of transportation and equal access to the city by the residents of North-Central Nigeria. The mean for the equity indicator was 0.545 (high). This implied that there was fair equity in the distribution of the infrastructure amongst the different cities and within the different neighbourhoods of these three cities in North-Central Nigeria.

9.3.1 Research findings and discussion on the Hangwurian development indicators in North-Central Nigeria

The analysis showed that the best indicator for measuring the sustainable infrastructure development indicators in North-Central Nigeria was environmental awareness, followed by sustainable urban infrastructure, Urban liveability was third, inclusive physical development was fourth, urban governance came fifth, while the *Hangwurian* city development indicator was a minor contributor to the sustainable development indicator. This was so because the

residents showed little interest in the way in which they consumed food/the pattern of their food consumption, that influenced their quality of life, the liveability of their communities, and their place shaping indicators. The analysis showed that the mean for the sustainable development indicator in North-Central Nigeria was 0.591 (higher). This indicated that there was a high potential for sustainability in these cities in North-Central Nigeria.

CHAPTER TEN

SUSTAINABLE DEVELOPMENT-URBAN LIVEABILITY- INCLUSIVE PHYSICAL DEVELOPMENT MODEL (*HANGWURIAN CITY DEVELOPMENT MODEL*) IN NORTH- CENTRAL NIGERIA

10.1 Introduction

Results using the SmartPLS version 3.3 software are offered in this section to investigate the hypothetical paths presented in this thesis (Ringle et al., 2005). The PLS structural equation modelling technique can estimate the standard regression coefficients for the paths connecting components (Croteau & Bergeron, 2001). Due to its flexibility in identifying formative and reflective latent variables, PLS was selected for this investigation, using the least-squares estimate method (Podsakoff et al., 2006). A component-based approach means that sample sizes and residual distributions are only somewhat restricted (Elbanna et al., 2013; Hair et al., 2012). Latent variables can also be modelled, and structural models can be assessed simultaneously using PLS-SEM (Elbanna et al., 2013). However, this study was exploratory and required testing. The exploratory method is considered widely as one of the most acceptable ways to develop new ideas. In addition, this tool can be used to assess the impact of common biases on the results (Podsakoff et al., 2003). This approach has been frequently employed by marketing and general management researchers (Elbanna et al., 2013; Hair et al., 2014; Sarstedt et al., 2014).

10.2 Model Development for Lafia, North-Central Nigeria

10.2.1 Measurement model

To determine the best indicator for the individual constructs, an exploratory factor analysis was conducted to ascertain the number of indicators to be retained for each of the six latent variables included in this study: urban liveability (URL), sustainable urban development (SUD), inclusive physical development (IPD), environmental awareness (EA), urban governance (UMG), and *Hangwurian* city development (HCD). These are indicated in Table 10.1. Fifteen indicators were retained for the URL construct; ten indicators were identified concerning the SUD construct; sixteen were retained for IPD; eleven for EA; twenty-two for urban management and governance; and fourteen for HCD. When assessing the measurement model

using the SmartPLS results, the following criteria had to be examined: indicator reliability, internal consistency reliability, convergent validity, and discriminant validity.

Each indicator's reliability was assessed using the square of its factor loadings, and it was found that almost all of the indicators had values close to the acceptable minimum of 0.7 (Oke & Ogunsemi, 2016), but the values were more significant than the minimum threshold for exploratory research of this nature (Hulland, 1999). The latent constructs had an internal consistency of more than 0.70, and their composite reliability scores varied from 0.819 per cent to 0.831 per cent. The internal consistency reliability was satisfactory for the measurement model's composite items. Table 10.1 shows that the model's convergent validity was examined, and the average variance (AVE) explained was more significant than 0.5 (Bagozzi & Yi, 1988).

Table 10.1: Model Path Analysis in Lafia, North-Central Nigeria

Latent variable	Latent Variable Label	Indicators	Loadings	Indicator Reliability (i.e., loadings ²)	Composite Reliability	R ²	AVE	Cronbach's Alpha
Access to the City		ATC 201	0.798	0.637	0.906	0.976	0.616	0.875
		ATC 202	0.824	0.679				
		ATC 204	0.799	0.638				
		ATC 208	0.814	0.663				
		CRF 140	0.735	0.540				
Credit Facilities		CRF 142	0.808	0.653	0.915	0.926	0.607	0.892
		CRF 143	0.800	0.640				
		CRF 144	0.808	0.653				
		CRF 145	0.757	0.573				
		CRF 146	0.784	0.615				
		CRF 147	0.735	0.540				
		CSP 193	0.845	0.714				
Consumption Pattern		CSP 194	0.773	0.598	0.868	0.976	0.623	0.798
		CSP 196	0.775	0.600				
		CSP 199	0.761	0.579				
Economic Prosperity		ECP 3	0.806	0.650	0.819	0.416	0.602	0.667
		ECP 4	0.712	0.507				
		ECP 8	0.805	0.648				
Environmental Dimension		ENV 34	0.868	0.753	0.837	0.247	0.633	0.712
		ENV 36 A	0.819	0.671				
		ENV 40	0.689	0.475				
Environmental Knowledge		ENVK 169	0.734	0.539	0.837	0.932	0.633	0.712
		ENVK 170	0.684	0.468				
		ENVK 175	0.721	0.520				
		ENVK 186	0.722	0.521				
Equity/Justice		EQJ 50	0.743	0.552	0.870	0.593	0.573	0.813
		EQJ 55	0.721	0.520				
		EQJ 56	0.788	0.621				
		EQJ 58	0.764	0.584				
		EQJ 59	0.767	0.588				
Equity Dimension		EQY 213	0.815	0.664				

	EQY 214	0.790	0.624				
	EQY 215	0.752	0.566				
	EQY 216	0.801	0.641	0.883	0.976	0.654	0.824
	EQY 217	0.803	0.645				
	EQY 219	0.746	0.557				
	FAMP 131	0.833	0.694				
Family Planning	FAMP 132	0.723	0.523				
	FAMP 133	0.793	0.629	0.855	0.149	0.597	0.779
	FAMP 134	0.735	0.540				
	HNS 151	0.716	0.513				
	HNS 152	0.800	0.640				
Hospital Network System	HNS 153	0.746	0.557				
	HNS 154	0.798	0.637	0.899	0.376	0.597	0.865
	HNS 155	0.802	0.643				
	HNS 156	0.770	0.593				
	LVC 101	0.794	0.630				
	LVC 102	0.730	0.533				
Liveable Communities	LVC 103	0.768	0.590				
	LVC 105	0.720	0.518	0.880	0.663	0.594	0.830
	LVC 108	0.837	0.701				
	LVC 109	0.794	0.630				
	MVA 162	0.785	0.616				
	MVA 163	0.785	0.616				
	MVA 164	0.793	0.629				
Motivation/Value	MVA 165	0.812	0.659				
	MVA 166	0.825	0.681	0.907	0.932	0.619	0.876
	MVA 166	0.714	0.510				
	MVA 168	0.785	0.616				
	PLS 110	0.761	0.597				
	PLS 111	0.775	0.601				
Place-Shaping	PLS 114	0.730	0.533				
	PLS 118	0.712	0.507	0.868	0.707	0.569	0.812
	PLS 119	0.792	0.627				

Population Management	POP 125	0.750	0.563	0.837	0.476	0.632	0.708
	POP 128	0.786	0.618				
	POP 130	0.846	0.716				
Quality of Life	QoL 88	0.798	0.637	0.860	0.533	0.605	0.783
	QoL 89	0.803	0.645				
	QoL 93	0.738	0.545				
	QoL 94	0.772	0.596				
Building Resilience	RES 72	0.783	0.613	0.931	0.983	0.626	0.915
	RES 73	0.809	0.654				
	RES 74	0.796	0.634				
	RES 75	0.794	0.630				
	RES 76	0.852	0.726				
	RES 78	0.788	0.621				
	RES 79	0.773	0.598				
Safety	RES 84	0.731	0.534	0.840	0.467	0.638	0.717
	SAF 65	0.727	0.529				
	SAF 67	0.818	0.669				
	SAF 69	0.846	0.716				
Social Dimension	SOC 18	0.839	0.704	0.875	0.090	0.637	0.810
	SOC 19	0.786	0.618				
	SOC 21	0.797	0.635				
	SOC 23	0.769	0.591				
Youth Empowerment	YTE 135	0.832	0.692	0.855	0.783	0.662	0.888
	YTE 136	0.802	0.643				
	YTE 139	0.806	0.650				

Source: Author's Analysis using SmartPLS 3.0 (2021)

10.2.2 Construct reliability and validity

Table 10.2 shows the significant criteria for evaluating the discriminant validity in the PLS analysis. Reflective structures should account for a more considerable proportion of variance than correlations with the latent variable (Chin, 1998), and items should load more strongly on their corresponding constructs than other constructs (Chin, 1998; Elbanna et al., 2013). The latent variable indicators had more substantial loadings than cross-loading, according to Table 10.2. They had greater variability (AVE) than the other types of conceptions. As a result, it could be concluded that the measuring model described here had the necessary validity and reliability to evaluate the structural model's predictive and explanatory potential.

This referred to how the numerous items used in the research to measure the same idea agreed with each other; whether or not there was convergent validity (Hair et al., 2014). The measures employed in this study were tested for convergent validity using the outer loadings or the average extracted variance (AVE) value. To prove that the latent variable was responsible for more than half of the variance in its indicators, an AVE value of 0.5 or greater had to be attained (Hair et al., 2010). Any loadings that fell below 0.5 were deleted, resulting in final AVE and CR values above the 0.5 and 0.7 benchmark values (please refer to Table 10.1).

As a part of the validation process, discriminant validity was used to determine whether or not a concept was indeed unique from other concepts (Hair et al., 2017). Fornell and Larcker's (1981) criterion, in which the square root of AVE should be more significant than the highest correlation with any other constructs, was frequent technique applied. There was sufficient discriminant validity in the assessments based on Fornell and Larcker's (1981) criterion. Hair et al. (2016), however, found that this criterion failed miserably when the constructions' indicator loadings differed by a small amount. Henseler et al. (2015) proposed the heterotrait-monotrait (HTMT) ratio be used as a cure to this problem. The mean of all the correlations between indicators across constructs assessing various constructs had to be used in comparison to the average heterotrait-heteromethod correlative indicators, as per Hair et al. (2017) (i.e., the mean of all of the correlations of the indicators measuring the same constructs). Tables 10.2, 10.3 and 10.4 show the findings of the HTMT statistics, the Fornell Larcker Criterion and VIF. The highest HTMT statistic shown in the table was 0.833, less than the threshold value of 0.850. The HTMT confidence interval was not zero, based on the consistent PLS bootstrapping. Thus, the discriminant validity was satisfactory. In conclusion, the measurement model had adequate construct validity.

Table 10.2: Fornell-Larcker Criterion for Discriminant Validity in Lafia, North-Central Nigeria

	ATC	CRF	CSP	EA	ECP	ENV	EQJ	EQY	FAMP	HCD	HNS	IJCD	IPD	LVC	MVA	PLS	POP	QoL	RES	SAF	SUD	UMG	URL	YTE
ATC	.785																							
CRF	.238	.779																						
CSP	.673	.270	.789																					
EA	-.044	-.104	-.062	.742																				
ECP	.127	.066	.130	.232	.776																			
ENV	.218	.168	.128	.231	.366	.796																		
EQJ	.220	.358	.241	-.022	.039	.255	.757																	
EQY	.708	.239	.760	-.011	.137	.140	.298	.809																
FAMP	.157	.306	.093	.121	.205	.095	.117	.042	.773															
HCD	.876	.261	.815	-.026	.145	.175	.296	.939	.109	.748														
HNS	.206	.596	.253	-.119	.053	.186	.357	.256	.284	.243	.773													
IJCD	.175	.748	.224	-.117	.078	.215	.348	.212	.249	.205	.693	.793												
IPD	.258	.330	.220	-.009	-.006	.270	.770	.276	.087	.285	.373	.367	.777											
LVC	.142	.340	.133	-.020	.071	.163	.422	.150	.160	.155	.311	.258	.354	.771										
MVA	-.022	-.083	-.031	.966	.216	.215	-.004	.029	.101	.005	-.088	-.110	.028	-.005	.787									
PLS	.195	.368	.206	.002	.109	.231	.435	.245	.188	.245	.389	.305	.365	.731	.016	.754								
POP	.134	.679	.135	-.117	.058	.100	.267	.134	.313	.138	.510	.593	.271	.329	-.104	.353	.795							
QoL	.256	.352	.209	-.032	.033	.177	.406	.203	.201	.251	.310	.322	.332	.644	-.011	.642	.355	.778						
RES	.266	.317	.228	-.007	-.012	.273	.757	.289	.064	.297	.368	.361	.991	.350	.030	.354	.254	.322	.791					
SAF	.242	.221	.208	-.031	-.025	.290	.666	.264	.061	.249	.298	.257	.683	.351	-.005	.310	.159	.316	.681	.799				
SUD	.164	.083	.119	.266	.645	.497	.172	.134	.162	.144	.132	.120	.115	.118	.242	.140	.029	.057	.106	.135	.798			
UMG	.243	.962	.268	-.128	.071	.159	.366	.243	.386	.266	.613	.744	.337	.354	-.108	.385	.690	.368	.318	.226	.103	.774		
URL	.219	.347	.182	.036	.100	.253	.390	.225	.211	.236	.359	.288	.325	.814	.059	.841	.387	.730	.316	.322	.114	.363	.748	
YTE	.235	.779	.226	-.068	.074	.137	.284	.223	.469	.245	.555	.651	.272	.316	-.067	.319	.619	.320	.251	.207	.110	.885	.311	.814

Source: Author's Analysis using SmartPLS 3.0 (2021)

Table 10.3: Heterotrait-Monotrait Ratio (HTMT) for Measuring the Discriminant Validity in Lafia, North-Central Nigeria

	ATC	CRF	CSP	EA	ECP	ENV	EQJ	EQY	FAMP	HCD	HNS	IJCD	IPD	LVC	MVA	PLS	POP	QoL	RES	SAF	SUD	UMG	URL	YTE
ATC																								
CRF	.271																							
CSP	.102	.318																						
EA	.095	.140	.104																					
ECP	.165	.132	.101	.296																				
ENV	.272	.234	.189	.282	.507																			
EQJ	.258	.416	.294	.089	.167	.338																		
EQY	.833	.279	.033	.115	.190	.178	.364																	
FAMP	.189	.337	.111	.160	.281	.157	.135	.081																
HCD	.195	.294	.060	.105	.191	.218	.347	.071	.448															
HNS	.247	.677	.311	.145	.090	.252	.424	.305	.333	.281														
IJCD	.226	.119	.295	.155	.140	.322	.447	.274	.353	.254	.883													
IPD	.289	.369	.253	.081	.167	.334	.899	.315	.122	.314	.423	.450												
LVC	.169	.390	.164	.090	.146	.212	.517	.182	.184	.180	.364	.327	.412											
MVA	.077	.122	.077	.066	.280	.270	.073	.101	.132	.090	.106	.152	.064	.088										
PLS	.232	.431	.250	.104	.187	.306	.536	.297	.229	.286	.466	.402	.429	.077	.289									
POP	.170	.845	.185	.162	.120	.179	.351	.175	.389	.173	.652	.822	.342	.420	.152	.463								
QoL	.305	.418	.262	.106	.101	.250	.512	.254	.246	.303	.375	.427	.397	.806	.095	.312	.472							
RES	.298	.350	.262	.078	.164	.337	.877	.333	.095	.328	.414	.439	.086	.403	.062	.414	.314	.382						
SAF	.302	.272	.264	.098	.231	.401	.876	.337	.074	.302	.370	.340	.841	.461	.090	.409	.220	.223	.833					
SUD	.191	.115	.147	.312	.877	.626	.216	.160	.196	.166	.154	.159	.141	.158	.286	.185	.094	.117	.127	.254				
UMG	.277	1.076	.318	.153	.124	.218	.427	.284	.443	.300	.698	.021	.380	.410	.135	.452	.865	.440	.351	.178	.135			
URL	.281	.428	.238	.104	.164	.369	.506	.294	.270	.299	.453	.397	.403	.007	.102	.071	.537	.365	.386	.446	.127	.449		
YTE	.286	.941	.291	.108	.111	.204	.348	.278	.601	.297	.675	.871	.325	.393	.108	.402	.843	.413	.293	.275	.149	.075	.409	

Source: Author's Analysis using SmartPLS 3.0 (2021)

Table 10.4: Collinearity Statistic (VIF) in Lafia, North-Central Nigeria

	ATC	CRF	CSP	EA	ECP	ENV	EQJ	EQY	FAMP	HCD	HNS	IJCD	IPD	LVC	MVA	PLS	POP	QoL	RES	SAF	SUD	UMG	URL	YTE
ATC										2.239														
CRF																								
CSP										2.587														
EA													1.025		1.000						1.017	1.000	1.105	
ECP																								
ENV																								
EQJ																								
EQY										2.895														
FAMP																								
HCD																								
HNS																								
IJCD																								
IPD						1.000				1.184									1.000	1.000				
LVC																								
MVA																								
PLS																								
POP																								
QoL																								
RES																								
SAF																								
SUD					1.000	1.000				1.038													1.099	
UMG	1.000								1.000		1.000	1.000	1.179				1.000				1.017		1.038	1.000
URL										1.152			1.161	1.000		1.000		1.000						
YTE																								

Source: Author's Analysis using SmartPLS 3.0 (2021)

10.2.3 Structural model results

It was then time to test the hypotheses based on the outcomes of the structural model created after the reliability and validity of the construct measures were established. In a regression study, the path coefficients of the PLS model were viewed as normalised beta weights. But prior to this interpretation, it was suggested that the model be examined for collinearity because ordinary least square regression was used to estimate the coefficients of the pathways. There was a possibility that collinearity in these results could be construed as bias, according to Hair et al. (2014). Consequently, this study followed Wong (2013); and Sarstedt et al. (2014) by determining if the constructs were related. The latent variable scores were utilised as inputs for the multiple regression to examine the difficulties with collinearity in the inner model, with the exogenous latent factors (i.e., EA, UMG, SUD, URL, and IPD) built to be the independent variables. The dependent variable, on the other hand, was the *Hangwurian* city development.

10.2.3.1 Path model

In a regression study, the path coefficients of the PLS model were viewed as normalised beta weights. A collinearity test had to be performed because the calculation of the coefficients of the paths was based on an ordinary least square regression, which was first suggested by Mooi and Sarstedt (2011); and Sarstedt et al. (2014). There was a possibility that collinearity in these results could be construed as bias, according to Hair et al. (2014). Consequently, this study followed Sarstedt et al. (2014); and Wong (2013)'s guidance by determining if the constructs were related. The latent variable scores were used as inputs for the multiple regression in which the exogenous latent variables were formed as independent variables to analyse the collinearity issues in the inner model.

In contrast, HCD was configured as the dependent variable. The path relationship between the various exogenous latent variables and their corresponding effects on the dependent variable HCD is illustrated in Figure 10.1. The results confirmed that a positive and significant relationship existed between environmental awareness (EA), urban management and governance (UMG), urban liveability (URL), sustainable urban development (SUD), inclusive physical development (IPD), and their corresponding effect on the *Hangwurian* city development (HCD). Several paths were analysed, from the EA to the HCD and from the UMG to the HCD.

Using the hypothetical path (ATC–HCD: path=0.392; $t=22.962$; $p=0.000$) and the hypothetical path (CSP–HCD: path=0.117; $t=8.398$; $p=0.000$) to HCD, the research found that the hypothetical path supported the hypothesised path (EQY–HCD: path=0.573; $t=31.111$; $p=0.000$). Table 10.5 and Figure 10.1 provide the hypotheses for *Hangwurian* city development and its endogenous latent variables. Table 10.5 presents the first three hypothesised paths for HCD and its endogenous factors, while additional variable analysis between both the exogenous variables and their endogenous variables are also included in the Table. EA to IPD (path=0.139; $t=0.283$; $p=0.773$); EA to URL (path=0.67; $t=1.181$; $p=0.038$); IPD to HCD (path=0.001; $t=1.164$; $p=0.245$); SUD to HCD (path=0.011; $p=0.094$); SUD to URL (path=0.58; $t=0.941$; $p=0.397$); URL to HCD (path=0.001; $t=0.140$; $p=0.889$). However, six of the thirty hypothesised paths were found to be unsupported: EA to IPD. The null hypothesis was adopted as an alternative hypothesis in all of the above-mentioned path analyses because the route coefficients for the exogeneous latent variables in Lafia, North Central Nigeria, did not support them.

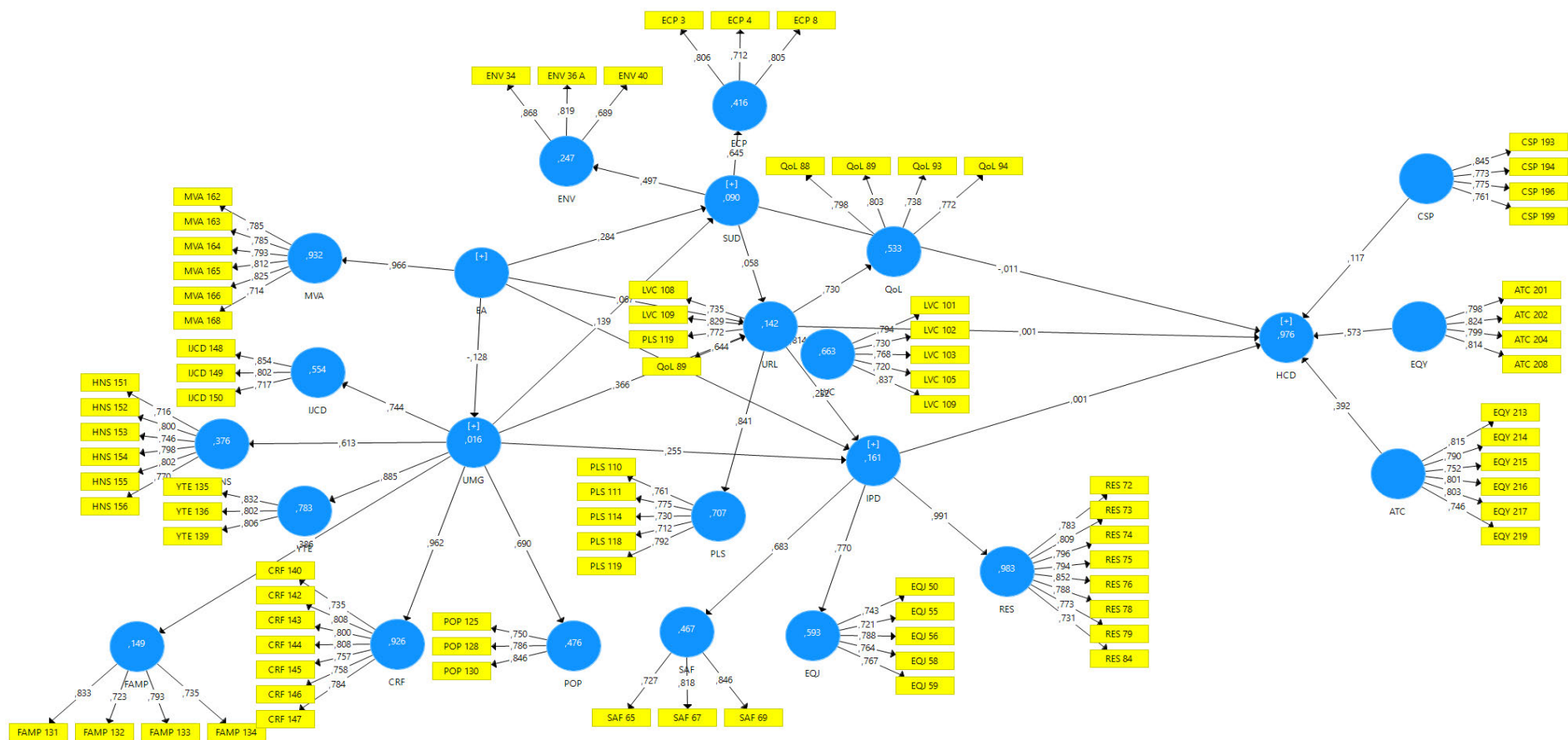


Figure 10.1: Path Coefficients and Analysis in Lafia, North-Central Nigeria

Source: Author's Analysis using SmartPLS 3.0 (2021)

Table 10.5: Path Coefficients in Lafia, North-Central Nigeria

Path Coefficients	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values	Decision
ATC -> HCD	.392	.393	.017	22.962	.000	Supported
CSP -> HCD	.117	.118	.014	8.398	.000	Supported
EA -> IPD	.015	.010	.052	.289	.773	Not Supported
EA -> MVA	.966	.966	.003	316.622	.000	Supported
EA -> SUD	.284	.281	.060	4.730	.000	Supported
EA -> UMG	-.128	-.128	.063	2.023	.044	Supported
EA -> URL	.067	.069	.057	1.181	.238	Not Supported
EQY -> HCD	.573	.572	.018	31.111	.000	Supported
IPD -> EQJ	.770	.770	.026	30.100	.000	Supported
IPD -> HCD	.001	.000	.009	.094	.925	Not Supported
IPD -> RES	.991	.992	.001	1186.307	.000	Supported
IPD -> SAF	.683	.686	.035	19.790	.000	Supported
SUD -> ECP	.645	.648	.037	17.204	.000	Supported
SUD -> ENV	.497	.500	.050	9.975	.000	Supported
SUD -> HCD	-.011	-.011	.009	1.164	.245	Not Supported
SUD -> URL	.058	.055	.062	.941	.347	Not Supported
UMG -> CRF	.962	.963	.004	236.564	.000	Supported
UMG -> FAMP	.386	.391	.060	6.414	.000	Supported
UMG -> HNS	.613	.611	.054	11.456	.000	Supported
UMG -> IJCD	.744	.743	.029	25.421	.000	Supported
UMG -> IPD	.255	.253	.062	4.082	.000	Supported
UMG -> POP	.690	.691	.039	17.564	.000	Supported
UMG -> SUD	.139	.141	.059	2.358	.019	Supported
UMG -> URL	.366	.367	.057	6.432	.000	Supported
UMG -> YTE	.885	.885	.014	64.874	.000	Supported
URL -> HCD	.001	.002	.009	.140	.889	Not Supported
URL -> IPD	.232	.231	.062	3.750	.000	Supported
URL -> LVC	.814	.815	.017	48.400	.000	Supported
URL -> PLS	.841	.841	.018	46.998	.000	Supported
URL -> QoL	.730	.731	.036	20.138	.000	Supported

Source: Author's Analysis using SmartPLS 3.5 (2021)

10.2.4 Analysing the predictive relevance (Q^2)

Q^2 , a measure of the study model's predictive power, was determined in accordance with Duarte and Raposo (2010); and Götz et al. (2010). Q^2 was determined via a blindfolding process. A predictive significance is shown by a Q^2 larger than 0, according to Hair et al. (2014), and a score below zero shows that the model is not predictively relevant. Q^2 results of 0.02, 0.15, and 0.35 indicate that an exogenous construct has a small, medium, and high predictive relevance for a specific endogenous construct, respectively (Hair et al., 2014). It was clear by Hair et al. (2013) that a moderately high level of predictive relevance and a significant coefficient of determination would support a model's ability to fit the data obtained.

Table 10.5 and Figure 10.2 highlight the relevance of the structural model's relationships and the predictive capacities of the endogenous latent variables. In the structural model, the R^2 values were acceptable because they exceeded the 10 per cent threshold recommended by Elbanna et al. (2013): credit facilities (CRF $R^2 = 92.6\%$); economic prosperity (ECP $R^2 = 41.6\%$); environmental awareness (ENV $R^2 = 24.7\%$); equity (EQY $R^2 = 59.3\%$); family planning (FAMP $R^2 = 14.9\%$); and consumption pattern (CSP $R^2 = 97.6\%$) were all acceptable.

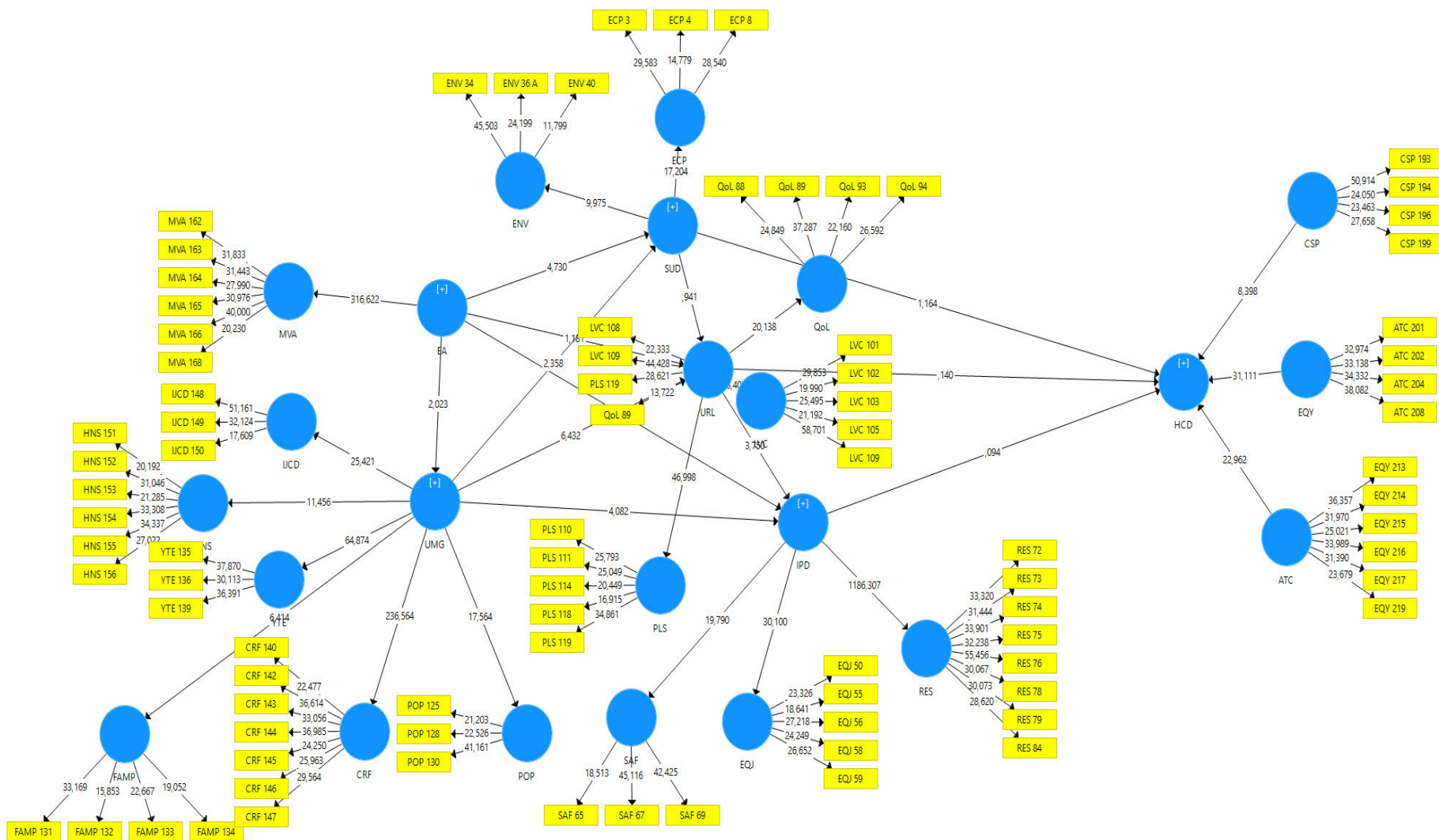


Figure 10.2: Structural Model Analysis in Lafia, North-Central Nigeria

Source: Author's Analysis using SmartPLS 3.0 (2021)

10.2.4.1 Predictive relevance of the endogenous variables

The endogenous variables, shown in Table 10.6, were found to have a predictive relevance (Q^2) that ranged from a value of less than zero to a value of more than zero, as benchmarked by Sarstedt et al. (2014), who used blindfolding to determine the predictive relevance of both exogenous and endogenous variables in their model construct. Many of the variables in Table 10.6 fell within the range of values 0.001 to +0.626, which indicated a strong correlation between the model's components and the predictive importance of the endogenous variables in Table 10.6. The endogenous variables' predictive relevance determines whether the prediction direction is positive or negative.

Table 10.6: Predictive Relevance Analysis in Lafia, North-Central Nigeria

	RMSE	MAE	MAPE	Q^2_{predict}	R^2 Result of Coefficient of Determinant
CRF 140	1.065	.898	46.245	.003	
CRF 142	1.115	.902	42.421	.019	
CRF 143	1.057	.902	49.175	.007	0.926
CRF 144	1.140	.927	48.549	.010	
CRF 145	1.100	.905	47.162	-.003	
CRF 146	1.125	.927	49.139	-.018	
CRF 147	1.157	.963	45.996	-.012	
ECP 3	.996	.816	31.523	.048	0.416
ECP 4	.953	.724	29.239	.006	
ECP 8	1.108	.919	41.680	.030	
ENV 34	1.054	.846	32.887	.036	0.247
ENV 40	1.007	.789	39.294	.017	
EQJ 50	1.004	.790	37.312	-.003	0.593
EQJ 55	1.032	.746	36.985	-.003	
EQJ 56	1.118	.876	44.366	-.002	
EQJ 58	.991	.793	40.854	-.002	
EQJ 59	1.022	.849	37.266	-.002	
FAMP 131	1.034	.767	35.818	-.012	0.149
FAMP 132	1.060	.803	35.061	-.010	
FAMP 133	1.017	.830	32.542	-.013	
FAMP 134	1.119	.911	39.256	-.005	
CSP 193	.798	.613	29.999	.493	0.976
ATC 201	.708	.552	28.211	.564	
ATC 202	.706	.543	29.114	.592	0.976
ATC 204	.771	.607	28.768	.570	
ATC 208	.703	.558	26.091	.626	
EQY 213	.708	.531	24.280	.538	0.976
EQY 214	.772	.594	27.207	.450	
EQY 216	.762	.623	25.182	.505	
HNS 151	.991	.820	42.409	.007	0.376
HNS 152	.959	.696	33.502	-.001	
HNS 153	.859	.700	36.382	.007	
HNS 154	.992	.787	40.161	.008	

HNS 155	.968	.781	37.575	.000	
HNS 156	.977	.757	34.366	.010	
SAF 63	.995	.812	40.492	-.003	0.467
RES 72	1.111	.897	45.476	-.004	
RES 73	1.288	1.112	53.953	-.004	
RES 74	1.052	.903	46.542	-.005	
RES 75	1.068	.898	48.105	-.005	
RES 76	1.181	1.002	43.409	-.006	0.983
RES 78	1.080	.869	45.162	-.005	
RES 79	1.288	1.118	48.699	-.004	
LVC 101	1.016	.765	37.432	-.003	
LVC 102	1.080	.879	42.582	-.007	
LVC 103	1.045	.833	39.449	-.003	
LVC 105	1.002	.772	34.603	-.004	0.663
LVC 109	1.002	.857	47.868	-.003	
MVA 162	.632	.495	17.060	.588	
MVA 163	.730	.571	21.417	.567	
MVA 164	.629	.481	15.162	.550	
MVA 165	.734	.583	22.552	.575	
MVA 166	.628	.479	16.568	.643	0.932
MVA 168	.712	.552	18.142	.516	
PLS 110	1.009	.780	34.795	-.005	
PLS 111	1.025	.821	40.719	.000	
PLS 114	.979	.788	40.099	-.006	
PLS 118	1.082	.918	49.923	-.005	0.707
PLS 119	.981	.795	38.546	-.001	
POP 125	1.191	1.004	51.741	.009	
POP 128	1.146	.935	46.804	.003	0.476
POP 130	.950	.777	39.774	.004	
QoL 88	.967	.695	32.283	-.005	
QoL 89	.964	.745	34.656	-.004	
QoL 93	1.080	.851	40.549	-.001	0.533
QoL 94	.934	.667	31.833	-.005	
RES 72	1.111	.897	45.475	-.004	
RES 73	1.288	1.112	53.953	-.004	
RES 74	1.052	.903	46.541	-.005	
RES 75	1.068	.898	48.105	-.005	
RES 76	1.181	1.002	43.407	-.006	0.983
RES 78	1.080	.869	45.161	-.005	
RES 79	1.288	1.118	48.699	-.004	
RES 84	1.047	.893	45.397	-.005	
SAF 65	.963	.814	42.381	-.001	
SAF 67	1.130	.930	49.846	-.001	0.840
SAF 69	1.034	.782	37.679	-.003	
SOC 23	1.066	.872	37.116	.044	
SOC 21	1.133	.926	39.340	.050	0.875
SOC 19	1.057	.845	37.679	.034	
SOC 18	1.115	.923	38.781	.029	

Source: Author's Analysis using SmartPLS 3.0 (2021)

10.2.4.2 Exogenous latent variable prediction summary

To test the predicting power of the structural model, each latent variable was blindfolded. After the blindfolding method was completed, the cross-validated redundancy values for each of the five constructs were analysed. It was found that HCD had a value larger than zero; UMG and SUD had values of less than zero; and IPD and URL had values equal to or less than zero (UMG: 0.008; IPD: -0.007; SUD: 0.063; URL: -0.006 and HCD: 0.975). It was thus clear from this study that the structural model could be used to predict outcomes. Table 10.7 shows the Q^2 and R^2 results from this analysis.

Table 10.7: Predictive Relevance of the Exogenous Variables in Lafia, North-Central Nigeria

	RMSE	MAE	Q^2 _Predict	R^2 Result of Coefficient of Determinant
HCD	.159	.118	.975	.976
IPD	1.010	.820	-.007	.554
SUD	.975	.791	.063	.467
UMG	1.002	.813	.008	.090
URL	1.011	.812	-.006	.016

Source: Author's Analysis using SmartPLS 3.0 (2021)

10.2.5 Importance performance map (IPMA) for *Hangwurian* City Development in Lafia, North-Central Nigeria

An IPMA (Ringle & Sarstedt, 2016) was used to enhance the analytic results of the current investigation to improve the findings. An IPMA evaluates the performance level of latent and manifest variables in a PLS-SEM analysis, according to Ringle and Sarstedt (2016). An IPMA considers the variables' impact on the target construct rather than focusing on the relevance of the latent and manifest factors (i.e., the path coefficient). As a result, an IPMA enables the selection of variables based on their importance to achieving the desired outcome. Researchers can find the most important activities for improving the dependent variable by studying the indicator level. An IPMA is thus a valuable tool for setting management priorities.

We can see in Table 10.8 the results of the calculations for the importance and performance of the latent variables (LV) and their constructs. Other constructs, including ATC, CSP, and EQY, played an essential role in the desired *Hangwurian* development. Since the first-order

constructs had such a sizeable outside loading, it was clear that the indicator variables were mutually supportive of one another (i.e., complementary), as seen by the high outer loadings on HCD.

Table 10.8: Importance Performance Analysis in Lafia, North-Central Nigeria

Latent Variable	LV Importance	LV Performance
ATC	0.383	47.849
CRF	0.973	45.169
CSP	0.109	43.683
ECP	0.580	53.051
ENV	0.460	64.521
EQJ	0.685	49.769
EQY	0.518	42.075
FAMP	0.370	52.409
HNS	0.532	45.305
LVC	0.871	45.392
MVA	1.009	67.154
PLS	0.864	45.941
POP	0.695	45.617
QoL	0.748	49.096
RES	1.014	49.183
SAF	0.653	46.419

Source: Author's Analysis using SmartPLS 3.0 (2021)

The importance performance of the indicators is shown in Table 10.8, and most of the variables had a moderate to relatively high level of importance and performance. For example: economic prosperity (ECP) (importance = 0.580, performance = 53.051; environmental dimension (ENV) (importance = 0.466, performance = 64.521); ATC (access to the city) (importance = 0.383, performance = 47.84); and CRF (credit facility) all have moderate to large importance and performance in terms of mapping their paths in the model in Lafia (refer to Figure 10.3).

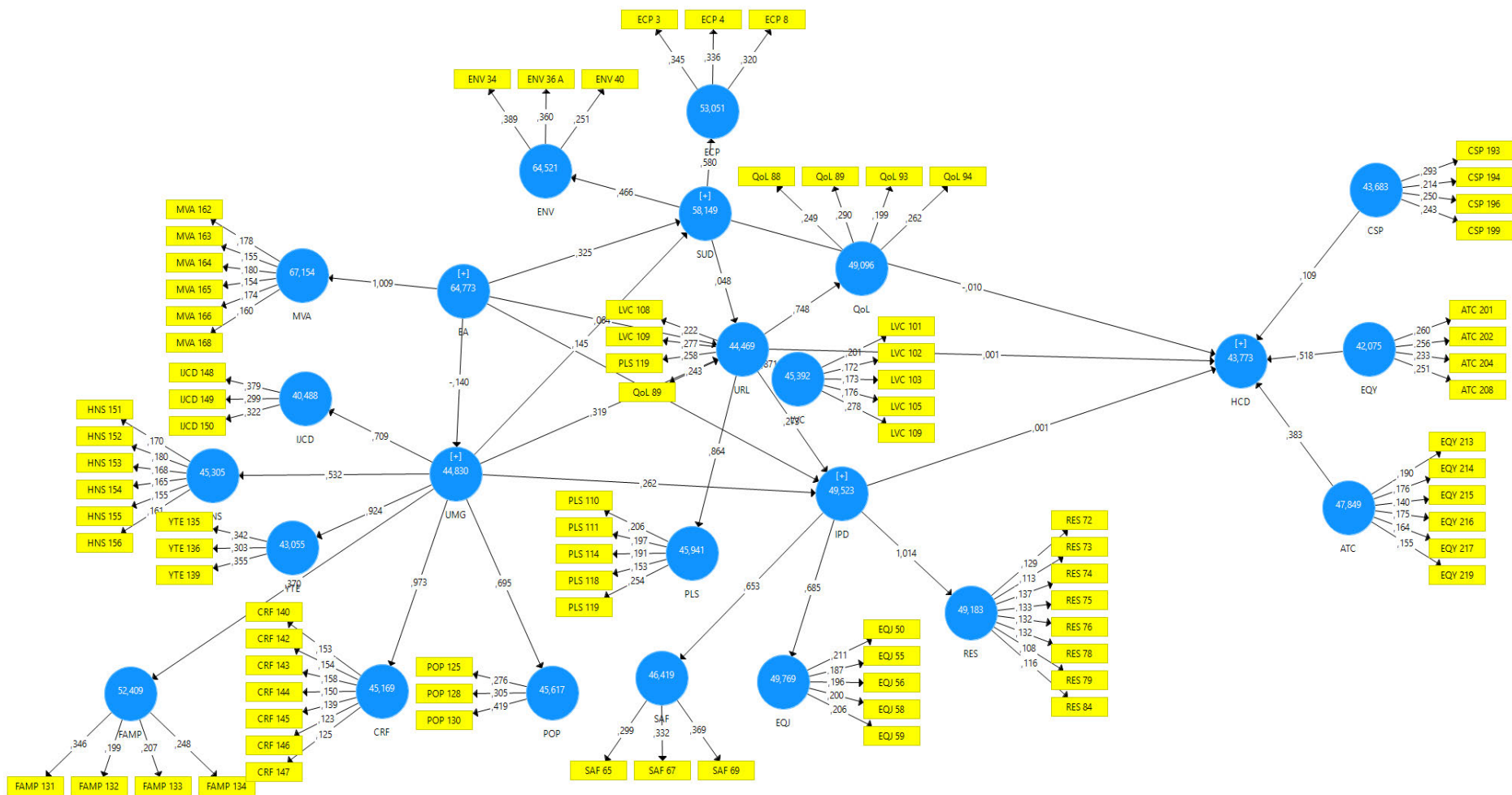


Figure 10.3: Latent Variable Performance in Lafia, North-Central Nigeria

Source: Author's Analysis using SmartPLS 3.0 (2021)

In furtherance of the underlining values of the importance-performance map analysis, this research presented the graphical display of the endogenous variables in a spot map indicating the importance and the percentage performance of the various endogenous variables underlining the *Hangwurian* city development and the other exogenous variables of the model. The graph indicated that the endogenous variables' performance was clustered between the 40 per cent to 70 per cent range, while the importance of the endogenous variables was dispersed across the graph. This analysis showed more interrelatedness in the performance of the endogenous variables but more disparity in the importance of the endogenous variables (refer to Figure 10.4).

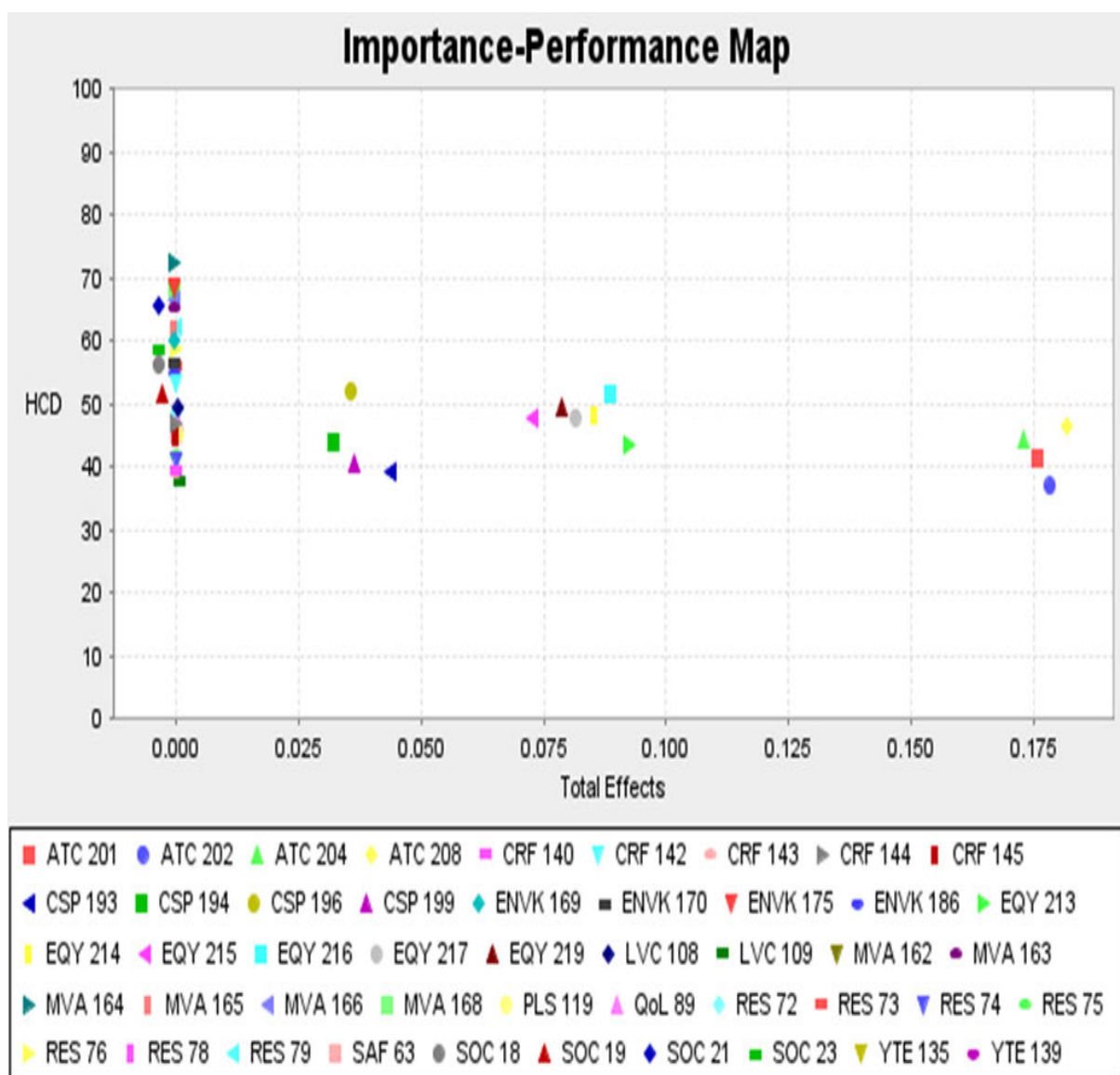


Figure 10.4: Endogenous Variable Importance Performance Map in Lafia, North-Central Nigeria

Source: Author's Analysis using SmartPLS 3.0 (2021)

Figure 10.5 depicts the importance-performance map of the study's exogenous variables. Lafia City in North-Central Nigeria is once again the focus of this model's structures. In the IPMA analysis of the exogenous latent variables, 45 to 65 per cent of the variables performed well. The relevance of the variables spanned from 0.001 to 0.6, demonstrating a closer relationship between the variables' performance and the exogenous latent variables' importance.

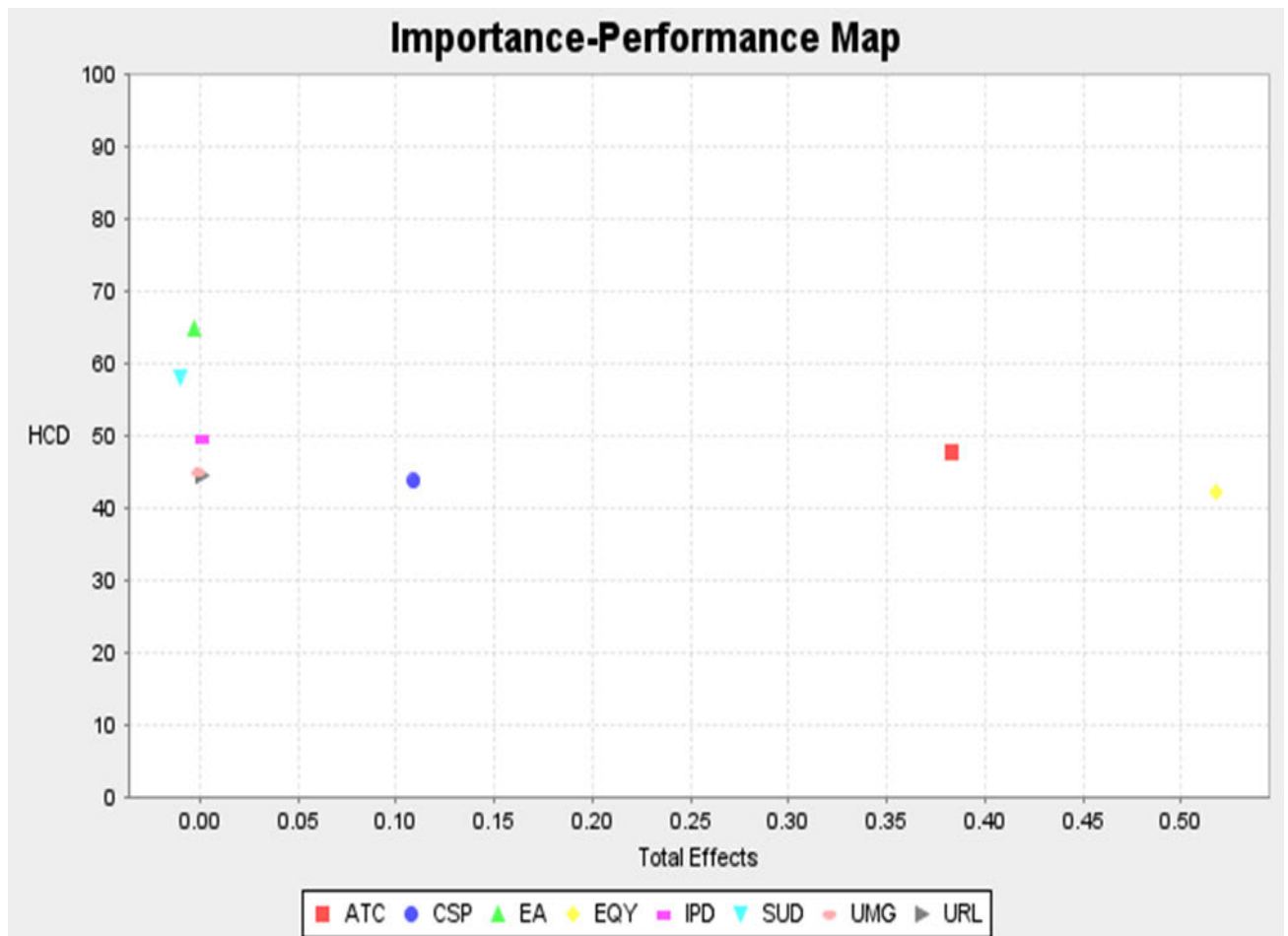


Figure 10.5: Exogenous Variable Importance Performance Map in Lafia, North-Central Nigeria

Source: Author's Analysis using SmartPLS 3.0 (2021)

10.2.6 Confirmatory tetrad analysis final results

According to the CTA-PLS theory, the latent/higher-order construct is a superior statistical measure to determine whether it is reflective or formative model (Hair et al., 2017). The tetrad form of built indicators is used in this method with all tetrad values are significant and the latent construct reflects this (Hair et al., 2017; Svensson et al., 2018). There was no empirical support

for reflective models in the CTA-PLS results for HCD in Lafia in North Central Nigeria, as shown in Table 10.9.

Assuming all model-implied tetrad values are zero or "vanish", the CTA-PLS tests the null hypothesis. There are four associated indicators, and a tetrad is the difference between two covariances' (r) products. Figure 10.0 showed a tetrad ATC 201, 202, 204, 208 $14 r_{201,202} - r_{204}r_{208}$ in the reflecting model. ATC 20114 ATC 202 14 ATC20414ATC208 should have had the same factor loadings if the reflective model was correct and all indicators accurately reflected the latent variables.

At least four things were required for each construct in the CTA-PLS. However, if I only had three or two, I could augment them with an item or items available (Bollen & Ting, 2000; Gudergan et al., 2008). Since the reflective model was global in scope, this argument made sense (Hair et al., 2017). Adding another reflective item should not have affected the results of the CTA-PLS because it tested the null hypothesis that all indicators reflected light and hence that all of the tetrads would vanish (Bollen & Ting, 2000; Gudergan et al., 2008). Reflective models can only be constructed if all four items of interest are reflective, and the CTA-PLS will reject the null hypothesis if any of the four items are formative. The research utilised the SmartPLS 3.0 software (Ringle et al., 2015) to produce 5,000 bootstrap sub-samples using Gudergan et al.'s (2008) methods.

Table 10.9 summarises the CTA-PLS results for the development of a *Hangwurian* city in Lafia, North-Central Nigeria. Even though the CTA results favoured the formative model, there were good reliability and validity scores for the constraints measured while using the reflective model. A Cronbach's alpha value of .71 or above was found in all of Lafia's constructs assessed, indicating good reliability. This city had a substantial AVE of at least .56, which indicated an excellent convergent validity score.

Table 10.9: Confirmatory Tetrad Analysis Final Results in Lafia, North-Central Nigeria

HCD	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values	Bias	CI Low	CI Up	Alpha adj.	z(1- alpha)	CI Low adj.	CI Up adj.
1: ATC 201, ATC 202, ATC 204, ATC 208	-.032	-.030	.061	.514	.607	.002	-.154	.087	.003	3.039	-.220	.153
2: ATC 201, ATC 202, ATC 208, ATC 204	-.016	-.013	.059	.267	.789	.003	-.134	.097	.003	3.039	-.197	.160
4: ATC 201, ATC 202, ATC 204, CSP 193	-.013	-.010	.061	.207	.836	.003	-.135	.105	.003	3.039	-.201	.170
6: ATC 201, ATC 204, CSP 193, ATC 202	-.034	-.033	.057	.593	.554	.001	-.148	.078	.003	3.039	-.209	.140
7: ATC 201, ATC 202, ATC 204, EQY 213	-.013	-.012	.048	.278	.781	.001	-.110	.080	.003	3.039	-.161	.132
10: ATC 201, ATC 202, ATC 204, EQY 214	-.025	-.024	.039	.654	.513	.001	-.103	.050	.003	3.039	-.145	.091
13: ATC 201, ATC 202, ATC 204, EQY 216	.036	.037	.056	.648	.517	.001	-.075	.145	.003	3.039	-.135	.206
17: ATC 201, ATC 202, CSP 193, ATC 208	-.048	-.049	.052	.916	.360	-.002	-.148	.056	.003	3.039	-.204	.112
23: ATC 201, ATC 202, EQY 214, ATC 208	-.024	-.023	.054	.446	.655	.001	-.132	.082	.003	3.039	-.190	.140
26: ATC 201, ATC 202, EQY 216, ATC 208	.069	.069	.050	1.363	.173	.000	-.030	.168	.003	3.039	-.084	.223
30: ATC 201, CSP 193, EQY 213, ATC 202	.020	.022	.058	.347	.729	.002	-.095	.132	.003	3.039	-.157	.194
33: ATC 201, CSP 193, EQY 214, ATC 202	-.020	-.020	.048	.428	.669	.001	-.115	.073	.003	3.039	-.166	.124
42: ATC 201, EQY 213, EQY 216, ATC 202	-.005	-.005	.038	.138	.890	.000	-.080	.070	.003	3.039	-.121	.111
73: ATC 201, ATC 204, EQY 214, EQY 216	.080	.078	.065	1.233	.218	-.002	-.045	.210	.003	3.039	-.115	.280
85: ATC 201, ATC 208, EQY 213, EQY 214	.131	.128	.048	2.719	.007	-.002	.039	.228	.003	3.039	-.013	.279
97: ATC 201, CSP 193, EQY 213, EQY 216	.098	.099	.052	1.875	.061	.001	-.006	.200	.003	3.039	-.062	.256
100: ATC 201, CSP 193, EQY 214, EQY 216	.084	.084	.053	1.589	.113	.000	-.020	.186	.003	3.039	-.077	.243
110: ATC 202, ATC 204, EQY 213, ATC 208	.015	.012	.052	.291	.771	-.003	-.084	.121	.003	3.039	-.140	.177
121: ATC 202, ATC 204, CSP 193, EQY 214	.109	.106	.050	2.186	.029	-.003	.014	.211	.003	3.039	-.040	.265
156: ATC 202, EQY 213, EQY 214, CSP 193	.085	.084	.038	2.242	.025	-.001	.012	.161	.003	3.039	-.029	.201

Source: Author's Analysis using SmartPLS 3.0 (2021)

10.2.7 Discussion of the Findings for Lafia City

The number of indicators to be retained for each of the six latent variables included in this study, namely urban liveability (URL), sustainable urban development (SUD), inclusive physical development (IPD), environmental awareness (EA), urban governance (UMG), and *Hangwurian* city development (HCD) was determined through exploratory factor analysis in order to determine the best indicator for the individual construct. Fifteen indicators were kept for the URL construct; ten were kept for the SUD construct; sixteen were kept for IPD; eleven were kept for EA; twenty-two were kept for urban management; and fourteen were kept for the HCD construct. The following criteria had to be checked when evaluating the measurement model based on the PLS results: indicator reliability, internal consistency reliability, convergence validity, and discriminant validity.

Each indicator's reliability was assessed using the square of its factor loadings, and it was found that almost all of the indicators had values close to the acceptable minimum of 0.7 (Oke & Ogunsemi, 2016). However, the values were more significant than the minimum threshold for exploratory research of this nature (Hulland, 1999). The latent constructs had an internal consistency of more than 0.70, and their composite reliability scores varied from 0.819 per cent to 0.831 per cent. The internal consistency reliability was satisfactory for the measurement model's composite items. Table 10.1 showed that the model's convergent validity was examined, and the average variance (AVE) explained was more significant than 0.5. (Bagozzi & Yi, 1988).

Table 10.2 showed the significant criteria for evaluating discriminant validity in a PLS analysis. Reflective structures should account for a more significant proportion of variance than correlations with latent variables (Chin, 1998), and items should load more strongly on their corresponding constructs than on other constructs (Chin, 1998; Elbanna et al., 2013). The latent variable indicators had more substantial loadings than cross-loading, according to Table 10.2. They had greater variability (AVE) than the other types of conceptions. As a result, it could be concluded that the measuring model described here had the necessary validity and reliability to evaluate the structural model's predictive and explanatory potential.

Convergent validity refers to how numerous items used in research to measure the same idea agree with each other (Hair et al., 2014). The measures employed in this study were tested for

convergent validity using outer loadings or the average extracted variance (AVE) value. In order to prove that a latent variable was responsible for more than half of the variance in its indicators, an AVE value of 0.5 or greater had to be attained (Hair et al., 2010). The final AVE and CR were both above the benchmark values of 0.5 and 0.7, respectively. All loadings below 0.5 were eliminated.

As a part of the validation process, discriminant validity was used to determine whether or not the concept was indeed unique from other concepts (Hair et al., 2017). Fornell and Larcker's (1981) criterion, in which the square root of AVE should be more significant than the highest correlation with any other constructs, was a criterion used in this study, and there was sufficient discriminant validity in the assessments based on the Fornell and Larcker (1981) criterion. Hair et al. (2016), however, disagree with the use of this criterion as they found that it failed miserably in instances where the constructions' indicator loadings differed by a small amount. The heterotrait-monotrait (HTMT) ratio proposed by Henseler et al. (2015) was therefore used as a cure to this problem.

The mean of all the correlations between indicators across constructs assessing various constructs was used in comparison to the average heterotrait-heteromethod correlative indicators, as per Hair et al. (2017) (i.e., the mean of all of the correlations of the indicators measuring the same constructs). Tables 10.2 and 10.3 showed the findings of the HTMT statistics and the Fornell Larcker Criterion. The highest HTMT statistic shown in the table was 0.833, less than the threshold value of 0.850. The HTMT confidence interval was not zero, based on the consistent PLS bootstrapping. As a result, the discriminant validity was good and, in my opinion, the model's construct validity was adequate.

Once the reliability and validity of the construct measures were established, it was time to test the hypotheses based on the outcomes of the structural model created. In a regression study, the path coefficients of the PLS model were viewed as normalised beta weights. Prior to this interpretation, it was suggested that the model be examined for collinearity because ordinary least square regression was used to estimate the coefficients of the pathways, as first suggested by Mooi and Sarstedt (2011); and Sarstedt et al. (2014). There was a possibility that collinearity in these results could be construed as bias, according to Hair et al. (2014). Consequently, this study followed Sarstedt et al. (2014); and Wong (2013) by determining if the constructs were related. The latent variable scores were utilised as inputs for the multiple regression to examine

the difficulties with collinearity in the inner model, with the exogenous latent factors (i.e., EA, UMG, SUD, URL, and IPD) built to be the independent variables. The dependent variable, on the other hand, was *Hangwurian* city development.

A path relationship was constructed between the numerous exogenous latent factors and their corresponding influence on the dependent variable, HCD. The findings confirmed that environmental awareness (EA), urban management and governance (UMG), urban liveability (URL), sustainable urban development (SUD), and inclusive physical development (IPD) had a positive and significant relationship, and their effect on the *Hangwurian* city development was as a result of this. An analysis of the various paths from the EA to the HCD and from the UMG to the HCD was done.

Using the hypothetical path (ATC – HCD: path = 0.392; $t=22.962$; $p=0.000$) and the hypothetical path (CSP – HCD: path = 0.117; $t=8.398$; $p=0.000$) to HCD, I found that the hypothetical path supported the hypothesised path (EQY – HCD: path = .573; $t=31.111$; $p=0.000$). Table 10.4 and Figure 10.1 demonstrate the hypothesised development routes for the *Hangwurian* city and its endogenous latent variables. Table 10.1 presents the first three hypothesised paths for HCD and its endogenous factors, while additional variable analyses between both the exogenous variables and their endogenous variables are also included in the Table. EA to IPD (path = 0.139; $t = 0.283$; $p=0.773$); EA to URL (path = 0.67; $t = 1.181$; $P=0.038$); IPD to HCD (path = 0.001; $t = 1.164$; $P=0.245$); SUD to HCD (path = 0.011; $P=0.094$), SUD to URL (path = 0.58; $t=0.941$; $P=0.397$); URL to HCD (path = 0.001; $t=0.140$; $P=0.889$). However, six of the thirty hypothesised paths were found to be unsupported: EA to IPD, the null hypothesis, was adopted as an alternative hypothesis in all of the above-mentioned path analyses because the route coefficients for the exogeneous latent variables in Lafia City in North-Central Nigeria did not support them.

Q^2 , a measure of the study model's predictive power, was used by Duarte and Raposo (2010); and Götz et al. (2010). Q^2 was determined via a blindfolding process. Predictive significance is shown by a Q^2 larger than 0, according to Hair et al. (2014); a score below zero shows that the model is not predictively relevant; and 0.02, 0.15, and 0.35 indicate that an exogenous construct has a small, medium, and high predictive relevance for a particular endogenous construct respectively (Hair et al., 2014). It was clear from Hair et al.'s (2013) reasoning that

a moderately high level of predictive relevance and a significant coefficient of determination supported the model's ability to fit the data.

Table 10.5 and Figure 10.2 highlighted the relevance of the structural model's relationships and the predictive capacity of the endogenous latent variables. In the structural model, the R^2 values were acceptable because they exceeded the 10 per cent threshold recommended by Elbanna et al. (2013). The credit facilities (CRF $R^2 = 92.6\%$); economic prosperity (ECP $R^2 = 41.6\%$); environmental awareness (ENV $R^2 = 24.7\%$); equity (EQY $R^2 = 59.3\%$); family planning (FAMP $R^2 = 14.9\%$); and consumption pattern (CSP $R^2 = 97.6\%$) were all acceptable. The predictive relevance Q^2 of each endogenous variable was listed in Table 10.5 and Figure 10.2.

The endogenous variables shown in Table 10.6 were found to have a predictive relevance (Q^2) that ranged from a value of less than zero to a value of more than zero, as benchmarked by Sarstedt et al. (2014), who used blindfolding to determine the predictive relevance of both exogenous and endogenous variables in their model construct. Many of the variables in Table 10.6 fell within the range of values from 0.001 to +0.626, which indicated a strong correlation between the model's components and the predictive importance of the endogenous variables. The endogenous variables' predictive relevance determined whether the prediction direction was positive or negative.

To test the predicting power of the structural model, each latent variable was blindfolded. After the blindfolding method was completed, the cross-validated redundancy values for each of the five constructs were analysed. It was found that HCD had a value larger than zero; while UMG and SUD had values less than zero; and IPD and URL had values equal to or less than zero (UMG: 0.008; IPD: -0.007; SUD: 0.063; URL: -0.006; and HCD: 0.975). It was clear from this study that the structural model could be used to predict outcomes. Table 10.6 showed the Q^2 and R^2 results from this analysis.

An IPMA (Ringle & Sarstedt, 2016) was used to enhance the analytic results of the current investigation to improve the findings. An IPMA evaluates the performance level of latent and manifest variables in a PLS-SEM analysis, according to Ringle and Sarstedt (2016). As a result, rather than focusing just on the relevance of latent and manifest factors (i.e., the path coefficient), IPMA considers the variables' impact on the target construct. An IPMA enables

the selection of variables based on their importance to achieving the desired outcome. As a result, researchers can find the most important activities for improving the dependent variable by studying the indicator level. To summarise, IPMA is a valuable tool for setting management priorities.

Table 10.7 displayed the importance-performance values and LV index values and the performance of the constructions according to Ringle and Sarstedt's (2016) standards. According to one study, while small-lot production isn't critical, it's also slower. Other constructs, including ATC, CSP, and EQY, played an essential role in the desired *Hangwurian* city development. Since the first-order constructs had such a sizeable outside loading, it was clear that the indicator variables were mutually supportive of one another (i.e., complementary), as seen by the high outer loadings on the HCD.

Table 10.7 revealed the correlation between the indicators' relative relevance and their actual results. Using an IPMA, it could be seen that most of the variables had a moderate to relatively high level of importance and performance, like the ECP (importance = 0.580, performance = 53.051), ENV (importance = 0.466, performance = 64.521), ATC (importance = 0.383, performance = 47.84), and CRF (importance: 0.973, performance: 45.169).

A spot map showing the importance and percentage performances of the primary endogenous variables underlining *Hangwurian* city growth and the other exogenous variables was presented in this research in order to support the importance-performance map analysis. The endogenous variables' performance was grouped in the 40 per cent to 70 per cent range, whereas their relevance was spread across the graph in Table 10.7 and Figure 10.4. The endogenous variables' performance was connected, while the endogenous variables' importance was significant.

This research also showed that the importance-performance map of the exogenous variable in the analysis was also significant for Lafia in North-Central Nigeria, based on this model's structures. In the IPMA analysis of the exogenous latent variables, 45 to 65 per cent of the variables performed well. The relevance of the variables ranged from 0.001 to 0.6, demonstrating a closer relationship between the variables' performance and the exogenous latent variables' importance.

In addition to theoretical support, the CTA-PLS is inferred as a better statistical measure to determine whether a latent/higher-order construct is reflective or formative (Hair et al., 2017). This approach is based on evaluating construct indicators in the tetrad form. The latent construct is reflective when all of the tetrad values are non-significant (Hair et al., 2017; Svensson et al., 2018). The CTA-PLS results for the HCD in Lafia City in North-Central Nigeria explained that none of the tetrads were significant and that provided empirical support to the reflective models.

CTA-PLS tests the null hypothesis that all model-implied tetrads have a value of zero or “vanish”. A tetrad (s) is the difference between two covariance (r) products among four associated indicators. For example, the reflective model in Figure 10.1 revealed a tetrad $ATC_{201, 202} - r_{201,202} - r_{204}r_{208}$. If the reflective model was true and all indicators represented the latent variable equally, then all factor loadings would be the same value: $ATC_{201} \frac{1}{4} ATC_{202} \frac{1}{4} ATC_{204} \frac{1}{4} ATC_{208}$.

Then, $r_{201,202} \frac{1}{4} ATC_{201}ATC_{202} \frac{1}{4} r_{204} \frac{1}{4} ATC_{204}ATC_{208} \frac{1}{4} r_{208}, \frac{1}{4} ATC_{204}ATC_{208}$. Of course, in real-world data, it is unlikely that $ATC_{201} \frac{1}{4} ATC_{202} \frac{1}{4} ATC_{204} \frac{1}{4} ATC_{208}$. Therefore, CTA-PLS employs the bootstrapping procedure in which several pseudo-samples are created from an original sample. In this research they numbered 5,000, and a statistical test was applied to determine whether the mean of the model-implied tetrads across thousands of cases was significantly different from zero. The reflective model would have had to be retained if it departed from zero because of chance alone.

At least four variables are required for each construct in the CTA-PLS. However, if we don't have four, we can supplement them with an available item or items (Bollen & Ting, 2000; Gudergan et al., 2008). Since the reflective model is global in scope, this argument makes sense (Hair et al., 2017). Adding another reflective item should not affect CTA-PLS results because it tests the null hypothesis that all indicators reflect light and hence all tetrads vanish (Bollen & Ting, 2000; Gudergan et al., 2008). Reflective models can only be constructed if all four items of interest are reflective. The CTA-PLS will reject the null hypothesis if any of the four items are formative. I utilised the SmartPLS 3 software, as per (Ringle et al., 2015), to produce 5,000 bootstrap sub-samples, as per Gudergan et al. (2008).

Even though most of the CTA results favoured the formative model, the constraints measure had good reliability and validity scores if one assumed the reflecting model, according to our CTA-PLS results. A Cronbach's alpha value of 0.71 or above was found for all of Lafia's assessed constructs, indicating good reliability. This city had a substantial AVE of at least 0.56, which indicated an excellent convergent validity score.

10.3 Model Development for Lokoja, North-Central Nigeria

10.3.1 Measurement model

Tables 10.10 show the number of indicators that were retained for each of the six (6) latent variables: Urban Liveability (URL), Sustainable Urban Development (SUD), Inclusive Physical Development (IPD), Environmental Awareness (EA), Urban Governance (UMG), and *Hangwurian* City Development (HCD) in Lokoja City. Fifteen indicators were kept for the URL construct, ten of which were related to SUD; sixteen were related to IPD; eleven were related to EA; twenty-two were related to urban management, and fourteen were related to HCD. The following criteria must be checked when evaluating the measurement model based on the PLS results: indicator reliability, internal consistency reliability, convergence validity, and discriminant validity.

When it came to the factor loadings, almost all of the indicators had values close to the minimum acceptable value of 0.7 (Oke & Ogunsemi, 2016). However, as shown in Table 10.10, the values exceeded the acceptable value that was considered the minimum threshold for exploratory research of this nature (Hulland, 1999; Oke & Ogunsemi, 2016). The individual constructs' internal consistency was higher than the acceptable 0.70 in the model, with composite reliability values for latent components ranging from 0.821 to 0.925. The internal consistency reliability was satisfactory for the measurement model's composite items. The model's convergent validity was examined (as seen in Table 10.9), and the average variance (AVE) explained was more significant than 0.5 (Bagozzi & Yi, 1988).

Table 10.10: Model Path Analysis in Lokoja, North-Central Nigeria

Latent Variable	Indicators	Loadings	Indicator Reliability (i.e., loadings ²)	Composite Reliability	R ²	AVE	Cronbach's alpha
Access to the City (HCD)	ATC 204	.741	0.5491	.888	.986	.614	.843
	ATC 208	.785	0.6162				
	ATC 209	.757	0.5730				
	ATC 210	.819	0.6708				
	ATC 211	.813	0.6610				
Credit Facilities (UMG)	CRF 139	.715	0.5112	.891	.864	.620	.847
	CRF 141	.786	0.6178				
	CRF 142	.806	0.6496				
	CRF 143	.824	0.6790				
	CRF 146	.802	0.6432				
Consumption Pattern (HCD)	CSP 196	.791	0.6257	.821	.409	.605	.677
	CSP 198	.732	0.5358				
	CSP 199	.807	0.6512				
Economic Prosperity (SUD)	ECP 3	.786	0.6178	.882	.799	.653	.822
	ECP 6	.857	0.7344				
	ECP 8	.731	0.5344				
	ECP 9	.853	0.7277				
Environmental Dimension (SUD)	ENV 36	.850	0.7225	.882	.726	.714	.800
	ENV 39	.857	0.7344				
	ENV 40	.850	0.7225				
Environmental Knowledge (EA)	ENVK 169	.782	0.6115	.846	.594	.579	.757
	ENVK 170	.749	0.5610				
	ENVK 175	.721	0.5198				
	ENVK 182	.711	0.5055				
	ENVK 185	.721	0.5198				
	ENVK 186	.752	0.5655				

Equity/Justice (IPD)	EQJ 54	.763	0.5822	.852	.453	.589	.768
	EQJ 55	.769	0.5914				
	EQJ 56	.773	0.5975				
	EQJ 57	.766	0.5868				
Equity (HCD)	EQY 213	.792	0.6272	.864	.532	.614	.791
	EQY 214	.782	0.6115				
	EQY 215	.779	0.6068				
	EQY 216	.780	0.6084				
Hospital Network System (UMG)	HNS 151	.771	0.5944	.874	.367	.581	.820
	HNS 152	.745	0.5550				
	HNS 153	.766	0.5868				
	HNS 154	.769	0.5914				
	HNS 155	.759	0.5761				
Liveable Communities (URL)	LVC 101	.717	0.5141	.861	.574	.553	.802
	LVC 102	.710	0.5041				
	LVC 103	.739	0.5461				
	LVC 105	.764	0.5837				
	LVC 106	.785	0.6162				
Motivation/Value (EA)	MVA 162	.769	0.5914	.925	.912	.637	.905
	MVA 163	.777	0.6037				
	MVA 164	.739	0.5461				
	MVA 165	.797	0.6352				
	MVA 166	.752	0.5655				
	MVA 167	.769	0.5913				
	MVA 168	.728	0.5300				
Place-Shaping (URL)	PLS 112	.803	0.6448	.856	.770	.599	.778
	PLS 113	.780	0.6084				
	PLS 114	.816	0.6659				
Population Management (UMG)	POP 127	.823	0.6773	.852	.401	.658	.740
	POP 128	.801	0.6416				

	POP 129	.809	0.6545				
Quality of Life (URL)	QoL 93	.677	0.4583	.820	.438	.533	.708
	QoL 94	.719	0.5170				
	QoL 95	.753	0.5670				
	QoL 96	.769	0.5913				
Building Resilience (IPD)	RES 73	.837	0.7005	.903	.935	.701	.857
	RES 74	.781	0.6099				
	RES 75	.806	0.6496				
	RES 76	.837	0.7005				
Safety (IPD)	SAF 67	.757	0.5730	.843	.737	.642	.724
	SAF 69	.816	0.6659				
	SAF 72	.774	0.5991				
Social Dimension (SUD)	SOC 16	.748	0.5595	.922	.905	.597	.903
	SOC 17	.800	0.6400				
	SOC 18	.823	0.6773				
	SOC 19	.810	0.6561				
	SOC 21	.762	0.8064				
	SOC 22	.776	0.6022				
	SOC 23	.717	0.5141				
	SOC 31	.748	0.5595				

Source: Author's Analysis using SmartPLS 3.0 (2021)

10.3.1.1 Construct reliability and validity

The PLS analysis evaluates discriminant validity using two main criteria, as given in Table 10.10. Reflective structures should account for a more significant proportion of variance than correlations with the latent variable (Chin, 1998), and items should load more strongly on their corresponding constructs than on other constructs (Chin, 1998; Elbanna et al., 2013). As seen in Table 10.11, there was no cross-loading for any of the latent variables' indicators. They had greater variability (AVE) than other types of conceptions. As a result, it could be concluded that the measuring model described here had the necessary validity and reliability to evaluate the structural model's predictive and explanatory potential.

A study's converging validity is determined by how well different items used to gauge the same idea agree (Hair et al., 2014). The measures employed in this study were tested for convergent validity using outer loadings or the average extracted variance (AVE) value. To prove that the latent variable was responsible for more than half of the variance in its indicators, an AVE value of 0.5 or greater had to be attained (Hair et al., 2010). Any loadings that fell below 0.5 were deleted, resulting in final AVE and CR values above the 0.5 and 0.7 benchmark values (please refer to Table 10.10).

As a last check, the discriminant validity of each construct was examined to see if it was indeed unique from the other constructs (Hair et al., 2017). Fornell and Larcker's (1981) criterion was used, in which the square root of the AVE had to be more significant than the highest correlation with any of the other constructs. There was sufficient discriminant validity in the assessments, based on the Fornell and Larcker criterion. As Hair et al. (2016) found this criterion to be a poor performer, even when the indicator loadings changed very little, the heterotrait-monotrait (HTMT) ratio proposed by Henseler et al. (2015) was used to overcome this problem. The mean of all the correlations between indicators across the constructs assessing the various constructs was used in comparison to the average heterotrait-heteromethod correlative, as per Hair et al. (2017).

Tables 10.11, 10.12 and 10.13 display the Fornell Larcker Criterion statistics, HTMT and VIF. The table shows that the highest HTMT statistic was 0.833, which was below the criterion of 1.115. The HTMT confidence interval did not contain a zero, based on the consistent PLS bootstrapping. As a result, the discriminant validity was good. The model's construct validity was thus adequate, in my opinion.

Table 10.11: Fornell-Larcker Criterion for Discriminant Validity in Lokoja, North-Central Nigeria

	ATC	CRF	CSP	EA	ECP	ENV	ENVK	EQJ	EQY	HCDM	HNS	IPD	LVC	MVA	PLS	POP	QoL	RES	SAF	SOC	SUD	UMG	URL
ATC	.784																						
CRF	.302	.788																					
CSP	.640	.220	.778																				
EA	-.180	-.308	-.136	.738																			
ECP	-.176	-.206	-.048	.259	.808																		
ENV	-.137	-.199	-.043	.242	.665	.845																	
ENVK	-.089	-.197	-.027	.771	.164	.158	.761																
EQJ	.206	.269	.137	-.157	-.092	-.076	-.116	.768															
EQY	.729	.242	.548	-.138	-.120	-.076	-.044	.154	.783														
HCDM	.958	.305	.704	-.183	-.168	-.121	-.078	.201	.868	.725													
HNS	.221	.578	.199	-.243	-.129	-.127	-.174	.242	.172	.222	.762												
IPD	.228	.333	.160	-.184	-.186	-.157	-.126	.673	.169	.221	.324	.786											
LVC	.193	.277	.129	-.155	-.089	-.074	-.075	.263	.157	.204	.255	.229	.744										
MVA	-.165	-.298	-.121	.955	.229	.210	.715	-.147	-.135	-.172	-.241	-.164	-.150	.798									
PLS	.183	.349	.143	-.280	-.187	-.140	-.169	.227	.137	.195	.290	.248	.622	-.276	.774								
POP	.176	.632	.162	-.282	-.158	-.167	-.172	.231	.133	.185	.497	.295	.278	-.269	.335	.811							
QoL	.140	.241	.131	-.174	-.143	-.098	-.104	.216	.101	.150	.222	.197	.609	-.166	.623	.242	.730						
RES	.235	.321	.165	-.195	-.208	-.171	-.141	.631	.167	.225	.308	.967	.214	-.174	.240	.300	.176	.837					
SAF	.177	.295	.123	-.152	-.139	-.113	-.099	.641	.148	.177	.289	.858	.210	-.137	.233	.231	.210	.721	.801				
SOC	-.121	-.172	-.017	.275	.774	.753	.186	-.043	-.086	-.117	-.084	-.112	-.073	.242	-.172	-.159	-.111	-.137	-.070	.773			
SUD	-.156	-.208	-.035	.284	.894	.852	.186	-.070	-.106	-.148	-.120	-.162	-.083	.247	-.182	-.175	-.127	-.185	-.116	.952	.738		
UMG	.300	.929	.205	-.318	-.230	-.211	-.189	.275	.233	.300	.603	.341	.296	-.304	.367	.634	.259	.327	.305	-.199	-.230	.721	
URL	.211	.351	.145	-.260	-.195	-.141	-.149	.254	.156	.220	.293	.249	.758	-.251	.878	.340	.662	.241	.229	-.173	-.185	.381	.712

Source: Author's Analysis using SmartPLS 3.0 (2021)

Table 10.12: Heterotrait-Monotrait Ratio (HTMT) for Measuring Discriminant Validity in Lokoja, North-Central Nigeria

Label	ATC	CRF	CSP	EA	ECP	ENV	ENVK	EQJ	EQY	HCD	HNS	IPD	LVC	MVA	PLS	POP	QoL	RES	SAF	SOC	SUD	URL
ATC																						
CRF	.358																					
CSP	.838	.289																				
EA	.204	.343	.165																			
ECP	.209	.238	.067	.296																		
ENV	.167	.236	.058	.280	.817																	
ENVK	.120	.247	.079	.914	.208	.203																
EQJ	.254	.334	.188	.183	.115	.098	.153															
EQY	.890	.296	.744	.158	.143	.097	.067	.197														
HCD	1.105	.353	.896	.200	.193	.143	.104	.241	1.036													
HNS	.262	.684	.261	.265	.153	.150	.210	.303	.207	.255												
IPD	.262	.388	.203	.201	.213	.186	.152	.820	.203	.248	.381											
LVC	.230	.327	.168	.162	.105	.086	.102	.332	.193	.236	.305	.271										
MVA	.190	.341	.148	1.027	.266	.246	.863	.176	.158	.191	.270	.183	.161									
PLS	.226	.425	.187	.325	.228	.180	.221	.293	.174	.237	.356	.303	.778	.328								
POP	.223	.800	.220	.337	.200	.217	.230	.306	.172	.228	.635	.366	.349	.328	.441							
QoL	.179	.307	.179	.210	.182	.127	.139	.292	.143	.188	.289	.250	.817	.205	.827	.333						
RES	.274	.378	.211	.216	.242	.206	.174	.777	.202	.256	.366	1.114	.255	.197	.297	.376	.225					
SAF	.224	.376	.173	.188	.184	.149	.138	.857	.199	.220	.367	1.067	.276	.174	.316	.314	.293	.907				
SOC	.139	.191	.035	.301	.893	.887	.225	.065	.104	.130	.103	.131	.085	.269	.205	.195	.137	.154	.106			
SUD	.176	.228	.053	.306	1.021	.986	.222	.090	.122	.162	.136	.179	.093	.269	.213	.209	.153	.203	.150	1.037		
URL	.264	.432	.191	.305	.243	.181	.196	.334	.198	.269	.363	.306	.936	.301	1.115	.450	.902	.298	.311	.209	.218	

Source: Author's Analysis using SmartPLS 3.0 (2021)

Table 10.13: Collinearity Statistics (VIF Analysis) in Lokoja, North-Central Nigeria

	ATC	CRF	CSP	EA	ECP	ENV	ENVK	EQJ	EQY	HCD	HNS	IPD	LVC	MVA	PLS	POP	QoL	RES	SAF	SOC	SUD	UMG	URL
ATC			1.000						1.000	2.702													
CRF																							
CSP										1.753													
EA							1.000			1.167	1.113	1.113		1.000							1.113	1.000	1.179
ECP																							
ENV																							
ENVK																							
EQJ																							
EQY										2.190													
HCDM																							
HNS																							
IPD								1.000		1.124								1.000	1.000				1.146
LVC																							
MVA																							
PLS																							
POP																							
QoL																							
RES																							
SAF																							
SOC																							
SUD					1.000	1.000				1.131										1.000			1.120
UMG		1.000									1.113	1.113				1.000					1.113		1.245
URL										1.153			1.000		1.000		1.000						

Source: Author's Analysis using SmartPLS 3.0 (2021)

10.3.2 Structural model results in Lokoja, North-Central Nigeria

The hypotheses were tested, based on the outcomes of the structural model created after the reliability and validity of the construct measures were established. In a regression study, the path coefficients of the PLS model were viewed as normalised beta weights, but prior to this interpretation, it was suggested that the model be examined for collinearity because ordinary least square regression was used to estimate the coefficients of the pathways, and there was a possibility that collinearity in these results could be construed as bias (Hair et al., 2014). Consequently, these were determined if the constructs were related (Sarstedt et al., 2014; Wong, 2013). The latent variable scores were utilised as the inputs for the multiple regression to examine any difficulties with collinearity in the inner model. The exogenous latent factors (i.e., EA, UMG, SUD, URL, and IPD) were used as the independent variables, while the dependent variable was the *Hangwurian* city development.

10.3.2.1 Path model in Lokoja, North-Central Nigeria

In the regression study, the path coefficients of the PLS model were viewed as normalised beta weights. A collinearity test was performed because the calculation of the coefficients of the paths was based on ordinary least square regression (Mooi & Sarstedt, 2011; Sarstedt et al., 2014). As the collinearity in these results could be construed as bias (Hair et al., 2014), it was determined if the constructs were related (Sarstedt et al., 2014; Wong, 2013). The latent variable scores were used as inputs for the multiple regression testing in which the exogenous latent variables were used as the independent variables to analyse the collinearity issues in the inner model.

The HCD was set up as the dependent variable, and Figure 10.6 depicts the link between the various exogenous latent factors and the dependent variable HCD. The findings confirmed that environmental awareness (EA), urban management and governance (UMG), urban liveability (URL), sustainable urban development (SUD), and inclusive physical development (IPD) had a positive and significant relationship and their effect on the *Hangwurian* City Development was the result. Analysis of the various paths from the EA to HCD and the UMG to HCD was done.

The HCD hypothesised path (ATC – HCD: path = 0.318; $t=36.994$; $p=0.000$) supported the model; environmental awareness (EA) to HCD (EA – HCD: path = 0.005; $t=3.092$; $p=0.002$);

inclusive physical development (IPD) to the HCD hypothesised path (IPD-HCD: path=0.002; $t=2.439$; $p=0.015$); and the hypothesised path for urban management and governance (UMG) to HCD (UMG – HCD: path =.005; $t=2.728$, $p=0.007$); Table 10.14 and Figure 10.6 demonstrate the hypotheses for *Hangwurian* city development and its endogenous latent variables. The first three theorised routes for HCD are represented here, along with the endogenous variables that go along with them. In addition to the path coefficient, t-statistics, and p-value, the table also includes other variable analyses between the exogenous and endogenous variables. Four of thirty-six hypotheses were found to be unsubstantiated, including sustainable urban development (SUD) to HCD (path = 0.001; $T=1.704$, $P=0.089$) and sustainable urban development (SUD) to PLS, LVC, and QoL (paths = 0.048, 0.056, 0.061; and 0.42; $p = 0.089$, 0.064, 0.063, and 0.064 respectively with T values =1.704, 1.858, 1.867 and 1.853). Consequently, in all of the routes described above, the alternative hypothesis was adopted because the path coefficients for the exogeneous latent variables in Lokoja City (North-Central Nigeria) were not in favour of them.

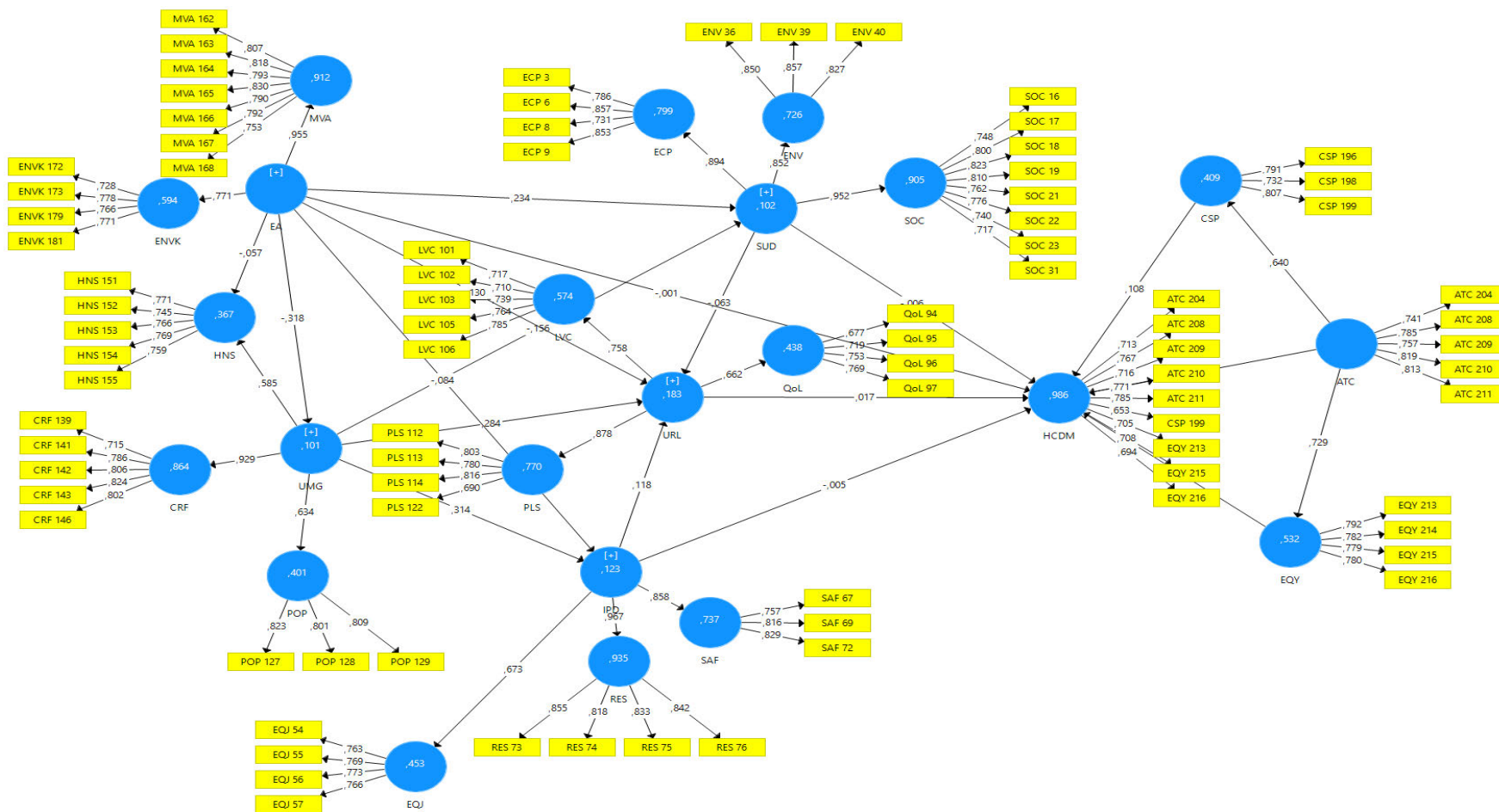


Figure 10.6: Path Coefficient and Analysis in Lokoja City

Source: Author's Analysis using SmartPLS 3.0 (2021)

Table 10.14: Path Coefficients in Lokoja, North-Central Nigeria

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values	Decision
ATC -> HCD	.318	.319	.009	36.994	.000	Supported
EA -> CRF	-.296	-.299	.030	9.805	.000	Supported
EA -> ECP	.253	.256	.031	8.156	.000	Supported
EA -> ENV	.242	.244	.030	8.138	.000	Supported
EA -> EQJ	-.124	-.126	.024	5.115	.000	Supported
EA -> HCD	-.005	-.005	.002	3.092	.002	Supported
EA -> HNS	-.186	-.190	.021	8.936	.000	Supported
EA -> IPD	-.100	-.101	.015	6.759	.000	Supported
EA -> LVC	-.197	-.199	.027	7.336	.000	Supported
EA -> PLS	-.229	-.230	.030	7.497	.000	Supported
EA -> POP	-.202	-.205	.023	8.802	.000	Supported
EA -> QoL	-.172	-.173	.024	7.095	.000	Supported
EA -> RES	-.178	-.181	.034	5.229	.000	Supported
EA -> SAF	-.158	-.160	.030	5.234	.000	Supported
EA -> SOC	.270	.273	.033	8.250	.000	Supported
EA -> SUD	.050	.050	.013	3.943	.000	Supported
EA -> URL	-.130	-.132	.018	7.083	.000	Supported
IPD -> HCD	.002	.002	.001	2.439	.015	Supported
IPD -> LVC	.089	.087	.028	3.247	.001	Supported
IPD -> PLS	.104	.100	.032	3.271	.001	Supported
IPD -> QoL	.078	.076	.024	3.261	.001	Supported
SUD -> HCD	-.001	-.001	.001	1.704	.089	Not Supported
SUD -> LVC	-.048	-.047	.026	1.858	.064	Not Supported
SUD -> PLS	-.056	-.054	.030	1.861	.063	Not Supported
SUD -> QoL	-.042	-.041	.023	1.853	.064	Not Supported
UMG -> ECP	-.139	-.140	.031	4.464	.000	Supported
UMG -> ENV	-.133	-.133	.030	4.469	.000	Supported
UMG -> EQJ	.211	.212	.026	8.172	.000	Supported
UMG -> HCD	.005	.005	.002	2.728	.007	Supported
UMG -> LVC	.251	.254	.027	9.444	.000	Supported
UMG -> PLS	.291	.293	.030	9.595	.000	Supported
UMG -> QoL	.219	.221	.024	9.053	.000	Supported
UMG -> RES	.304	.305	.035	8.680	.000	Supported
UMG -> SAF	.269	.271	.031	8.583	.000	Supported
UMG -> SOC	-.148	-.149	.033	4.479	.000	Supported
UMG -> URL	.047	.046	.013	3.565	.000	Supported

Source: Author's Analysis using SmartPLS 3.0 (2021)

10.3.3 Analysing the Predictive Relevance (Q^2) in Lokoja City

Q^2 is a measure of a study model's predictive power (Duarte & Raposo, 2010; Götz et al., 2010).

The Q^2 was determined via a blindfolding process. Predictive significance is shown by a Q^2 larger than 0, according to Hair et al. (2014); a score below zero shows that the model is not

predictively relevant; and scores of 0.02, 0.15, and 0.35 indicate that an exogenous construct has a small, medium, and high predictive relevance for a specific endogenous construct, respectively. A moderately high level of predictive relevance and a significant coefficient of determination support a model's ability to fit data (Hair et al., 2014).

As indicated in Table 10.15 and Figure 10.7, the predictive power of the endogenous latent variables and the relevance of the structural model linkages were explored. In the structural model, the R^2 values were acceptable because they exceeded the 10 per cent threshold recommended by Elbanna et al. (2013). Credit facilities (CRF $R^2 = 92.6\%$), economic prosperity (ECP $R^2 = 41.6\%$), environmental awareness (ENV $R^2 = 24.7\%$), Equity (EQY = 59.3%), family planning (FAMP $R^2 = 14.9\%$), and consumption pattern (CSP $R^2 = 97.6\%$) were all acceptable. The R^2 values for each endogenous variable are provided in Table 10.15, together with their related predictive relevance (Q^2).

10.3.3.1 Predictive relevance of the endogenous variables in Lokoja

The predictive relevance (Q^2) of the endogenous variables ranged from values of 0 to values greater than > 0 , as benchmarked by Sarstedt et al. (2014) in their use of blindfolding to determine the predictive relevance of both the exogenous and endogenous variables of a model construct. As shown in Table 10.15, many of the endogenous variables had values ranging from -0.00 to +0.664, showing that the model constructs' endogenous variables offered support for the structural model's predicted predictive value in Lokoja in North-Central Nigeria. The endogenous variables' predictive relevance determined whether the prediction direction was positive or negative.

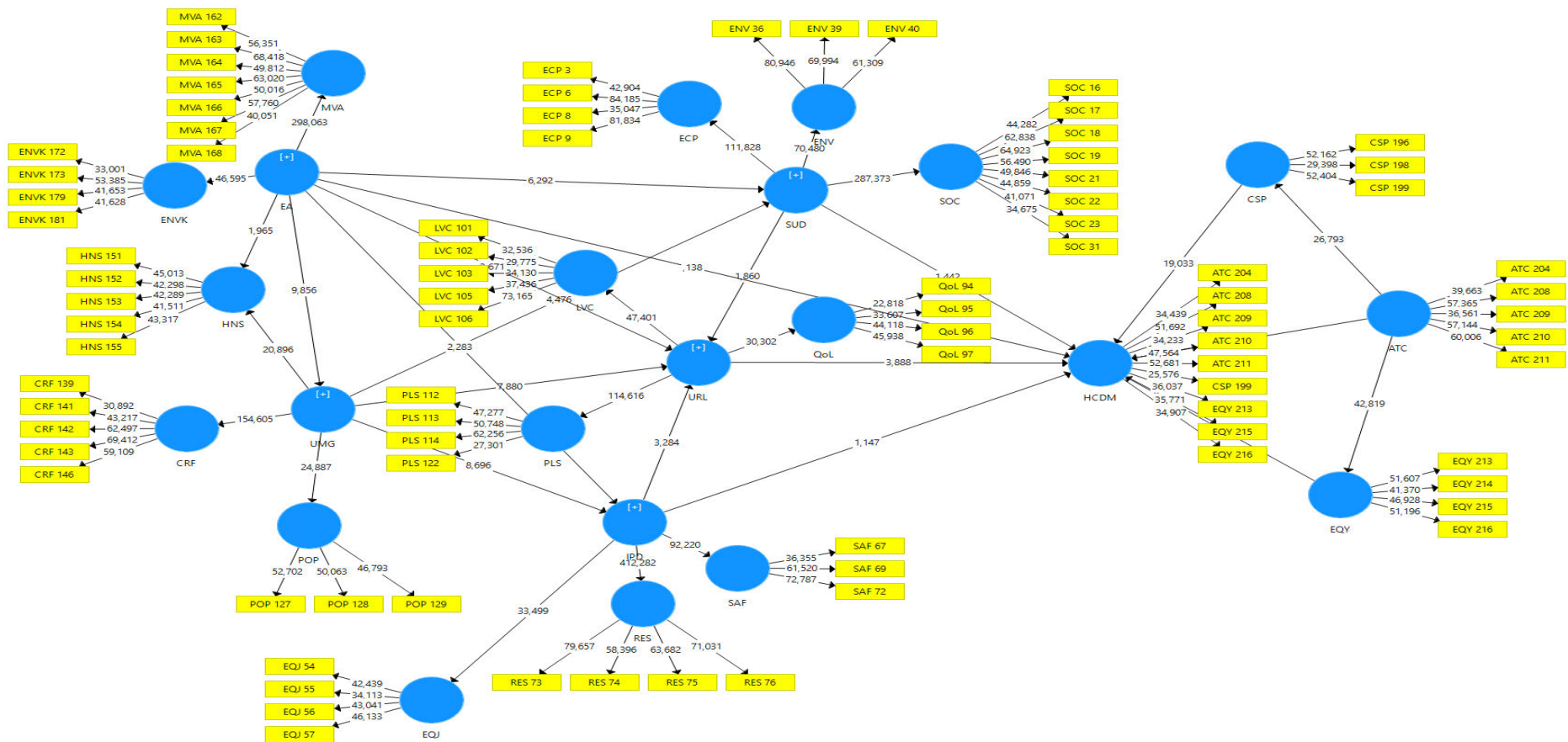


Figure 10.7: Structural Model Analysis in Lokoja City

Source: Author's Analysis using SmartPLS 3.0 (2021)

Table 10.15: Predictive Relevance Analysis in Lokoja, North-Central Nigeria

	RMSE	MAE	MAPE	Q ² _predict	R ² Result of Coefficient of Determinant
CRF 142	1.045	.868	50.506	.056	
CRF 146	1.142	.944	50.694	.043	
CRF 141	1.147	.934	47.557	.061	
CRF 139	1.043	.859	46.638	.055	
CRF 143	1.117	.934	51.218	.070	
CSP 198	.924	.730	36.250	.197	
CSP 196	.980	.775	37.736	.226	
CSP 199	.948	.762	40.946	.306	
ECP 6	1.308	1.141	47.820	.051	
ECP 9	1.311	1.136	49.404	.042	
ECP 8	1.118	.935	34.609	.022	
ECP 3	1.091	.927	34.123	.055	
ENV 40	1.063	.874	33.163	.027	
ENV 39	1.151	.977	38.434	.052	
ENV 36	1.143	.936	40.178	.042	
ENVK 179	.907	.715	28.167	.357	
ENVK 181	.874	.657	24.442	.336	
ENVK 172	.907	.708	27.011	.296	
ENVK 173	.916	.672	28.195	.380	
EQJ 55	1.056	.861	46.110	.013	
EQJ 56	1.118	.906	46.055	.012	
EQJ 54	1.082	.857	44.625	.014	
EQJ 57	1.060	.862	44.633	.013	
EQY 216	.884	.695	33.006	.331	
EQY 213	.875	.692	34.066	.339	
EQY 215	.847	.666	33.356	.345	
EQY 214	.889	.702	33.408	.278	
EQY 216	.889	.691	32.240	.323	
ATC 208	.702	.534	25.381	.612	
EQY 215	.852	.659	32.149	.338	
EQY 213	.881	.689	33.313	.331	
ATC 209	.675	.504	26.257	.568	
ATC 204	.715	.567	26.247	.544	
ATC 211	.644	.479	23.526	.657	
CSP 199	.950	.745	39.140	.303	
ATC 210	.627	.464	23.043	.664	
HNS 155	1.030	.817	38.464	.039	
HNS 153	.985	.798	40.418	.011	
HNS 152	.976	.816	45.088	.060	
HNS 151	.994	.798	39.801	.031	
HNS 154	.994	.813	40.287	.011	
RES 76	1.169	.951	46.517	.029	
RES 74	1.024	.859	47.173	.022	
SAF 72	1.091	.909	48.283	.005	
RES 73	1.227	1.015	51.286	.028	
RES 75	1.038	.869	47.277	.019	
SAF 69	1.072	.861	42.568	.012	
LVC 101	.982	.782	39.454	.002	
LVC 105	1.019	.804	38.044	.010	
LVC 106	1.059	.885	47.282	.037	
LVC 103	1.007	.830	41.793	-.002	
MVA 166	.763	.555	21.358	.565	
MVA 165	.698	.523	20.215	.635	
MVA 162	.685	.516	17.791	.590	
MVA 167	.773	.593	24.215	.590	

MVA 163	.738	.556	21.191	.603
MVA 168	.740	.549	19.375	.530
MVA 164	.709	.522	18.494	.545
PLS 113	1.004	.809	40.546	.047
PLS 122	1.068	.897	49.217	.030
PLS 114	.983	.815	43.240	.038
PLS 112	1.022	.864	47.916	.065
POP 128	1.063	.901	49.686	.056
POP 127	1.123	.932	50.003	.038
POP 129	1.012	.844	45.577	.047
QoL 96	.987	.768	37.914	.015
QoL 95	1.007	.836	43.263	.012
QoL 97	1.043	.885	48.883	.028
QoL 94	.967	.773	36.962	.007
RES 73	1.227	1.015	51.285	.028
RES 74	1.024	.859	47.156	.022
RES 76	1.169	.951	46.518	.029
RES 75	1.038	.869	47.278	.019
SAF 72	1.090	.909	48.331	.006
SAF 69	1.072	.861	42.567	.012
SAF 67	1.100	.904	48.299	.024
SOC 19	1.149	.964	37.773	.040
SOC 23	1.128	.941	37.815	.058
SOC 16	1.121	.946	37.457	.042
SOC 17	1.232	1.025	45.613	.045
SOC 22	1.109	.920	36.031	.032
SOC 31	1.147	.960	39.364	.033
SOC 18	1.146	.953	37.186	.033
SOC 21	1.064	.873	32.040	.063
ECP 9	1.311	1.134	49.353	.042
ENV 36	1.143	.936	40.179	.042
ECP 3	1.092	.929	34.193	.054
ECP 6	1.308	1.141	47.808	.051
SOC 16	1.121	.945	37.442	.043
SOC 19	1.149	.964	37.763	.040
ECP 8	1.118	.935	34.611	.022
ENV 39	1.151	.978	38.444	.052
SOC 17	1.232	1.025	45.578	.045
SOC 18	1.146	.954	37.196	.034
SOC 22	1.109	.921	36.053	.032
ENV 40	1.063	.874	33.163	.027
SOC 21	1.064	.873	32.037	.063
CRF 145	1.136	.957	53.913	.059
CRF 143	1.117	.930	50.915	.070
CRF 144	1.104	.933	53.036	.088
YTE 138	1.107	.922	51.650	.048
IJCD 147	1.108	.921	52.387	.050
CRF 142	1.045	.867	50.359	.056
QoL 93	1.088	.906	48.203	.026
LVC 106	1.058	.878	46.828	.038
PLS 113	1.004	.808	40.454	.048
PLS 114	.983	.812	43.043	.038

Source: Author's Analysis using SmartPLS 3.0 (2021)

10.3.4 Importance performance map (IPMA) for the *Hangwurian* city development in Lojoka

An IPMA was used to enhance the analytic results of the current investigation to improve the findings. An IPMA evaluates the performance level of the latent and manifest variables in a PLS-SEM analysis, according to Ringle and Sarstedt (2016). Rather than focusing just on the relevance of latent and manifest factors (i.e., the path coefficient), the IPMA considers the variables' impact on the target construct. As a result, the IPMA enables the selection of variables based on their importance to achieving the desired outcome. Researchers can find the most important activities for improving the dependent variable by studying the indicator level. To summarise, an IPMA is a valuable tool for setting management priorities.

Table 10.16 displays the importance-performance values and LV index values and the performance of the constructions according to Ringle and Sarstedt's (2016) standards. Equities (EQY) as an indicator of HCD showed a moderate performance of 42 per cent, but a high level of importance of 0.717 for the other constructs. ATC, CSP, and EQY were the variables of the constructions in the desired *Hangwurian* city development. The other constructs tended to be similarly significant. Since the first-order constructs had such a sizeable outside loading, it was clear that the indicator variables were mutually supportive of one another (i.e., complementary), as seen by the high outer loadings on the HCD.

Table 10.16: Importance-Performance Analysis in Lokoja, North-Central Nigeria

Latent Variable Performances	LM Importance	LV Performances
ATC	0.717	47.849
CRF	0.856	45.169
CSP	0.647	43.683
EA	-0.001	64.773
ECP	1.027	53.051
ENV	0.944	64.521
EQJ	0.642	49.769
EQY	0.099	42.075
HNS	0.644	45.305
IPD	1.041	49.523
LVC	0.723	45.392
MVA	1.026	67.154
PLS	0.855	45.941
POP	0.577	45.617
QoL	0.610	49.096
RES	1.041	49.183
SAF	0.864	46.419
SUD	-0.006	58.149
UMG	0.235	44.830
URL	-0.017	44.469

Source: Author's Analysis using SmartPLS 3.0 (2021)

In Table 10.16, the importance-performance of the indicators is laid out in greater detail. Most of the variables in the IPMA had moderate to high importance and performance, such as economic prosperity ECP (importance = 1.027, performance = 53.051); environmental dimension ENV: (importance = 0.944, performance = 64.773); ATC: access to the city (importance = 0.717, performance = 47.849); CRF: credit facilities (importance = 0.856, performance = 45.169) in Lokoja City with Figure 10.8 showing the network of linkage and performance of the variables.

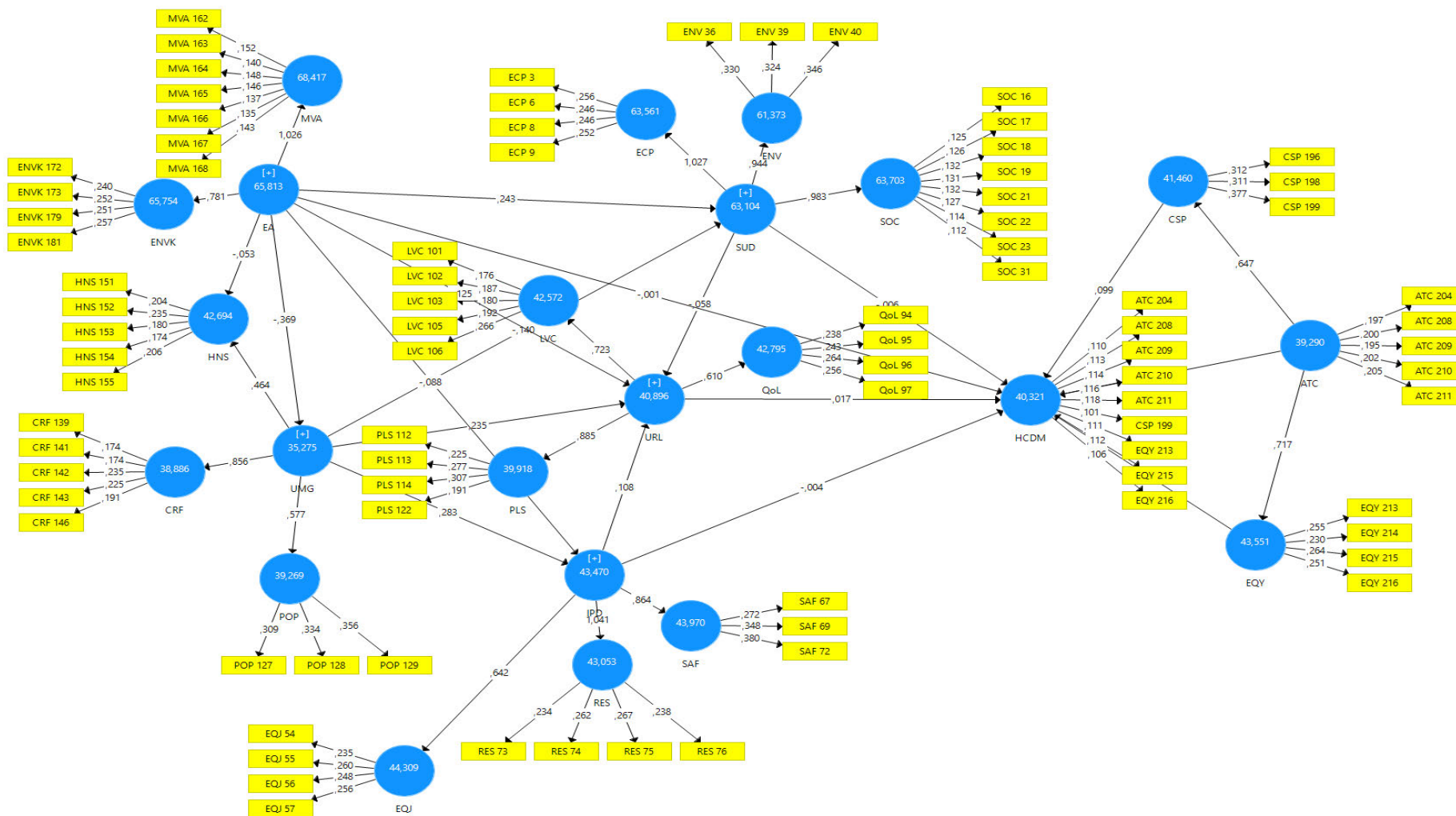


Figure 10.8: Latent Variable Performance in Lokoja

Source: Author's Analysis using SmartPLS 3.0 (2021)

A spot map showing the importance and percentage performance of the primary endogenous variables underlining *Hangwurian* city growth and the other exogenous variables is presented in this research in order to support the importance-performance map analysis. The endogenous variable performance ranged from 38 per cent to 75 per cent, with their relevance being scattered across the graph, as shown in Figure 10.9 showing the importance-performance maps for the endogenous variables. The endogenous variables' performance was more connected, while the endogenous variables' importance was significant.

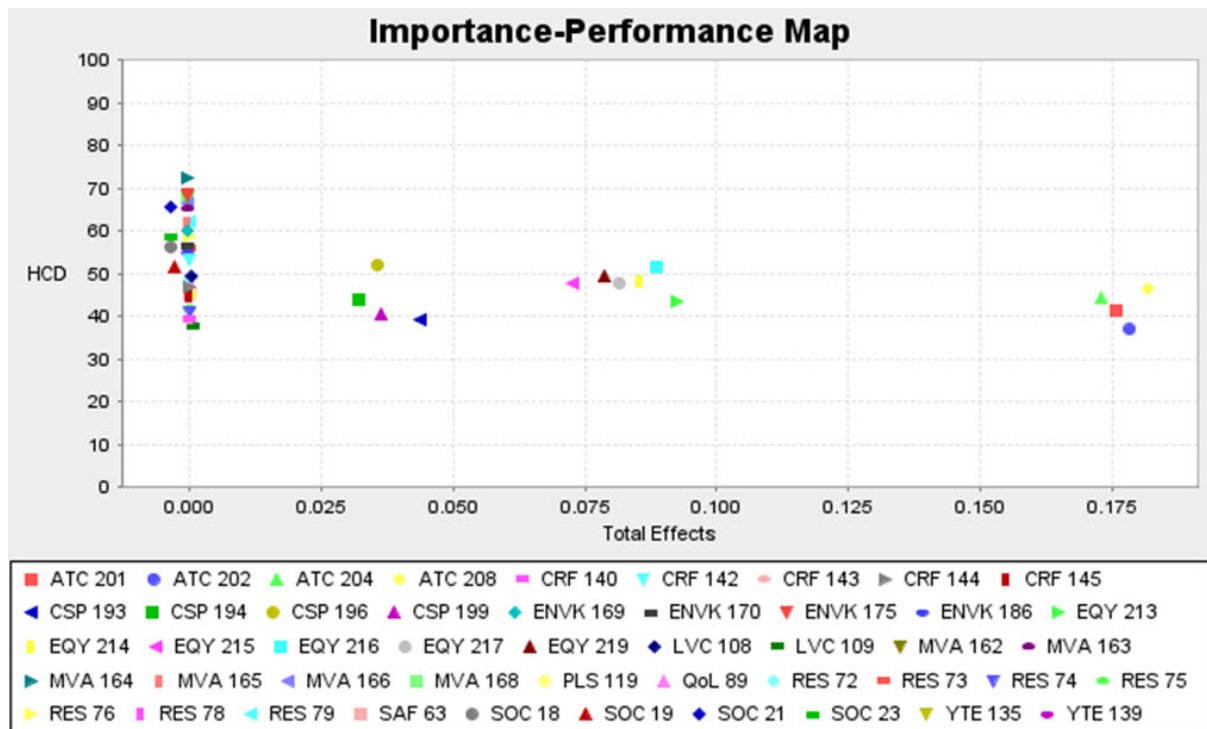


Figure 10.9: Endogenous Variables' Importance-Performance Map

Source: Author's Analysis using SmartPLS 3.0 (2021)

Additionally, Figure 10.10 shows the importance-performance map of the exogenous variable of the analysis in this research. It concerns the model's constructs for city development in Lokoja, North Central Nigeria. The analysis of the IPMA for the exogenous latent variables showed that the performance of the variables ranged from 45 per cent to 65 per cent. In contrast, the importance of the variables ranged between -0.001 and 1.041, indicating a closer interrelatedness of the performance of the variables, but a disparity in the importance of the exogenous latent variables.

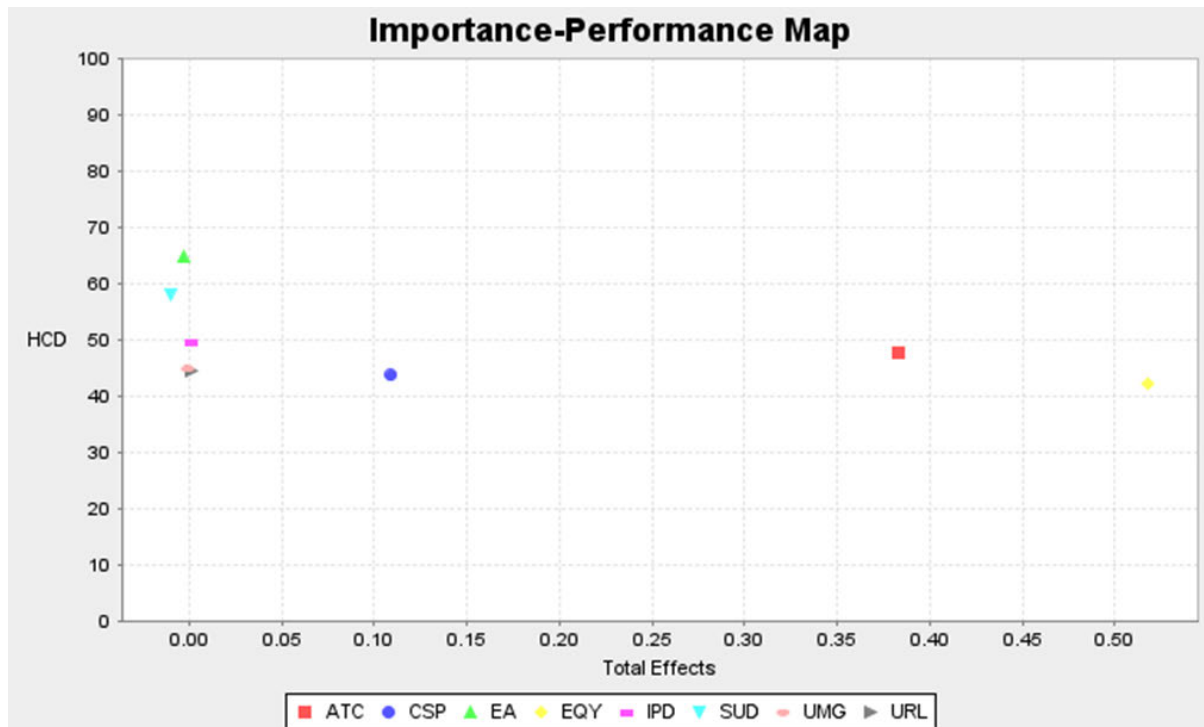


Figure 10.10: Exogenous Variables' Importance-Performance Map

Source: Author's Analysis from SmartPLS 3.0 (2021)

10.3.5 Confirmatory tetrad analysis final results for Lokoja City

As additional theoretical support, the CTA-PLS provides a better statistical measure to determine whether a latent/higher-order construct is reflective or formative (Hair et al., 2017). This approach is based on evaluating construct indicators in the tetrad form. The latent construct is reflective when all the tetrad values are non-significant (Hair et al., 2017; Svensson et al., 2018). Table 10.17 provides the CTA-PLS results for the HCD in Lokoja, North-Central Nigeria, explaining that none of the tetrads were significant and that provided empirical support for the reflective model.

As explained above, least four items were required for each construct in the CTA-PLS. If we only had two or three items, we could augment them with other items available (Bollen & Ting, 2000; Gudergan et al., 2008). Since the reflective model was global in scope, this argument made sense (Hair et al., 2017). Adding another reflective item would not affect the results of CTA-PLS because it tested the null hypothesis that all indicators reflected light and hence all tetrads vanished (Bollen & Ting, 2000; Gudergan et al., 2008). Reflective models could only be constructed if all four items of interest were reflective, and the CTA-PLS would reject the null hypothesis if any of the four items were formative. The research used utilised the

SmartPLS 3.0 software (Ringle et al., 2015) to produce 5,000 bootstrap subsamples, as per Gudergan et al. (2008).

Table 10.17 summarises the CTA-PLS results for Lokoja City's *Hangwurian* city development. Even though the CTA-PLS results favoured the formative model, I found good reliability and validity scores for the constraints measured while assuming the reflecting model. A Cronbach's alpha value of 0.71 or more was found for all of Lokoja's constructs assessed, indicating high reliability. A value of 0.56 or above indicated good convergent validity in this city.

Table 10.17: Confirmatory Tetrad Analysis Final Results in Lokoja, North-Central Nigeria

HCD	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values	Bias	CI Low	CI Up	Alpha adj.	z(1- alpha)	CI Low adj.	CI Up adj.
1: ATC 204, ATC 208, ATC 209, ATC 210	.007	.009	.028	.264	.792	.001	-.049	.061	.002	3.130	-.082	.094
2: ATC 204, ATC 208, ATC 210, ATC 209	-.018	-.017	.029	.626	.532	.001	-.076	.038	.002	3.130	-.110	.072
4: ATC 204, ATC 208, ATC 209, ATC 211	.022	.021	.031	.700	.484	-.001	-.038	.083	.002	3.130	-.074	.119
6: ATC 204, ATC 209, ATC 211, ATC 208	.040	.041	.027	1.486	.138	.001	-.014	.091	.002	3.130	-.046	.122
9: ATC 204, ATC 209, CSP 199, ATC 208	-.025	-.023	.026	.929	.353	.002	-.079	.025	.002	3.130	-.110	.056
10: ATC 204, ATC 208, ATC 209, EQY 213	.005	.006	.031	.161	.872	.001	-.056	.065	.002	3.130	-.092	.101
13: ATC 204, ATC 208, ATC 209, EQY 215	-.033	-.034	.029	1.165	.245	.000	-.089	.023	.002	3.130	-.123	.057
17: ATC 204, ATC 208, EQY 216, ATC 209	.002	.002	.025	.082	.935	.000	-.046	.051	.002	3.130	-.075	.080
20: ATC 204, ATC 208, ATC 211, ATC 210	.051	.052	.029	1.718	.086	.002	-.009	.107	.002	3.130	-.043	.141
26: ATC 204, ATC 208, EQY 213, ATC 210	-.004	-.003	.029	.139	.889	.001	-.062	.052	.002	3.130	-.096	.086
29: ATC 204, ATC 208, EQY 215, ATC 210	-.050	-.050	.026	1.916	.056	.000	-.100	.002	.002	3.130	-.130	.032
33: ATC 204, ATC 210, EQY 216, ATC 208	.064	.066	.032	2.031	.043	.002	.000	.124	.002	3.130	-.037	.161
41: ATC 204, ATC 208, EQY 215, ATC 211	-.004	-.003	.034	.108	.914	.001	-.070	.062	.002	3.130	-.109	.101
47: ATC 204, ATC 208, EQY 213, CSP 199	-.015	-.016	.030	.501	.617	-.001	-.074	.045	.002	3.130	-.109	.080
49: ATC 204, ATC 208, CSP 199, EQY 215	-.085	-.083	.028	3.082	.002	.002	-.141	-.033	.002	3.130	-.173	.000
51: ATC 204, CSP 199, EQY 215, ATC 208	.042	.041	.031	1.361	.174	-.001	-.017	.105	.002	3.130	-.054	.141
57: ATC 204, EQY 213, EQY 215, ATC 208	.010	.011	.030	.329	.742	.001	-.049	.067	.002	3.130	-.084	.101
109: ATC 204, ATC 210, ATC 211, CSP 199	.031	.031	.026	1.173	.241	.000	-.021	.082	.002	3.130	-.052	.113
113: ATC 204, ATC 210, EQY 213, ATC 211	.025	.025	.035	.721	.471	.000	-.043	.093	.002	3.130	-.083	.133
133: ATC 204, ATC 210, EQY 213, EQY 216	.084	.084	.027	3.090	.002	.000	.031	.138	.002	3.130	-.001	.169
137: ATC 204, ATC 210, EQY 216, EQY 215	.112	.114	.030	3.739	.000	.001	.052	.170	.002	3.130	.017	.205
149: ATC 204, ATC 211, EQY 215, EQY 213	-.003	-.003	.028	.114	.909	.000	-.059	.053	.002	3.130	-.092	.086
151: ATC 204, ATC 211, EQY 213, EQY 216	.006	.005	.028	.227	.820	-.001	-.048	.063	.002	3.130	-.081	.095
161: ATC 204, CSP 199, EQY 216, EQY 213	.071	.069	.031	2.263	.024	-.001	.011	.134	.002	3.130	-.026	.170
165: ATC 204, EQY 215, EQY 216, CSP 199	.008	.007	.022	.349	.727	-.001	-.035	.053	.002	3.130	-.061	.079
174: ATC 208, ATC 210, CSP 199, ATC 209	-.037	-.038	.032	1.151	.250	-.002	-.097	.028	.002	3.130	-.134	.065
231: ATC 208, CSP 199, EQY 215, ATC 210	-.046	-.047	.030	1.527	.128	.000	-.105	.014	.002	3.130	-.141	.049

Source: Author's analysis using SmartPLS 3.0 (2021)

10.3.6 Discussion of the findings for Lokoja City

A factor analysis was conducted to identify the best indicator for each of the six latent variables in this study, namely urban liveability (URL), sustainable urban development (SUD), inclusive physical development (IPD), environmental awareness (EA), urban governance (UG), and *Hangwurian* city development. These were shown in Tables 10.10 through 10.12. Fifteen indicators were kept for the URL construct; ten of which were related to SUD; sixteen were related to IPD; eleven were related to EA; twenty-two were related to urban management; and fourteen were related to HCD. The following criteria were checked when evaluating the measurement model based on the PLS results: indicator reliability, internal consistency reliability, convergence validity, and discriminant validity.

When looking at the factor loadings, almost all of the indicators had values close to the minimum acceptable value of 0.7 (Oke & Ogunsemi, 2016). However, as shown in Table 10.10 (which was considered the minimum threshold for exploratory research of this nature), the values exceeded the acceptable values (Hulland, 1999; Oke & Ogunsemi, 2016). The individual constructs' internal consistency was higher than the acceptable 0.70 in the model, with composite reliability values for the latent components ranging from 0.821 to 0.925. The internal consistency reliability was satisfactory for the measurement model's composite items. Table 10.10 showed that the model's convergent validity was examined, and the average variance (AVE) explained was more significant than 0.5 (Bagozzi & Yi, 1988).

Table 10.11 showed the significant criteria for evaluating the discriminant validity in the PLS analysis. Reflective structures should account for a more significant proportion of any variance than correlations with the latent variable, and items should load more strongly on their corresponding constructs than on other constructs, according to Chin (1998); and Elbanna et al. (2013). The findings in Table 10.10 showed that the loadings of all the latent variables' indicators were bigger than the cross-loading. They had more significant variability (AVE) than the other types of conceptions. As a result, it was concluded that the measuring model described had the necessary validity and reliability to evaluate the structural model's predictive and explanatory potential.

A study's converging validity is determined by how well the different items used to gauge the same idea agree (Hair et al., 2014). The measures employed in this study were tested for

convergent validity using the outer loadings or the average extracted variance (AVE) value. To prove that the latent variable was responsible for more than half of the variance in its indicators, the AVE value had to be 0.5 or greater (Hair et al., 2010). All loadings that fell below 0.5 were deleted, resulting in final AVE and CR values above the 0.5 and 0.7 benchmark values (please refer to Table 10.10).

The discriminant validity of the model's construct was then examined to see if it was actually unique from other constructs (Hair et al., 2017). To do this, Fornell and Larcker's (1981) criterion was used, where the square root of the AVE had to be more significant than the highest correlation with any of the other constructs. There was sufficient discriminant validity in the assessment based on Fornell and Larcker's (1981) criterion. However, in order to eliminate any possible poor performance of this criterion (Hair et al., 2016), the heterotrait-monotrait (HTMT) ratio (Henseler et al., 2015) was used. The mean of all the correlations between the indicators across the constructs measuring the same constructs was used in comparison to the average heterotrait-heteromethod correlation (Hair et al., 2017).

Tables 10.11 and 10.12 provided the results of the HTMT statistics and the Fornell Larcker Criterion, and the maximum HTMT statistic was 0.833, which was lower than the threshold value of 1.115. The HTMT confidence interval did not contain zero, based on the consistent PLS bootstrapping. As a result, the discriminant validity was deemed to be good, and the model's construct validity was thus adequate.

The hypotheses were tested, based on the outcomes of the structural model created after the reliability and validity of the construct measures were established. In a regression study, the path coefficients of the PLS model were viewed as normalised beta weights following examination of the model for collinearity, because ordinary least square regression was used to estimate the coefficients of the pathways. Because of the possibility of the collinearity in these results being construed as a bias (Hair et al., 2014), I determined whether or not the constructs were related, as per Wong (2013); and Sarstedt et al. (2014). The latent variable scores were utilised as inputs for the multiple regression tests to examine any difficulties with collinearity in the inner model, and the exogenous latent factors (i.e., EA, UMG, SUD, URL, and IPD) were set as the independent variables. The dependent variable was the HCD.

In the regression study, the path coefficients of the PLS model were viewed as normalised beta weights. A collinearity test was performed because the calculation of the coefficients of the paths was based on ordinary least square regression, as per Mooi and Sarstedt (2011); and Sarstedt et al. (2014). As collinearity in these results could be construed as bias, according to Hair et al. (2014), tests were conducted to determine if the constructs were related (Wong, 2013; Sarstedt et al., 2014). The latent variable scores were used as the inputs for the multiple regression in which the exogenous latent variables were set as the independent variables to analyse any collinearity issues in the inner model.

HCD, on the other hand, was set up as the dependent variable. In Figure 10.9 that there was a direct correlation between the external variables and the HCD's related effect on this variable. The findings confirmed that environmental awareness (EA), urban management and governance (UMG), urban liveability (URL), sustainable urban development (SUD), and inclusive physical development (IPD) had a positive and significant relationship and their effect on the *Hangwurian* city development (HCD) was as a result of this. Analyses of the various paths from the EA to the HCD and the UMG to the HCD were done.

The HCD hypothesised path (ATC – HCD: path = 0.318; $t=36.994$; $p=0.000$) supported the hypothesised path; environmental awareness (EA) to HCD (EA – HCD: path = 0.005; $t=3.092$; $p=0.002$); inclusive physical development (IPD) to HCD hypothesised path (IPD - HCD: path 0.002; $t=2.439$; $p=0.015$); and the hypothesised path for urban management and governance (UMG) to HCD (UMG – HCD: path =.005; $t=2.728$ and $p=0.089$. Table 10.13 and Figure 10.10 demonstrated the hypothesised routes for *Hangwurian* city development and its endogenous latent variables. The first three theorised routes for HCD were represented, along with the endogenous variables that went along with them. In addition to the path coefficient, t-statistics, and p-values, the table also included other variable analyses between the exogenous and endogenous variables. Four of thirty-six hypotheses were found to be unsubstantiated, including sustainable urban development (SUD) to HCD (path = 0.001; $t=1.704$, $p=0.089$); and sustainable urban development (SUD) to PLS, LVC, and QoL (paths = 0.048, 0.056, 0.061; and 0.42, respectively; $t=1.853$ and p-values = 0.089, 0.064, 0.063 and 0.064 for all the insignificant variables of SUD). As a result, the alternative hypothesis was rejected since the path coefficients for the exogenous latent variables in Lokoja, North-Central Nigeria, did not support it.

Q^2 , a measure of a study model's predictive power, was suggested by Duarte and Raposo (2010); and Götz et al. (2010). Q^2 was determined via a blindfolding process. A predictive significance is shown by a Q^2 larger than 0, according to Hair et al. (2014), and a score below zero shows that the model is not predictively relevant. Scores of 0.02, 0.15, and 0.35 indicate that an exogenous construct has a small, medium, and high predictive relevance for a particular endogenous construct, respectively (Hair et al., 2014). It is clear from Hair et al. (2013) that a moderately high level of predictive relevance and a significant coefficient of determination support a model's ability to fit data.

In Table 10.11 and Figure 10.7, the predictive power of the endogenous latent variables and the relevance of the structural model linkages were established. In the structural model, the R^2 values were acceptable because they exceeded the 10 per cent threshold recommended by Elbanna et al. (2013). Credit facilities (CRF $R^2 = 92.6\%$); economic prosperity (ECP $R^2 = 41.6\%$); environmental awareness (ENV $R^2 = 24.7\%$); equity (EQY $R^2 = 59.3\%$); family planning (FAMP $R^2 = 14.9\%$); and consumption pattern (CSP $R^2 = 97.6\%$) were all acceptable when quantifying the predictive power of each of the endogenous variables by calculating their R^2 and Q^2 values.

Table 10.15 showed that the predictive relevance (Q^2) of the endogenous variables ranged from values of 0 to values greater than > 0 , as benchmarked by Sarstedt et al. (2014) in their use of blindfolding to determine the predictive relevance of both exogenous and endogenous variables of model's construct. As shown in Table 10.16, many of the endogenous variables had values ranging from -0.00 to +0.664, showing that the predictive significance of the model constructs' endogenous variables supported the structural model's predictive relevance in Lokoja City in North-Central Nigeria. Although their negative or positive values influenced the predictive importance of the endogenous variables, the prediction direction was only positive or negative.

An IPMA was used to enhance the analysis outcomes. An IPMA evaluates the performance level of latent and manifest variables in a PLS-SEM analysis, according to Ringle and Sarstedt (2016). An IPMA provides information on how vital variables are to the goal of the construct, rather than just how important they are (i.e., the path coefficient). As a result, an IPMA makes it possible to place the variables in their order of importance to improve a specific variable. This then allows researchers to find the most significant activities for improving the dependent

variable by studying the indicator level. To summarise, an IPMA is a valuable tool for setting management objectives and determining their importance.

According to Ringle and Sarstedt (2016) the construct importance-performance values and LV index values must be displayed, and this occurred in Table 10.16. Equities (EQY) as an indicator of HCD had a moderate performance of 42 per cent, but a high significance of 0.717 to other constructs. Additionally, the variables ATC, CSP, and EQY played a vital role in the focused development of the *Hangwurian* constructions. Since the first-order constructs had such a sizeable outer loading, it was clear that the indicator variables were mutually supportive of each other (i.e., there was complementarity).

Table 10.16 summarised the IPMA's findings, which showed that the most important variables, such as economic prosperity ECP (importance = 1.027, performance = 53.051), environmental dimension ENV (importance = 0.944, performance = 64.773), access to the city ATC (importance = 0.717, performance = 47.849), and credit facilities CRF (importance = 0.856, performance = 45.169), all had moderate to large importance and performance.

Furthermore, this research showed the endogenous variables in a spot map that illustrated their importance and performance percentages and the other exogenous variables of the model, per the importance-performance map analysis. According to Figure 10.8, 10.9 and 10.10; also as shown in Table 10.16 the performance of the endogenous variables ranged from 38 per cent to 75 per cent, with the relevance of the endogenous factors scattered over the curve. The endogenous variables had a greater degree of interdependence in their performance, but they also had a more significant discrepancy in importance.

The importance-performance map of the exogenous variables was shown in Figure 10.8. It had to do with how the city of Lokoja in Nigeria's North-Central region planned to develop using the concept. According to the IPMA analysis, the exogenous latent variables performed between 45 and 65 per cent of the time. As a result, the relevance of the variables varied from -0.001 to 1.041, suggesting that the variables' performance was closely linked but that the exogenous latent factors had a disproportionate influence.

The CTA-PLS provides a better statistical assessment of the latent/higher-order construct in terms of whether it is reflecting or formative in nature (Hair et al., 2017), and the construct

indicators are evaluated using the tetrad form. When all tetrad values are insignificant, the latent construct is reflective (Hair et al., 2017; Svensson et al., 2018). Table 10.17 showed the CTA-PLS results for HCD in Lokoja, North-Central Nigeria, demonstrating that none of the tetrads were significant and this gave empirical support for this reflective model. The CTA-PLS tests the null hypothesis that all model-implied tetrads have the value of zero or “vanish”. A tetrad (s) is the difference between two covariances (r) products among four associated indicators.

At least four items are required for each construct in the CTA-PLS. Where four are not available, they can be supplemented with other items available (Bollen & Ting, 2000; Gudergan et al., 2008). Adding another reflective item would not affect the results of the CTA-PLS because it tests the null hypothesis that all indicators reflect light and hence all tetrads vanish (Bollen & Ting, 2000; Gudergan et al., 2008). Reflective models can only be constructed if all four items of interest are reflective. The CTA-PLS will reject the null hypothesis if any four items are formative. I utilised the SmartPLS 3.0 software and produced the 5,000 bootstrap sub-samples required for the analysis (Ringle et al., 2015; Gudergan et al. 2008).

Table 10.17 described the CTA-PLS findings for the growth of a *Hangwurian* city in Lokoja in North-Central Nigeria. The CTA-PLS results favoured a formative model, and I found good reliability and validity scores for the constraints measure while assuming the reflective model. A Cronbach's alpha value of 0.71 or above was found for all of Lokoja's constructs assessed, indicating good reliability. This city had a substantial AVE of at least 0.56, which indicated an excellent convergent validity score.

10.4 Model Development for Minna, North-Central Nigeria

10.4.1 Measurement model for Minna, North-Central Nigeria

To determine the best indicator for the individual construct, an exploratory factor analysis was conducted to ascertain the number of indicators to be retained for each of the six latent variables included in this study. These were urban liveability (URL), sustainable urban development (SUD), inclusive physical development (IPD), environmental awareness (EA), urban governance (UMG), and *Hangwurian* city development (HCD). The factor analysis is indicated in Table 10.18. For the URL construct, 15 indicators were retained; 10 indicators were

identified for the SUD construct; 16 were retained for the IPD construct; 11 for the EA construct; 22 for the urban management and governance construct; and 14 for HCD. In assessing the measurement model from the PLS results, the following criteria had to be examined: indicator reliability, internal consistency reliability, convergent validity, and discriminant validity.

Almost all of the indicators were found to have factor loading square values nearer to the acceptable minimum value of 0.7 for indicator reliability (Oke & Ogunsemi, 2016). However, as shown in Table 10.18, the values were more significant than 0.4, which was considered the minimum threshold for exploratory research of this type (Hulland, 1999). All of the latent constructs exhibited internal consistency values greater than or equal to the threshold of 0.70 in the model, and the composite reliability values varied from 0.757 to 0.882. The internal consistency reliability was satisfactory for the measurement model's composite items. A test of the model's convergent validity showed that the average variance explained (AVE) values were more significant than 0.5 (see Table 10.18) (Bagozzi & Yi, 1988). It emerged that the Cronbach's alpha values for the measured variables did not match the required 0.7 Cronbach's alpha value, but they were still suitable for an exploratory study (Hulland, 1999).

Table 10.18: Model Path Analysis in Minna, North-Central Nigeria

Latent Variable	Indicators	Loadings	Indicator Reliability (i.e., loadings ²)	Composite Reliability	R ²	AVE	Cronbach's Alpha
ACCESS TO THE CITY (HCD)	ATC 201	.768	0.5898	.803	1.000	.577	.631
	ATC 209	.690	0.4761				
	ATC 211	.815	0.6642				
CREDIT FACILITIES (UMG)	CRF 143	.786	0.6178	.806	.298	.581	.642
	CRF 145	.744	0.5535				
	CRF 146	.757	0.5730				
CONSUMPTION PATTERN (HCD)	CSP 192	.775	0.6006	.831	1.000	.622	.699
	CSP 193	.764	0.5837				
	CSP 194	.825	0.6806				
ECONOMIC PROSPERITY (SUD)	ECP 6	.811	0.6578	.871	.631	.577	.739
	ECP 8	.753	0.5670				
	ECP 9	.862	0.7430				
ENVIRONEMNTAL DIMENSION (SUD)	ENV 34	.706	0.5000	.850	.379	.655	.662
	ENV 36	.838	0.7022				
	ENV 40	.767	0.5883				
ENVIRONEMNTAL KNOWLEDGE (EA)	ENVK 173	.755	0.5700	.815	.791	.596	.834
	ENVK 178	.747	0.5580				
	ENVK 179	.728	0.5300				
	ENVK 184	.771	0.5944				
	ENVK 185	.811	0.6577				
	ENVK 186	.809	0.6545				
EQUITY/JUSTICE (IPD)	EQJ 55	.744	0.5535	.882	.213	.599	.637
	EQJ 56	.767	0.5883				
	EQJ 58	.771	0.5944				
	EQY 214	.747	0.5580	.805	1.000	.579	.626
	EQY 216	.795	0.6320				
	EQY 219	.725	0.5256				
FAMILY PLANNING (UMG)	FAMP 130	.902	0.8136	.800	.023	.572	.477

	FAMP 132	.693	0.4802				
INFORMATION FLOW (UMG)	IJCD 148	.740	0.5476	.783	.127	.647	.363
	IJCD 149	.820	0.6724				
LIVEABLE COMMUNITIES (URL)	LVC 104	.729	0.5314	.803	.184	.577	.465
	LVC 105	.874	0.7639				
MOTIVATION AND VALUE (EA)	MVA 165	.742	0.5506	.757	.002	.610	.818
	MVA 166	.670	0.4489				
PLACE SHAPING (URL)	PLS 114	.842	0.7089	.825	1.000	.702	.561
	PLS 122	.770	0.5929				
POPULATION MANAGEMENT (UMG)	POP 124	.718	0.5155	.784	1.000	.647	.582
	POP 128	.726	0.5271				
	POP 129	.770	0.5929				
QUALITY OF LIFE (URL)	QoL 96	.803	0.6448	.820	.154	.695	.492
	QoL 97	.825	0.6806				
RESILIENCE (IPD)	RES 73	.762	0.5806	.782	.932	.545	.711
	RES 74	.787	0.6193				
	RES 76	.830	0.6889				
SAFETY (IPD)	SAF 68	.808	0.6529	.797	.208	.663	.567
	SAF 70	.861	0.7413				
SOCIAL DIMENSION (SOC)	SOC 19	.753	0.5670	.836	.669	.629	.762
	SOC 21	.729	0.5314				
	SOC 22	.815	0.6642				
	SOC 23	.738	0.5446				
	SOC 24	.717	0.5141				
YOUTH EMPOWERMENT AND INNOVATION	YTE 134	.794	0.6304	.821	.284	.697	.401
	YTE 138	.787	0.6194				

Source: Author's Analysis using SmartPLS 3.0 (2021)

10.4.1.1 Construct reliability and validity in Minna, North-Central Nigeria

Table 10.18 shows the significant criteria for evaluating discriminant validity in the PLS analysis. Reflective structures should account for a more significant proportion of variance than correlations with the latent variable (Chin, 1998), and items should load more strongly on their corresponding constructs than on other constructs (Chin, 1998; Elbanna et al., 2013). Table 10.18 shows that all the indicators of the latent variables had loadings greater than the cross-loading. They also had greater variability (AVE) than the other types of conceptions. As a result, it could be concluded that the measuring model described here had the necessary validity and reliability to evaluate the structural model's predictive and explanatory potential.

Convergent validity refers to how numerous items used in research to measure the same idea agree with each other (Hair et al., 2014). The measures employed in this study were tested for convergent validity using outer loadings or the average extracted variance (AVE) values. To prove that the latent variable was responsible for more than half of the variance in its indicators, an AVE value of 0.5 or greater had to be attained (Hair et al., 2010). Any loadings that fell below 0.5 were deleted, resulting in final AVE and CR values above the 0.5 and 0.7 benchmark values (please refer to Table 10.18).

As a part of the validation process, discriminant validity was used to determine whether or not the concept was indeed unique from other concepts (Hair et al., 2017). Fornell and Larcker's (1981) criterion was used, where the square root of the AVE should have been more significant than the highest correlation with any of the other constructs. There was sufficient discriminant validity in the assessments based on the Fornell and Larcker (1981) criterion. However, Hair et al. (2016) claim that this is a criterion that fails when small differences are present in the indicator loadings of the constructs, so the heterotrait-monotrait (HTMT) ratios proposed by Henseler et al. (2015) were determined to overcome this problem.

The mean of all the correlations between indicators across constructs assessing various constructs had to be used in comparison to the average heterotrait-heteromethod correlative, as per Hair et al. (2017) (i.e., the mean of all of the correlations of the indicators measuring the same constructs). Tables 10.19; 10.20 and Table 10.21 present the findings of the Fornell Larcker Criterion; the HTMT statistics and VIF Statistics. According to Table 10.19, the highest Fornell Larcker Criterion statistic was 0.838, which fell short of the threshold value of 0.850. The HTMT confidence interval did not contain zero, based on the consistent PLS

bootstrapping. As a result, the discriminant validity was good. The model's construct validity was thus adequate, in my opinion.

Table 10.19: Fornell-Larcker Criterion for Discriminant Validity in Minna, North Central Nigeria

	ATC	CRF	CSP	EA	ECP	ENV	ENVK	EQJ	EQY	FAMP	HCD	IJCD	IPD	LVC	PLS	POP	QoL	RES	SAF	SOC	SUD	UMG	URL	YTE
ATC	.759																							
CRF	.031	.762																						
CSP	.411	.041	.789																					
EA	.032	-.041	.046	.759																				
ECP	-.055	-.014	.002	.073	.809																			
ENV	-.019	-.084	.064	-.011	.583	.772																		
ENVK	-.035	-.049	.067	.889	.082	-.004	.774																	
EQJ	.106	.143	.179	-.039	.085	.110	-.044	.761																
EQY	.516	.089	.314	-.038	-.096	.030	-.091	.059	.756															
FAMP	-.004	.176	.002	.008	.036	.022	.021	.085	.033	.804														
HCD	1.000	.031	.411	.032	-.055	-.019	-.035	.106	.516	-.004	.759													
IJCD	.037	.402	.096	.020	.096	.032	.011	.122	.084	.227	.037	.781												
IPD	.094	.174	.111	-.046	-.024	.065	-.065	.462	.033	.032	.094	.052	.838											
LVC	-.041	.017	.127	-.021	.057	.120	.026	.119	.000	.032	-.041	-.010	-.051	.804										
PLS	-.086	.091	-.019	-.014	-.022	.046	-.021	.022	-.097	.059	-.086	-.008	-.027	.429	.834									
POP	.042	.546	.136	-.041	.003	.034	-.064	.216	-.012	.150	.042	.355	.268	.017	.186	.738								
QoL	-.026	.032	-.062	-.046	-.027	.008	-.081	.072	-.087	.042	-.026	.033	-.031	.413	.392	-.022	.814							
RES	.105	.174	.115	-.049	-.016	.057	-.066	.507	.044	.030	.105	.040	.965	-.041	-.033	.259	-.013	.793						
SAF	.034	.097	.167	.064	.084	.139	.072	.457	.036	.059	.034	.021	.457	-.065	.026	.239	.034	.490	.835					
SOC	.077	-.165	.072	.054	.622	.617	.064	.051	-.023	.010	.077	.061	.002	.027	.003	-.042	.037	.007	.024	.761				
SUD	.001	-.041	.013	.060	.794	.615	.054	.038	-.064	-.006	.001	.076	-.036	.002	-.033	-.003	-.027	-.046	.048	.818	.771			
UMG	.043	.546	.137	-.041	.003	.033	-.064	.215	-.011	.150	.043	.356	.267	.017	.186	1.000	-.021	.258	.239	-.042	-.003	.738		
URL	-.086	.091	-.018	-.013	-.022	.046	-.021	.022	-.097	.059	-.086	-.007	-.027	.429	1.000	.186	.393	-.033	.026	.003	-.033	.186	.834	
YTE	-.029	.472	.012	.029	.022	-.046	.029	.173	.002	.188	-.029	.378	.229	.042	.132	.532	.032	.226	.177	-.062	-.015	.533	.133	.791

Source: Author's Analysis using SmartPLS 3.0 (2021)

Table 10.20: Heterotrait-Monotrait Ratio (HTMT) for Measuring the Discriminant Validity in Minna, North-Central Nigeria

	ATC	CRF	CSP	EA	ECP	ENV	ENVK	EQJ	EQY	FAMP	HCD	IJCD	IPD	LVC	PLS	POP	QoL	RES	SAF	SOC	SUD	UMG	URL	YTE
ATC																								
CRF	.148																							
CSP	.612	.068																						
EA	.107	.102	.159																					
ECP	.109	.160	.060	.089																				
ENV	.098	.158	.099	.089	.820																			
ENVK	.130	.093	.098	.023	.106	.094																		
EQJ	.185	.223	.267	.109	.130	.200	.116																	
EQY	.825	.143	.477	.143	.171	.080	.157	.193																
FAMP	.118	.306	.131	.134	.122	.093	.106	.144	.128															
HCD	.586	.148	.612	.107	.109	.098	.130	.185	.825	.118														
IJCD	.192	.823	.189	.125	.234	.116	.111	.250	.205	.559	.192													
IPD	.161	.288	.167	.078	.112	.104	.104	.763	.151	.107	.161	.127												
LVC	.125	.157	.295	.106	.163	.260	.096	.214	.102	.073	.125	.091	.203											
PLS	.146	.164	.089	.107	.063	.102	.068	.083	.192	.105	.146	.212	.049	.823										
POP	.134	.887	.212	.108	.115	.144	.099	.352	.109	.274	.134	.771	.456	.087	.324									
QoL	.135	.203	.114	.129	.147	.118	.157	.138	.222	.150	.135	.131	.120	.860	.745	.195								
RES	.161	.253	.157	.072	.101	.079	.097	.764	.135	.074	.161	.127	.468	.134	.055	.388	.112							
SAF	.085	.158	.247	.131	.150	.230	.118	.756	.164	.140	.085	.148	.795	.120	.049	.421	.130	.775						
SOC	.130	.250	.103	.103	.837	.865	.084	.115	.091	.178	.130	.179	.148	.171	.102	.093	.093	.131	.105					
SUD	.096	.164	.074	.100	.098	.922	.081	.082	.136	.167	.096	.155	.089	.260	.117	.075	.141	.087	.149	.111				
UMG	.134	.887	.212	.108	.115	.144	.099	.352	.109	.274	.134	.771	.456	.087	.324	.718	.195	.388	.421	.093	.075			
URL	.146	.164	.089	.107	.063	.102	.068	.083	.192	.105	.146	.212	.049	.823	.782	.324	.745	.055	.049	.102	.117	.324		
YTE	.126	.924	.157	.116	.122	.172	.076	.341	.186	.410	.126	.993	.477	.260	.277	.105	.092	.417	.381	.196	.157	.105	.277	

Source: Author's Analysis using SmartPLS 3.0 (2021)

Table 10.21: Collinearity Statistics (VIF) in Minna, North-Central Nigeria

	ATC	CRF	CSP	EA	ECP	ENV	ENVK	EQJ	EQY	FAMP	HCD	IJCD	IPD	LVC	PLS	POP	QoL	RES	SAF	SOC	SUD	UMG	URL	YTE
ATC											1.514													
CRF																								
CSP											1.235													
EA							1.000						1.002								1.002	1.000	1.002	
ECP																								
ENV																								
ENVK																								
EQJ																								
EQY											1.403													
FAMP																								
HCD																								
IJCD																								
IPD								1.000			1.019							1.000	1.000					
LVC																								
PLS																								
POP																								
QoL																								
RES																								
SAF																								
SOC																								
SUD					1.000	1.000					1.010									1.000				
UMG		1.000								1.000		1.000	1.002			1.000					1.002		1.002	1.000
URL											1.014			1.000	1.000		1.000							
YTE																								

Source: Author's Analysis using SmartPLS 3.0 (2021)

10.4.2 Structural model results for Minna, North-Central Nigeria

The hypotheses were then tested based on the outcomes of the created structural model after the reliability and validity of construct measures had been established. In a regression study, the path coefficients of the PLS model were viewed as normalised beta weights. But prior to this interpretation, the model was examined for collinearity because ordinary least square regression was used to estimate the coefficients of the pathways. There was a possibility that collinearity in these results could be construed as bias (Hair et al., 2014), so multiple regression testing was conducted to see if the constructs were related (Sarstedt et al., 2014; Wong, 2013). The latent variable scores were utilised as the inputs for the multiple regression testing to look for difficulties with collinearity in the inner model, while the exogenous latent factors (i.e., EA, UMG, SUD, URL, and IPD) were used as the independent variables. The dependent variable was *Hangwurian* city development.

10.4.2.1 Path model in Minna, North-Central Nigeria

In the regression study, the path coefficients of the PLS model were viewed as normalised beta weights. A collinearity test was performed because the calculation of the coefficients of the paths was based on ordinary least square regression (Mooi & Sarstedt, 2011; Sarstedt et al., 2014). As the collinearity in these results could be construed as bias (Hair et al., 2014), I determined if the constructs were related (Sarstedt et al., 2014; Wong, 2013). The latent variable scores were used as inputs for the multiple regression testing in which the exogenous latent variables were used as the independent variables to analyse the collinearity issues in the inner model.

HCD was configured as the dependent variable. The path relationship between the various exogenous latent variables and their corresponding effects on the dependent variable, HCD, is illustrated in Figure 10.11. The results confirmed that a positive and significant relationship existed between environmental awareness (EA), urban management and governance (UMG), urban liveability (URL), sustainable urban development (SUD), inclusive physical development (IPD), and their corresponding effect on the *Hangwurian* city development (HCD). Several paths were analysed, from the EA to the HCD and from the UMG to the HCD.

The hypothesised path of environmental awareness (EA) to ENVK (EA – ENVK: path = 0.889; $t=96.449$; $p=0.000$) indicated support for the hypothesised path. Inclusive physical

development (IPD) to EQJ also showed a supported hypothesised path (IPD – EQJ: path = 0.461; $t=9.495$; $p=0.000$). The hypotheses for *Hangwurian* city development and its endogenous latent variables are presented in Table 10.22 and Figure 10.12. The first three hypotheses regarding HCD's endogenous variables were examined in this study. In addition, the path coefficient, t-statistics, and p-values for each of the exogenous and endogenous variables are shown in the Table. As a result of this analysis, six of the thirty hypotheses were found to be unsupported. These were: environmental awareness (EA) to inclusive physical development (IPD), where the path was (EA -IPD: path = 0.035; $p=0.537$); EA -> SUD (path=0.060; $t=0.818$; $p=0.359$); EA -> UMG (path= -0.000; $t=0.09$; $p=0.996$); and UMG -> SUD (path=0.000; $p=0.996$). In other words, the alternative hypothesis was rejected since the path coefficients for the exogenous latent variables in Minna in North-Central Nigeria did not support it. ATC to HCD, CSP to HCD, EQY to HCD, IPD to HCD, SUD to HCD, and URL to HCD were all hypothesised routes that the analysis could not determine.

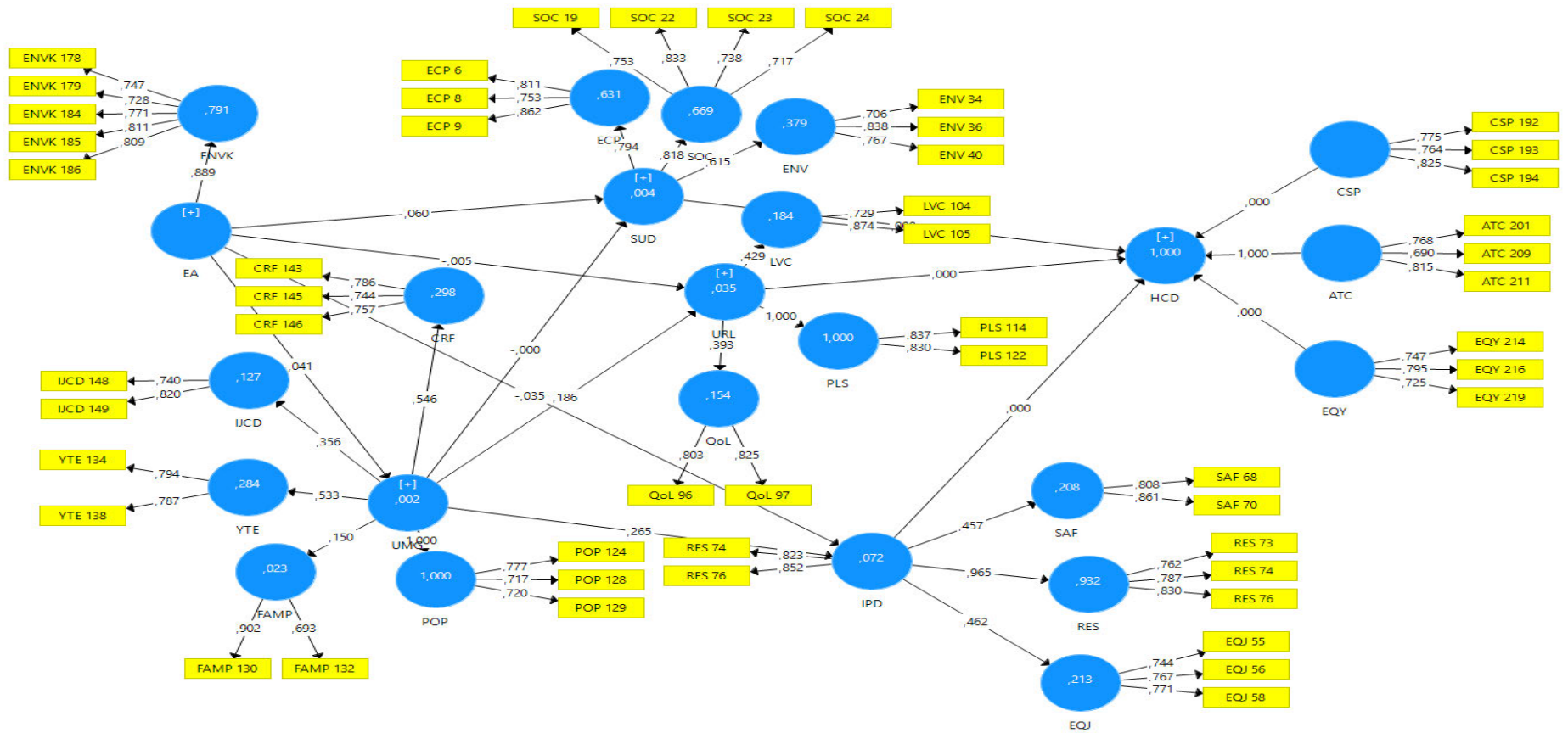


Figure 10.10: Measurement Model Analysis for Minna City

Source: Author's Analysis using SmartPLS 3.0 (2021)

Table 10.22: Path Coefficients in Minna, North-Central Nigeria

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T (O/STDEV)	Statistics	P Values	Decision
ATC -> HCD	1.000	1.000	.000		Undefined	Infinite	Undefined
CSP -> HCD		.000	.000		Undefined	Infinite	Undefined
EA -> ENVK	.889	.890	.009		96.449	.000	Supported
EA -> IPD	-.035	-.037	.057		.617	.537	Unsupported
EA -> SUD	.060	.063	.065		.918	.359	Unsupported
EA -> UMG	-.041	-.043	.070		.589	.556	Unsupported
EA -> URL	-.005	-.003	.056		.093	.926	Unsupported
EQY -> HCD		.000	.000				Undefined
IPD -> EQJ	.462	.471	.049		9.495	.000	Supported
IPD -> HCD		.000	.000				Undefined
IPD -> RES	.965	.966	.002		471.007	.000	Supported
IPD -> SAF	.457	.463	.054		8.378	.000	Supported
SUD -> ECP	.794	.796	.021		37.522	.000	Supported
SUD -> ENV	.615	.618	.045		13.547	.000	Supported
SUD -> HCD		.000	.000				Undefined
SUD -> SOC	.818	.819	.018		44.917	.000	Supported
UMG -> CRF	.546	.548	.045		12.245	.000	Supported
UMG -> FAMP	.150	.162	.062		2.401	.017	Supported
UMG -> IJCD	.356	.362	.070		5.091	.000	Supported
UMG -> IPD	.265	.268	.060		4.456	.000	Supported
UMG -> POP	1.000	1.000	.000		6932.382	.000	Supported
UMG -> SUD	.000	.000	.060		.005	.996	Unsupported
UMG -> URL	.186	.188	.061		3.043	.002	Supported
UMG -> YTE	.533	.537	.046		11.583	.000	Supported
URL -> HCD		.000	.000				Undefined
URL -> LVC	.429	.433	.053		8.099	.000	Supported
URL -> PLS	1.000	1.000	.000		9359.943	.000	Supported
URL -> QoL	.393	.396	.052		7.594	.000	Supported

Source: Author's Analysis using SmartPLS 3.0 (2021)

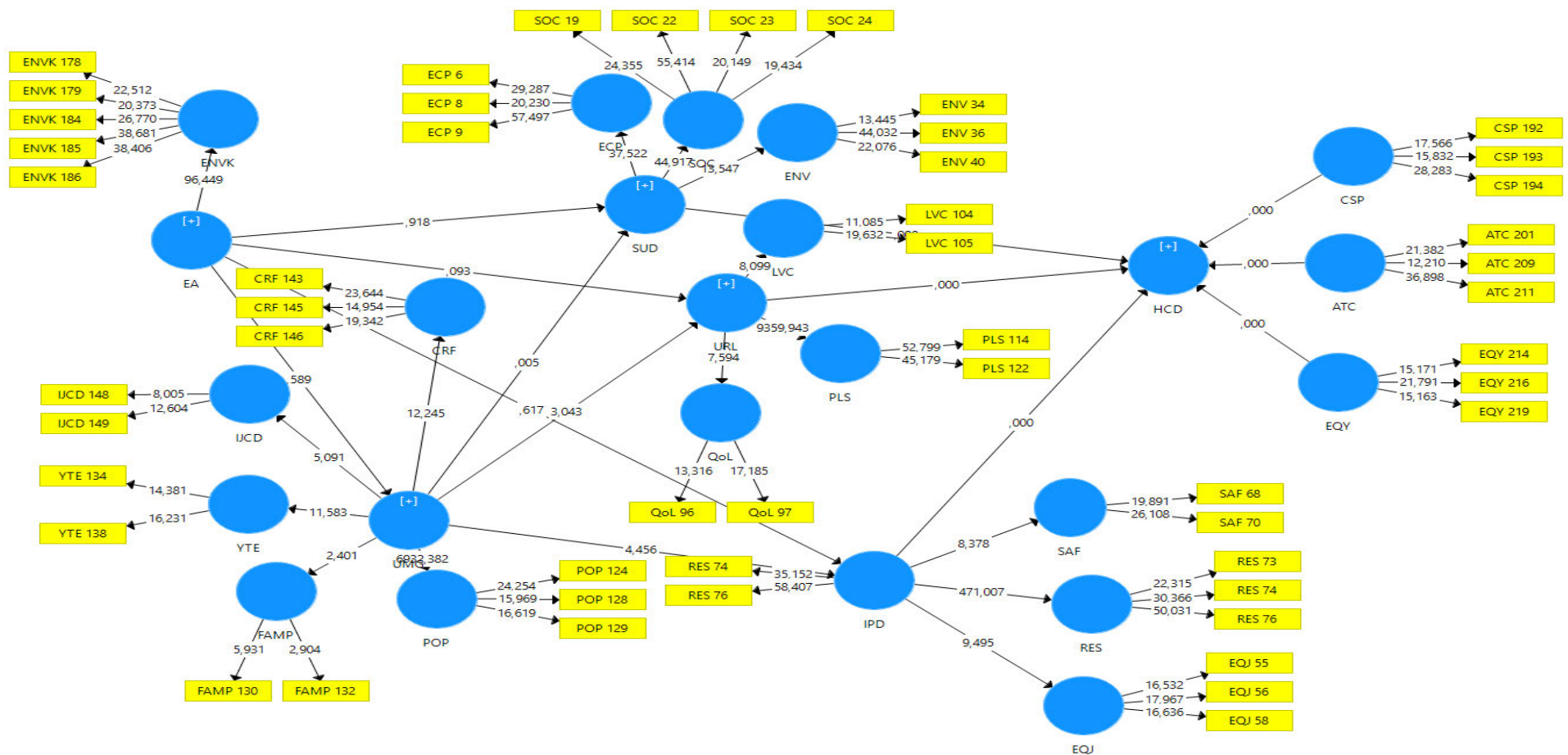


Figure 10.12: Structural Model Analysis for Minna City

Source: Author's Analysis using SmartPLS 3.0 (2021)

10.4.3Analysing the predictive relevance (Q^2) in Minna, North-Central Nigeria

Q^2 is a measure of a study model's predictive power (Duarte & Raposo, 2010; Götz et al., 2010). The Q^2 was determined via a blindfolding process. Predictive significance is shown by a Q^2 larger than 0, according to Hair et al. (2014), and a score below zero shows that the model is not predictively relevant. Scores of 0.02, 0.15, and 0.35 indicate that an exogenous construct has a small, medium, and high predictive relevance for a particular endogenous construct, respectively (Hair et al., 2014). Hair et al. (2013) explain that significant results for a coefficient of determination and medium predictive relevance provide enough statistical support to validate a model's fit.

As indicated in Table 10.23 the predictive capacity of the endogenous latent variables was investigated next, and the importance of the structural model links was established. In the structural model, the R^2 values were acceptable because they were above the recommended threshold of 10 per cent: CSP R^2 = 100.00 per cent; ECP R^2 = 63.11 per cent; ENV R^2 = 37.91 per cent; EQY R^2 = 100.00 per cent; ATC R^2 = 100.00 per cent; and EQY R^2 = 100.00 per cent. The endogenous variables are listed in Table 10.24 and Figure 10.14 with their R^2 values and the accompanying predictive relevance Q^2 .

10.4.3.1 Predictive relevance of the endogenous variables in Minna, North-Central Nigeria

Table 10.23 shows that the predictive relevance of the endogenous variables ranged from values of 0 to values greater than > 0 , as benchmarked by Sarstedt et al. (2014) in their use of blindfolding to determine the predictive relevance of both exogenous and endogenous variables, with the R^2 values of most exogenous latent variables being within the substantial range. There were many endogenous variables with values between -0.005 and +0.664, seen in Table 10.23, which indicated that the structural model supported the predictive importance of the model constructs' endogenous variables. The endogenous variables' predictive relevance, on the other hand, determined whether the prediction direction was positive or negative.

Table 10.23: Predictive Relevance Analysis in Minna, North-Central Nigeria

	RMSE	MAE	MAPE	Q ² _predict	R ² Result of Coefficient of Determinant
CRF 142	1.045	.868	50.506	.056	0.298
CRF 146	1.142	.944	50.694	.043	
CRF 141	1.147	.934	47.557	.061	
CRF 139	1.043	.859	46.638	.055	
CRF 143	1.117	.934	51.218	.070	
CSP 198	.924	.730	36.250	.197	1.000
CSP 196	.980	.775	37.736	.226	
CSP 199	.948	.762	40.946	.306	
ECP 6	1.308	1.141	47.820	.051	
ECP 9	1.311	1.136	49.404	.042	
ECP 8	1.118	.935	34.609	.022	0.631
ECP 3	1.091	.927	34.123	.055	
ENV 40	1.063	.874	33.163	.027	
ENV 39	1.151	.977	38.434	.052	
ENV 36	1.143	.936	40.178	.042	
ENVK 179	.907	.715	28.167	.357	0.791
ENVK 181	.874	.657	24.442	.336	
ENVK 172	.907	.708	27.011	.296	
ENVK 173	.916	.672	28.195	.380	
EQJ 55	1.056	.861	46.110	.013	
EQJ 56	1.118	.906	46.055	.012	0.213
EQJ 54	1.082	.857	44.625	.014	
EQJ 57	1.060	.862	44.633	.013	
EQY 216	.884	.695	33.006	.331	
EQY 213	.875	.692	34.066	.339	
EQY 215	.847	.666	33.356	.345	1.000
EQY 214	.889	.702	33.408	.278	
ATC 208	.702	.534	25.381	.612	
ATC 209	.675	.504	26.257	.568	
ATC 204	.715	.567	26.247	.544	
ATC 211	.644	.479	23.526	.657	1.000
ATC 210	.627	.464	23.043	.664	
RES 76	1.169	.951	46.517	.029	
RES 74	1.024	.859	47.173	.022	
SAF 72	1.091	.909	48.283	.005	
SAF 69	1.072	.861	42.568	.012	0.208
LVC 101	.982	.782	39.454	.002	
LVC 105	1.019	.804	38.044	.010	
LVC 106	1.059	.885	47.282	.037	
MVA 166	.763	.555	21.358	.565	
MVA 165	.698	.523	20.215	.635	0.002
MVA 162	.685	.516	17.791	.590	
MVA 167	.773	.593	24.215	.590	
MVA 163	.738	.556	21.191	.603	

MVA 168	.740	.549	19.375	.530	
MVA 164	.709	.522	18.494	.545	
PLS 113	1.004	.809	40.546	.047	1.000
PLS 122	1.068	.897	49.217	.030	
PLS 114	.983	.815	43.240	.038	
PLS 112	1.022	.864	47.916	.065	
POP 128	1.063	.901	49.686	.056	1.000
POP 127	1.123	.932	50.003	.038	
POP 129	1.012	.844	45.577	.047	
QoL 96	.987	.768	37.914	.015	
QoL 95	1.007	.836	43.263	.012	0.154
QoL 97	1.043	.885	48.883	.028	
QoL 94	.967	.773	36.962	.007	
RES 73	1.227	1.015	51.285	.028	
RES 74	1.024	.859	47.156	.022	0.912
RES 76	1.169	.951	46.518	.029	
RES 75	1.038	.869	47.278	.019	0.208
SAF 72	1.090	.909	48.331	.006	
SAF 69	1.072	.861	42.567	.012	
SAF 67	1.100	.904	48.299	.024	
SOC 19	1.149	.964	37.773	.040	
SOC 23	1.128	.941	37.815	.058	
SOC 16	1.121	.946	37.457	.042	0.669
SOC 17	1.232	1.025	45.613	.045	
SOC 22	1.109	.920	36.031	.032	
SOC 31	1.147	.960	39.364	.033	
SOC 18	1.146	.953	37.186	.033	
SOC 21	1.064	.873	32.040	.063	
PLS 113	1.004	.808	40.454	.048	1.000
PLS 114	.983	.812	43.043	.038	

Source: Author's Analysis using SmartPLS 3.0 (2021)

10.4.4 Importance-performance map (IPMA) for *Hangwurian* city development

As part of the ongoing efforts to better understand the data collected for this investigation, I used an IPMA. An IPMA evaluates the performance level of the latent and manifest variables in a PLS-SEM analysis (Ringle & Sarstedt, 2016). Rather than focusing just on the relevance of the latent and manifest factors (i.e., the path coefficients), the IPMA considers the variables' impact on the target construct. To put it another way: to improve the target variable, the IPMA allows you to prioritise the variables. Identifying the most crucial tasks for improving the dependent variable is possible by analysing the indicator level. To put it simply, the IPMA is a valuable tool for prioritising managerial actions.

Table 10.24 shows the latent variable (LV) index values and the performance of the constructs' importance-performance per Ringle and Sarstedt's (2016) criteria. Small batch production was less critical compared to the other designs and had slower performance. Other constructs, including ATC, CSP, and EQY, played an equally important role in the desired *Hangwurian* city development. Since the first-order constructs had a sizeable outside loading, it was clear that the indicator variables were mutually supportive of one another (i.e., complementary), as seen by the high outer loadings on the HCD construct.

Table 10.24: Importance-Performance Analysis in Minna, North-Central Nigeria

Latent Variable Performances	LM Importance	LV Performances
ATC	0.717	47.849
CRF	0.856	45.169
CSP	0.647	43.683
EA	-0.369	64.773
ECP	1.027	53.051
EQJ	0.642	49.769
EQY	0.099	42.075
HNS	0.464	45.305
IPD	0.044	49.523
LVC	0.140	45.392
PLS	0.885	45.941
POP	0.577	45.617
QoL	0.610	49.096
RES	1.041	49.183
SAF	0.864	46.419
SUD	0.006	58.149
UMG	0.283	44.830
URL	0.017	44.469

Source: Author's Analysis using SmartPLS 3.0 (2021)

Table 10.24 showed the relative importance and performance of the various metrics. Table 10.24 summarised the IPMA's findings, which showed that the most important variables, such as economic prosperity ECP (importance = 1.027, performance = 53.051); environmental awareness EA (importance = -0.369, performance = 64.773); Access to the City ATC (importance = 0.717, performance = 47.849); and credit facilities CRF: (importance = 0.856, performance = 45.169), had a moderate to large importance and performance. The IPMA model map is shown in Figure 10.13

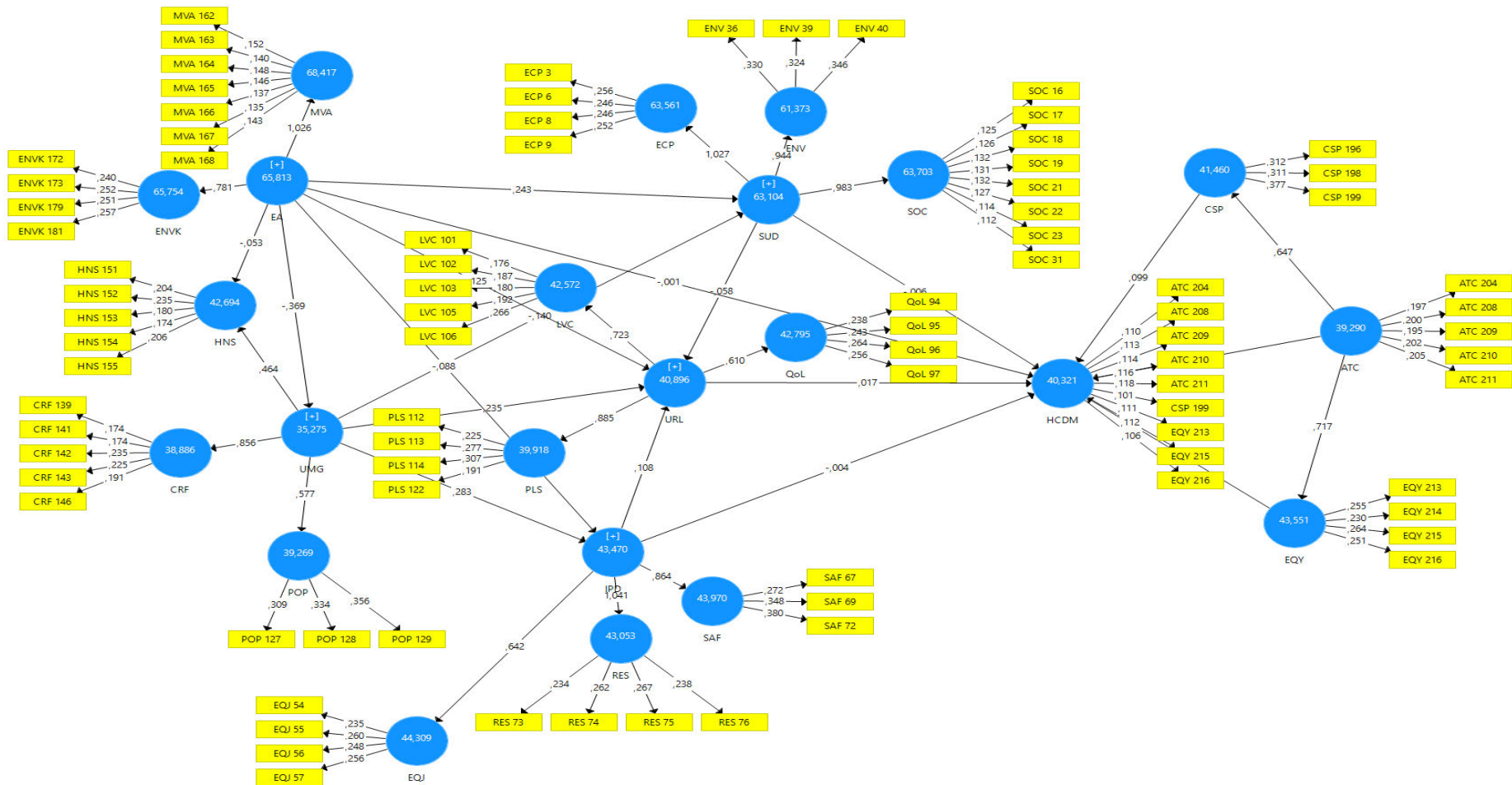


Figure 10.13: Latent Variable Performance for Minna City

Source: Author's Analysis using SmartPLS 3.0 (2021)

A spot map showing the significance and percentage performance of the endogenous variables behind the growth of the *Hangwurian* city and the other exogenous variables was prepared for this research, to further the underlining values of the importance-performance map analysis. As seen in Figure 10.14 the performance of the endogenous variables was distributed over the graph, with a range of 40 per cent to 70 per cent, as previously mentioned in Table 10.24. The endogenous variables' performance was interdependent, but their relative importance was more disparate, as shown by this analysis.

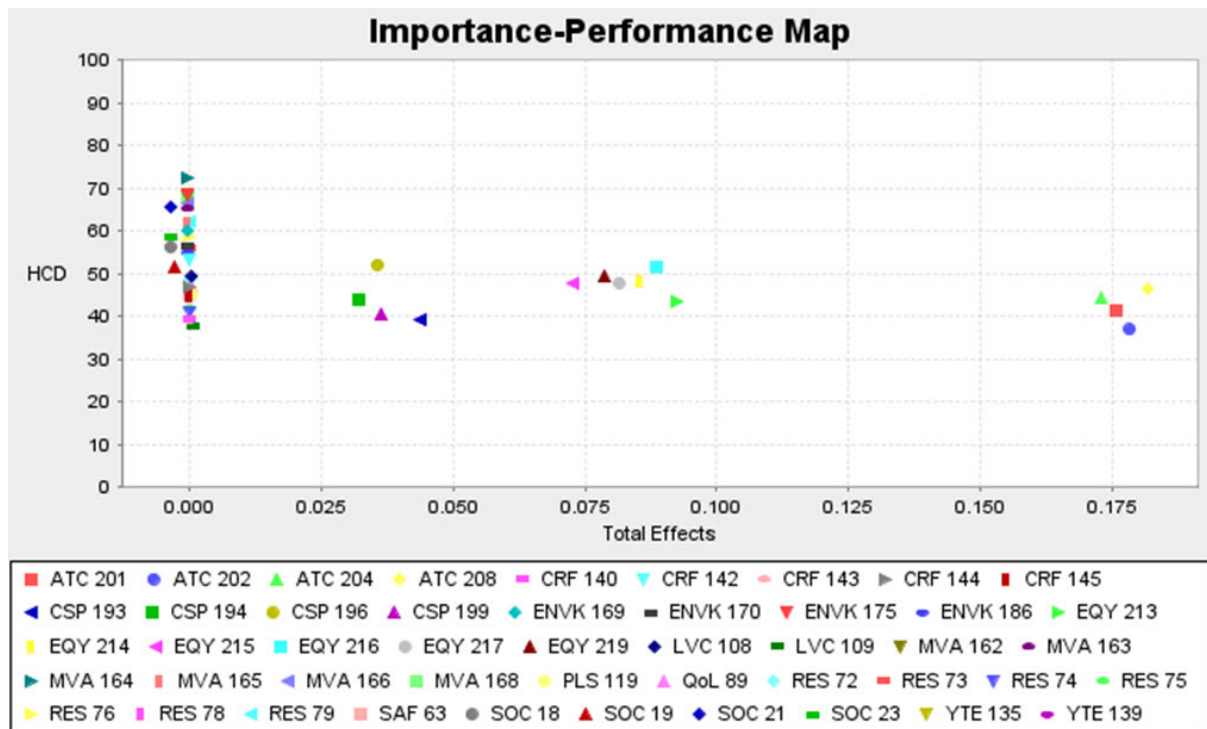


Figure 10.14: Endogenous Variable Importance Performance Map for Minna City

Source: Author's Analysis using SmartPLS 3.0 (2021)

Additionally, Figure 10.15 shows the importance-performance map of the exogenous variable analysis in this research. This concerns the model's constructs for city development in Minna, North-Central Nigeria. The analysis of the IPMA for the exogenous latent variables shows that the performance of the variables ranged from 38 per cent to 75 per cent. In contrast, the importance of the variables ranged between 0.001 and 0.180, indicating a closer interrelatedness of the performance of the variables but a disparity in the importance of the exogenous latent variables.

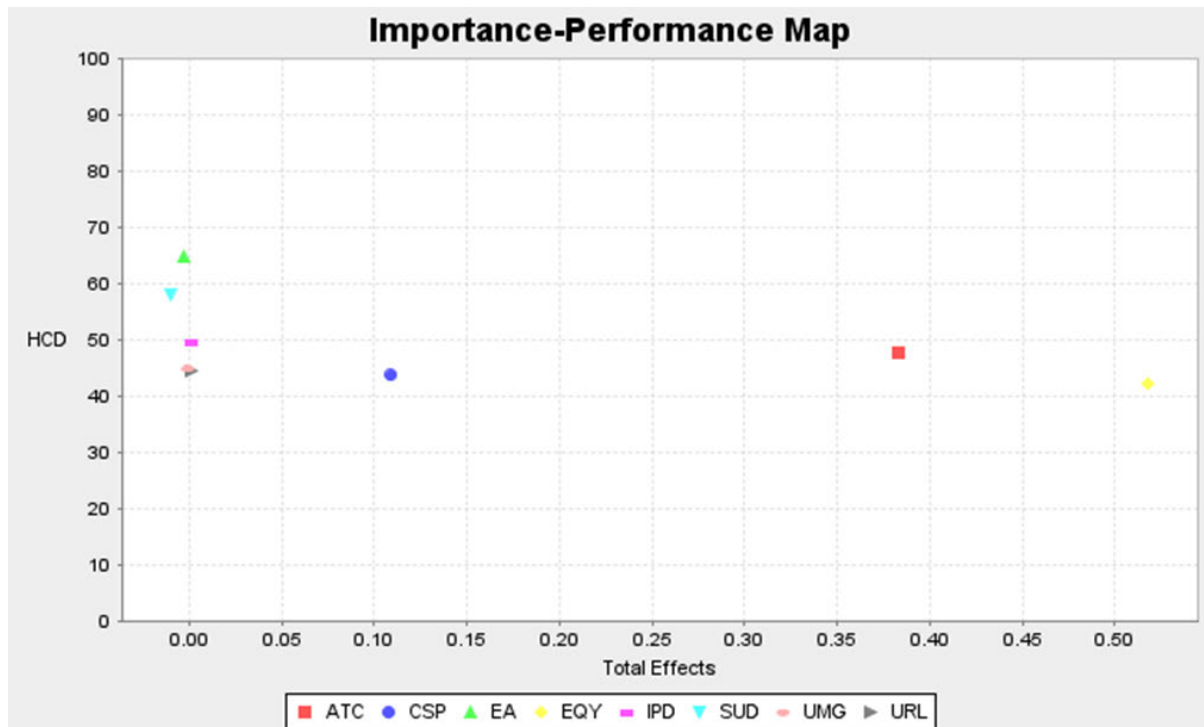


Figure 10.15: Exogenous Variables' Importance-Performance Map in Minna

Source: Author's Analysis using SmartPLS 3.0 (2021)

10.4.5 Confirmatory tetrad analysis final results for Minna City

According to CTA-PLS theory, the latent/higher-order construct is a superior statistical measure to determine whether it is reflective or forming (Hair et al., 2017). The tetrad form of build indicators is used in this method. When all of the tetrad values are insignificant, the latent construct is reflective (Hair et al., 2017; Svensson et al., 2018). Using CTA-PLS, Table 10.25 shows that none of the tetrads in Minna, North-Central Nigeria, gave empirical evidence for a reflective model.

The tetrad of atc202 14; atc204 14; atc208. That's how it works: r201, 202 14 ATC T201 ATC T202 ATC T204 ATC T208 1ATC T208. Atc14 atc202 14 atc204 14 atc208 is unlikely in real-world data. This is why the CTA-PLS uses the bootstrapping process, which creates a large number of fake samples based on a single real one; in this case, the sample size was 5,000. The CTA-PLS then performs a statistical test to see whether the model-implied tetrad mean is substantially different from zero. It should be kept if the reflecting model does not deviate from zero by chance.

If we only have three or two items, we can use another item available to augment the CTA-PLS requirement for a construct, but the standard does not require this (Bollen & Ting, 2000; Gudergan et al., 2008). These elements are consistent with the reflective model's logic because of their global character (Hair et al., 2017). A new reflective item should not affect results because the CTA-PLS examines the null hypothesis that all indicators reflect and hence all tetrads disappear (Bollen & Ting, 2000; Gudergan et al., 2008). In this case, the entire set of four should be considered a reflective model, even if only one or two of the four pieces are reflective. The CTA-PLS will reject the null hypothesis if any of the four items are formative. SmartPLS 3 software (Ringle et al., 2015) was used per Gudergan et al.'s (2008) guidelines to produce 5,000 bootstrap sub-samples for the analysis.

Tables 10.25 highlights the CTA-PLS findings for the growth of a *Hangwurian* type city in Minna in Nigeria's North-Central region. The restrictions measure had adequate reliability and validity scores when assumed to be reflecting a formative model, despite most of the CTA results favouring it. Cronbach's alpha values of 0.71 or higher were found for every construct measured in Minna City, indicating high reliability. This city's AVE was at least 0.56, indicating strong convergent validity.

Table 10.25: Confirmatory Tetrad Analysis Final Results in Minna, North-Central Nigeria

HCD	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values	Bias	CI Low	CI Up	Alpha adj.	z(1- alpha)	CI Low adj.	CI Up adj.
1: ATC 204, ATC 208, ATC 209, ATC 210	.007	.009	.028	.264	.792	.001	-.049	.061	.002	3.130	-.082	.094
2: ATC 204, ATC 208, ATC 210, ATC 209	-.018	-.017	.029	.626	.532	.001	-.076	.038	.002	3.130	-.110	.072
4: ATC 204, ATC 208, ATC 209, ATC 211	.022	.021	.031	.700	.484	-.001	-.038	.083	.002	3.130	-.074	.119
6: ATC 204, ATC 209, ATC 211, ATC 208	.040	.041	.027	1.486	.138	.001	-.014	.091	.002	3.130	-.046	.122
9: ATC 204, ATC 209, CSP 199, ATC 208	-.025	-.023	.026	.929	.353	.002	-.079	.025	.002	3.130	-.110	.056
10: ATC 204, ATC 208, ATC 209, EQY 213	.005	.006	.031	.161	.872	.001	-.056	.065	.002	3.130	-.092	.101
13: ATC 204, ATC 208, ATC 209, EQY 215	-.033	-.034	.029	1.165	.245	.000	-.089	.023	.002	3.130	-.123	.057
17: ATC 204, ATC 208, EQY 216, ATC 209	.002	.002	.025	.082	.935	.000	-.046	.051	.002	3.130	-.075	.080
20: ATC 204, ATC 208, ATC 211, ATC 210	.051	.052	.029	1.718	.086	.002	-.009	.107	.002	3.130	-.043	.141
26: ATC 204, ATC 208, EQY 213, ATC 210	-.004	-.003	.029	.139	.889	.001	-.062	.052	.002	3.130	-.096	.086
29: ATC 204, ATC 208, EQY 215, ATC 210	-.050	-.050	.026	1.916	.056	.000	-.100	.002	.002	3.130	-.130	.032
33: ATC 204, ATC 210, EQY 216, ATC 208	.064	.066	.032	2.031	.043	.002	.000	.124	.002	3.130	-.037	.161
41: ATC 204, ATC 208, EQY 215, ATC 211	-.004	-.003	.034	.108	.914	.001	-.070	.062	.002	3.130	-.109	.101
47: ATC 204, ATC 208, EQY 213, CSP 199	-.015	-.016	.030	.501	.617	-.001	-.074	.045	.002	3.130	-.109	.080
49: ATC 204, ATC 208, CSP 199, EQY 215	-.085	-.083	.028	3.082	.002	.002	-.141	-.033	.002	3.130	-.173	.000
51: ATC 204, CSP 199, EQY 215, ATC 208	.042	.041	.031	1.361	.174	-.001	-.017	.105	.002	3.130	-.054	.141
57: ATC 204, EQY 213, EQY 215, ATC 208	.010	.011	.030	.329	.742	.001	-.049	.067	.002	3.130	-.084	.101
109: ATC 204, ATC 210, ATC 211, CSP 199	.031	.031	.026	1.173	.241	.000	-.021	.082	.002	3.130	-.052	.113
113: ATC 204, ATC 210, EQY 213, ATC 211	.025	.025	.035	.721	.471	.000	-.043	.093	.002	3.130	-.083	.133
133: ATC 204, ATC 210, EQY 213, EQY 216	.084	.084	.027	3.090	.002	.000	.031	.138	.002	3.130	-.001	.169
137: ATC 204, ATC 210, EQY 216, EQY 215	.112	.114	.030	3.739	.000	.001	.052	.170	.002	3.130	.017	.205
149: ATC 204, ATC 211, EQY 215, EQY 213	-.003	-.003	.028	.114	.909	.000	-.059	.053	.002	3.130	-.092	.086
151: ATC 204, ATC 211, EQY 213, EQY 216	.006	.005	.028	.227	.820	-.001	-.048	.063	.002	3.130	-.081	.095
161: ATC 204, CSP 199, EQY 216, EQY 213	.071	.069	.031	2.263	.024	-.001	.011	.134	.002	3.130	-.026	.170
165: ATC 204, EQY 215, EQY 216, CSP 199	.008	.007	.022	.349	.727	-.001	-.035	.053	.002	3.130	-.061	.079
174: ATC 208, ATC 210, CSP 199, ATC 209	-.037	-.038	.032	1.151	.250	-.002	-.097	.028	.002	3.130	-.134	.065
231: ATC 208, CSP 199, EQY 215, ATC 210	-.046	-.047	.030	1.527	.128	.000	-.105	.014	.002	3.130	-.141	.049

Source: Author's Analysis using SmartPLS 3.0 (2021)

10.4.6 Discussion of the findings in Minna City

Six latent variables (URL, SUD, IPD, EA, UMG, and *Hangwurian* city development) were analysed. The number of retained indicators for each of the six latent variables was shown in Table 10.19. Twenty-two urban management and governance (UMG) and fourteen human capital development (HCD) indicators were related to SUD. A total of 15 of these indicators were used in the URL creation. When assessing the measurement model based on the PLS data, the PLS results had to be evaluated for reliability, internal consistency, convergence validity, and discriminant validity.

To determine the reliability of an indicator, the research looked at the square of the factor loadings for each indicator. While the values shown in Table 10.19 were less significant than 0.4, which was considered the minimum threshold for exploratory research of this type, it was determined that most indicators had acceptable minimum values closer to 0.7 (Hulland, 1999; Oke & Ogunsemi, 2016). The reliability of the latent components ranged from 0.757 to 0.882, based on the internal consistency of the various conceptions. The measuring model's composite items had appropriate internal consistency dependability. As indicated in Table 10.19, the model's convergent validity was examined, and the average variance (AVE) exceeded 0.5. Bozzi and Yi (1988) said that the Cronbach's alpha values for the tested variables indicated that they were still adequate for exploratory research, despite several variables failing to meet the 0.7 alpha requirement (Hulland, 1999).

The discriminant validity in the PLS analysis was assessed using Table 10.20, which listed the most important criteria. Reflective constructions should account for a more significant proportion of variation than correlations with the latent variable (Chin, 1998), and items should be more strongly related to their associated construct than other constructs (Elbanna et al., 2013). The cross-loadings for all of the latent variables were greater than 0, as seen in the table. The AVE of these constructions was higher than that of other constructions. The research developed a measurement model with sufficient validity and reliability to test the structural model's predictive and explanatory power.

Convergent validity refers to how different test items intended to measure the same concept are consistent (Hair et al., 2014). The convergent validity of the measurements in this study was examined using outer loadings and the average extracted variance (AVE) value. If the

latent variable's AVE is more than 0.50, it should account for more than half of the indicator's variance (Hair et al., 2010). After all loadings below 0.5 were excluded, the final AVE and CR were above the benchmark value of 0.5 and 0.7, respectively (please refer to Table 10.19).

Determining whether or not a notion is distinct from others is done using discriminant validity as a component of the validation procedure (Hair et al., 2017). In 1981, the Fornell and Larcker (1981) criterion, which stated that AVE's square root should be greater than its highest correlation with any other construct, was widely used. Fornell and Larcker criterion assessments have sufficient discriminant validity. According to Hair et al. (2016), when the constructs' indicator loadings differ by only a small amount, this criterion performs horribly. Remedy: The Henseler et al. (2015) HTMT ratio is a more reliable criterion that should be utilised. Average heterotrait-heteromethod correlation (HTMT) is the average of all correlations between indicators across different construct measures, rather than the average monotrait-heteromethod correlation (HTMT). Thus, HTMT is an average correlation between heterotraits and heteromethods (i.e., the mean of all correlations of indicators measuring the same constructs). The Fornell Larcker Criterion and HTMT statistics were shown in Tables 10.22 and 10.23, respectively. A value of 0.838 is the highest Fornell Larcker Criterion statistic; nonetheless, this value fell short of the 0.850 cut-off. Because of the consistency of PLS bootstrapping, this interval did not include zero. The discriminant validity was acceptable because of this, so the construct validity of the model appeared to be good.

It was then time to evaluate the assumptions that had been posited using the outcomes of the developed structural model, which had proven its reliability and validity. As with standardised beta weights in a regression, path coefficients in a PLS model were treated the same way. But prior to this interpretation, it was suggested that the model be examined for collinearity because ordinary least square regression was used to estimate the coefficients of the pathways. Hair et al. (2014) argued that bias might be inferred from the presence of collinearity in the findings of these analyses. As a result, to determine if there was collinearity between the constructs, the research took the same approach as Sarstedt et al. (2014); and Wong (2013). Using the latent variable scores for multiple regression, the exogenous latent variables (EA, UMG, SUD, URL, and IPD) were generated as independent variables. *Hangwurian* City Development, on the other hand, was deemed the dependent variable in the experiment.

Similar to typical beta values in regression analysis, PLS model path coefficients were used in the same way. Prior to this, however, the model was examined for collinearity, as per Mooi and Sarstedt (2011); and Sarstedt et al. (2014), because the estimation of the path coefficients was based on ordinary least squares regression (OLS). Hair et al. (2014) argued that bias might be inferred from the presence of collinearity in the findings of these analyses. Consequently, this study followed the instructions of Sarstedt et al. (2014); and Wong (2013) by determining if the two constructs were related. Multiple regression was utilised to assess the inner model's collinearity difficulties, and the scores of the latent variables were employed as inputs for that regression's independent variables (URL, SUD, IPD, EA, and UMG).

HCD, on the other hand, was set up as the dependent variable. Figure 10.10 depicted the link between the numerous exogenous latent factors and their related effects on the dependent variable HCD. Environmental awareness (EA), urban management and governance (UMG), urban liveability (URL), sustainable urban development (SUD), inclusive physical development (IPD), and their effect on the *Hangwurian* city development were found to have a positive and statistically significant association (HCD). The EA-HCD and UMG-HCD paths were both examined in detail.

The paths of environmental awareness, inclusive physical development, resilience, and coping with stress were all supported by the hypothesised path. The path of SUD to ECP (SUD-ECP: path = 0.794; $t = 37.522$; $p=0.000$) and IPD to EQJ (IPD-EQJ: path = 0.460; $t = 9.495$; $p=0.000$) also supported the hypothesised path, as did the path of EA to ENVK (EA-ENVK: path = 0.889; $t=96.449$; $p=0.000$). Table 10.24 and Figure 10.11 demonstrated the hypotheses for *Hangwurian* City Development and its endogenous latent variables. The first three hypotheses regarding HCD's endogenous variables were examined in this study. In addition, the path coefficient, t-statistics, and p-values for each of the exogenous and endogenous variables were shown in the table. Six out of thirty hypothesised pathways were unsupported, including the path from environmental awareness (EA) to inclusive physical development (IPD), where path = 0.035; $t = 0.617$; $p=0.537$ was found, and the paths from EA to SUD (path = 0.060; $t = 0.918$; $p=0.359$ was found), and from EA to UMG (path = 0.041; $t = 0.589$; $p=undefined$). All of these route coefficients in Minna, North-Central Nigeria, were found to support the null hypothesis. Hence the alternative hypothesis was rejected in all of these analyses. As a result of this investigation, some of the hypothesised routes could not be established, including ATC to HCD, CSP to HCD, EQY to HCD, IPD to HCD, SUD to HCD, and URL to HCD.

Using the predictive relevance of Q^2 , I evaluated the study model's ability to predict the spatial flow of urban development within the urban fabric of Minna (Duarte & Raposo, 2010). Q^2 was determined via a blindfolding process. Predictive significance is shown by a Q^2 larger than 0, according to Hair et al. (2014), and a score below zero shows that the model is not predictively relevant. The predictive relevance for a given endogenous component for an external construct is 0.02, 0.15, and 0.35, respectively (Hair et al., 2014). It was explained by Hair et al. (2013) that a significant coefficient of determination and a medium level of predictive significance provide statistical support for a model's fit.

Following this, the predictive potential of the endogenous latent variables was tested, and the importance of the structural model's links was established, as shown in Table 10.23. Results from the structural model showed that the R^2 values were acceptable because they had a greater than 10 per cent significance, according to Elbanna et al. (2013): consumption pattern (CSP R^2 = 100.00%); economic prosperity (ECP R^2 = 63.1%); environmental awareness (ENV R^2 = 37.9%); equity (EQY R^2 = 100.00%); and access to the city (ATC R^2 = 100.00%). Each endogenous variable's R^2 value and the accompanying predictive value (Q^2) were shown.

Table 10.16 showed that the predictive relevance of the endogenous variables ranged from values of 0 to values of greater than > 0 , as benchmarked by Sarstedt et al. (2014) in their use of blindfolding to determine the predictive relevance of both exogenous and endogenous variables. That is why Table 10.26's endogenous variables ranged from -0.005 to +0.664, which supported the structural model's ability to anticipate future outcomes because of their predictive value. However, the predictive relevance of the endogenous variables' negative or positive values determined if the forecast was positive or adverse in direction.

The research used the IPMA (Ringle & Sarstedt, 2016) to see whether I could improve the current study's analysis results. The IPMA evaluates the performance level of latent and manifest variables in a PLS-SEM analysis, according to Ringle and Sarstedt (2016). In other words, using the IPMA instead of path coefficients provides insight into the importance of the variables to the target construct, rather than just the importance of the latent and manifest variables. This ability to prioritise variables makes the IPMA so effective at improving a target variable. As a result, researchers can find the most important activities for improving the

dependent variable by studying the indicator level. To put it simply, IPMA is a valuable tool for prioritising managerial actions.

Table 10.24 displayed the importance-performance values and LV index values and the performance of the constructions, according to Ringle and Sarstedt's (2016) standards. Small batch production is less critical compared to the other designs and has slower performance. Besides ATC, CSP, and EQY, other variables were likely crucial for the intended *Hangwurian* City Development. High outer loadings of the first order constructs on the second order HCD reflected the mutually supportive nature of the linkages (i.e., complementarity) among the indicator variables, in keeping with their relevance.

Table 10.24 showed the importance-performance of the indicators. Most of the variables in the table showed moderate to high importance and performance, such as economic prosperity (ECP: importance = 1.027, performance = 53.051); environmental awareness (EA: importance = -0.369, performance = 64.773); access to the city (ATC: importance = 0.717, performance = 47.849); and credit facilities (CRF: importance = 0.856, performance = 45.169).

The endogenous variables were displayed graphically in a spot map to show the importance and percentage performance of the various endogenous variables underlying the development of the *Hangwurian* city and the other exogenous variables in this research to further the underlining values of the importance-performance map analysis. The endogenous variables' performance was grouped in the 40 per cent to 70 per cent range, whereas their relevance was spread out across the graph in Table 10.24 and Figure 10.14. The endogenous variables' performance was interdependent, but their relative importance was more disparate, as shown by this analysis.

The importance-performance map of the exogenous variable was shown in Figure 10.15 as well. The performance of the variables in Minna ranged from 38 per cent to 75 per cent, according to the IPMA analysis of the exogenous latent variables. The relevance of the variables, on the other hand, spanned from 0.001 to 0.180, demonstrating a closer relationship between the variables' performance and the exogenous latent variables' importance.

As a superior statistical measure, the CTA-PLS is used in addition to theoretical support in order to evaluate if a latent/higher-order concept is reflecting or formative (Hair et al., 2017).

The tetrad-based evaluation of the construct indicators is used in this method. When all of the tetrad values are non-significant, the latent concept is reflective (Hair et al., 2017; Svensson et al., 2018). Using the CTA-PLS, Table 10.25 showed that none of the tetrads in Minna, North-Central Nigeria, gave empirical evidence of being a reflective model.

If there are only two or three items available, another item can be used to augment the CTA-PLS requirement for a construct, but the standard does not require this (Bollen & Ting, 2000; Gudergan et al., 2008). However, since the reflective model is global in scope, this argument makes sense (Hair et al., 2017). Adding another reflective item should not affect the results of the CTA-PLS because it tests the null hypothesis that all indicators reflect light and hence all tetrads vanish (Bollen & Ting, 2000; Gudergan et al., 2008). Assuming that each of the four items of interest is reflective, the entire set of four should still be considered a reflective model. The CTA-PLS will reject the null hypothesis if any of the four items are formative. The SmartPLS 3 software (Ringle et al., 2015) was utilised to produce the 5,000 bootstrap sub-samples required for the analysis, as per Gudergan et al. (2008).

Table 10.25 described the CTA-PLS findings for the growth of a *Hangwurian* city in Minna, North-Central Nigeria. Even though most of the CTA results favoured the formative model, the restrictions measure showed acceptable reliability and validity scores if the reflective model was assumed. Cronbach's alpha values of 0.71 or more were found in all of Minna's assessed constructs, indicating high reliability. A good convergent validity could be seen in this city, where the AVE was at least 0.56.

10.5 Model Development for North-Central Nigeria

10.5.1 Measurement model

To determine the best indicator for the individual construct, exploratory factor analysis was conducted to ascertain the number of indicators to be retained for each of the six latent variables included in this study. These were urban liveability (URL), sustainable urban development (SUD), inclusive physical development (IPD), environmental awareness (EA), urban governance (UMG) and *Hangwurian* city development (HCD). The factor analysis is presented in Table 10.26. For the URL construct, 15 indicators were retained; 10 indicators were identified concerning SUD; 16 were retained for IPD; 11 for EA; 22 for urban management and governance; and 14 for HCD. When assessing the measurement model from the PLS results, the following criteria were examined: the factor loadings, indicator reliability, internal consistency reliability, convergent validity, and the discriminant validity.

For the indicator reliability, the square of the factor loadings of each indicator was examined, and it was observed that almost all of the indicators in Table 10.26 had values nearer to Oke and Ogunsemi's (2016) acceptable minimum value of 0.7. The values were more significant than 0.4, which Hulland (1999) considered as the minimum threshold for exploratory research of this nature. The model showed that all of the individual constructs had an internal consistency higher than the acceptable 0.70; the composite reliability values ranged from 0.824 to 0.925 for the latent constructs. Therefore, the composite items of the measurement model had adequate internal consistency reliability. The convergent validity of the model was evaluated, as per Bagozzi and Yi (1988), and the values of the average variance (AVE) explained were higher than 0.5, as shown in Table 10.26.

Table 10.26: Model Path Analysis for *Hangwurian* City Development in North-Central Nigeria

Latent Variable	Indicators	Loadings	Indicator Reliability (i.e., loadings ²)	Composite Reliability	R ²	AVE	Cronbach's Alpha
Access to the City	ATC 204	0.743	0.552	0.888	0.911	0.614	0.843
	ATC 208	0.785	0.616				
	ATC 209	0.746	0.557				
	ATC 210	0.825	0.681				
	ATC 211	0.816	0.666				
	ATC 211	0.743	0.552				
Credit Facilities	CRF 141	0.749	0.561	0.849	0.942	0.548	0.766
	CRF 142	0.788	0.621				
	CRF 143	0.830	0.689				
	CRF 144	0.841	0.707				
	CRF 145	0.833	0.694				
Consumption Pattern	CSP 192	0.787	0.619	0.826	0.399	0.614	0.684
	CSP 193	0.819	0.671				
	CSP 196	0.742	0.551				
Economic Prosperity	ECP 3	0.786	0.618	0.882	0.798	0.653	0.822
	ECP 6	0.857	0.734				
	ECP 8	0.731	0.534				
	ECP 9	0.852	0.726				
	ECP 9	0.786	0.617				
Environment	ENV 36	0.850	0.723	0.882	0.725	0.714	0.800
	ENV 39	0.857	0.734				
	ENV 40	0.827	0.684				
Environmental Knowledge	ENVK 169	0.768	0.590	0.914	0.909	0.570	0.892
	ENVK 170	0.750	0.563				
	ENVK 175	0.743	0.552				
	ENVK 182	0.763	0.582				
	ENVK 185	0.784	0.615				

	ENVK 186	0.804	0.646				
	ENVK 187	0.714	0.510				
	ENVK 189	0.713	0.508				
Equity/Justice	EQJ 54	0.763	0.582	0.852	0.453	0.589	0.768
	EQJ 55	0.769	0.591				
	EQJ 56	0.773	0.598				
	EQJ 57	0.766	0.587				
Equity	EQY 213	0.801	0.642	0.864	0.736	0.613	0.791
	EQY 214	0.780	0.609				
	EQY 215	0.789	0.623				
	EQY 216	0.762	0.581				
Hospital Network Services	HNS 151	0.796	0.634	0.891	0.309	0.577	0.803
	HNS 153	0.786	0.618				
	HNS 154	0.797	0.635				
	HNS 155	0.791	0.626				
Liveable Communities	LVC 102	0.708	0.501	0.871	0.588	0.628	0.762
	LVC 103	0.741	0.549				
	LVC 105	0.770	0.593				
	LVC 106	0.821	0.674				
Motivation and Value	MVA 162	0.807	0.651	0.846	0.903	0.579	0.905
	MVA 163	0.818	0.669				
	MVA 164	0.793	0.629				
	MVA 165	0.830	0.689				
	MVA 166	0.790	0.624				
	MVA 167	0.792	0.627				
	MVA 168	0.753	0.567				
Place Shaping	PLS 112	0.809	0.654	0.925	0.761	0.637	0.756
	PLS 113	0.812	0.659				
	PLS 114	0.835	0.697				
Population	POP 127	0.822	0.676	0.859	0.403	0.671	0.740

	POP 128	0.802	0.643				
	POP 129	0.809	0.654				
Quality of Life	QoL 93	0.837	0.700	0.852	0.625	0.658	0.689
	QoL 96	0.751	0.564				
	QoL 97	0.751	0.564				
Building Resilience	RES 73	0.837	0.701	0.824	0.907	0.609	0.871
	RES 74	0.751	0.564				
	RES 75	0.811	0.658				
	RES 76	0.830	0.689				
	RES 78	0.709	0.503				
	RES 84	0.695	0.483				
Safety	SAF 67	0.756	0.572	0.903	0.739	0.609	0.724
	SAF 69	0.817	0.667				
	SAF 72	0.829	0.687				
Social	SOC 16	0.766	0.587	0.843	0.900	0.642	0.886
	SOC 17	0.816	0.666				
	SOC 18	0.829	0.687				
	SOC 19	0.823	0.677				
	SOC 21	0.771	0.594				
	SOC 22	0.783	0.613				

Source: Author's Analysis SmartPLS 3.0 (2021)

10.5.1.1 Construct reliability and validity of the Hangwurian city development in North-Central Nigeria

Table 10.26 shows the two essential criteria for evaluating discriminant validity in the PLS analysis. Reflective constructs should account for a more significant proportion of variance than correlations with the latent variable, and items should load more strongly on their corresponding constructs than on other constructs (Chin, 1998; Elbanna et al., 2013). This table shows that the loadings for all of the latent variables were more significant than the cross-loadings for all of the indicators. In comparison to the other constructs, the AVE of these constructions was higher. Thus, it could be concluded that the measuring model described here had the validity and reliability necessary to evaluate the structural model's predictive and explanatory potential.

Convergent validity, according to Hair et al. (2014), refers to how numerous items used in a study to measure the same idea agree with each other. The average variance extracted (AVE) value was used to analyse the convergent validity of the measures utilised in this study. It was necessary to acquire an AVE value of 0.5 or above to demonstrate that a hidden variable accounted for more than half of the variance in its corresponding indicators (Hair et al., 2010). Loadings that fell below 0.5 were deleted, resulting in final AVE and CR values above the 0.5 and 0.7 benchmark values (see Table 10.26).

CR and discriminant validity were also tested to ensure that a construct was genuinely unique from other constructs, as per Hair et al. (2017). The Fornell and Larcker (1981) criterion was used to determine that there was sufficient discriminant validity in the assessment. This criterion states that the AVE's square root should be more significant than its highest correlation with any other construct. But, as Hair et al. (2016) claim that this criterion does not perform well, the criterion recommended by Henseler et al. (2015) was used as well. This was the heterotrait-monotrait (HTMT) ratio. According to Hair et al. (2017), the HTMT is an average heterotrait-heteromethod correlation (i.e., the mean of the correlations across the indicators measuring distinct constructs) compared to the average monotrait-heteromethod correlation (i.e., the mean of the correlations across the indicators measuring the same construct) (i.e., the mean of all the correlations of the indicators measuring the same constructs). The Fornell Larcker Criterion results are set out in Table 10.27; the HTMT statistics are set out in Table 10.28; and the Collinearity Statistics [VIF] shown in Table 10.29. According to Table 10.27,

the highest Fornell Larcker Criterion statistic was 0.845, which fell short of the threshold value of 0.850. The HTMT confidence interval in Table 10.28 did not contain zero, based on the consistent PLS bootstrapping. As a result, the discriminant validity was acceptable. The model's construct validity was sufficient; hence it could be considered as adequate.

Table 10.27: Fornell-Larcker Criterion for the Discriminant Validity of the *Hangwurian* City Development in North-Central Nigeria

	ATC	CRF	CSP	EA	ECP	ENV	ENVK	EQJ	EQY	HCDM	HNS	IPD	LVC	MVA	PLS	POP	QoL	RES	SAF	SOC	SUD	UMG	URL
ATC	0.784																						
CRF	0.291	0.741																					
CSP	0.617	0.226	0.783																				
EA	-0.180	-0.328	-0.163	0.738																			
ECP	-0.175	-0.238	-0.089	0.260	0.808																		
ENV	-0.136	-0.223	-0.068	0.243	0.665	0.845																	
ENVK	-0.177	-0.313	-0.149	0.953	0.265	0.252	0.755																
EQJ	0.206	0.259	0.170	-0.157	-0.092	-0.076	-0.151	0.768															
EQY	0.730	0.231	0.549	-0.140	-0.122	-0.078	-0.128	0.159	0.783														
HCDM	0.954	0.287	0.631	-0.169	-0.167	-0.123	-0.160	0.220	0.858	0.760													
HNS	0.199	0.532	0.170	-0.203	-0.114	-0.105	-0.183	0.232	0.145	0.184	0.793												
IPD	0.228	0.313	0.161	-0.184	-0.186	-0.156	-0.186	0.673	0.171	0.230	0.313	0.786											
LVC	0.195	0.273	0.147	-0.160	-0.093	-0.081	-0.147	0.249	0.159	0.197	0.248	0.214	0.761										
MVA	-0.164	-0.310	-0.161	0.950	0.229	0.210	0.812	-0.147	-0.137	-0.161	-0.203	-0.164	-0.157	0.798									
PLS	0.173	0.363	0.145	-0.278	-0.183	-0.139	-0.255	0.222	0.128	0.172	0.254	0.236	0.592	-0.274	0.819								
POP	0.175	0.621	0.195	-0.282	-0.158	-0.167	-0.267	0.231	0.133	0.165	0.480	0.295	0.270	-0.269	0.324	0.811							
QoL	0.187	0.281	0.149	-0.201	-0.165	-0.142	-0.189	0.232	0.136	0.186	0.219	0.221	0.629	-0.193	0.635	0.266	0.781						
RES	0.232	0.307	0.146	-0.189	-0.195	-0.156	-0.192	0.661	0.162	0.226	0.299	0.952	0.217	-0.166	0.236	0.300	0.211	0.781					
SAF	0.178	0.279	0.143	-0.152	-0.139	-0.113	-0.151	0.641	0.151	0.194	0.274	0.860	0.193	-0.137	0.220	0.231	0.225	0.730	0.801				
SOC	-0.120	-0.204	-0.066	0.266	0.763	0.725	0.277	-0.038	-0.093	-0.122	-0.064	-0.115	-0.066	0.228	-0.157	-0.154	-0.143	-0.115	-0.078	0.798			
SUD	-0.155	-0.241	-0.081	0.285	0.893	0.851	0.294	-0.070	-0.108	-0.150	-0.099	-0.162	-0.086	0.247	-0.177	-0.175	-0.165	-0.165	-0.116	0.948	0.738		
UMG	0.293	0.971	0.228	-0.316	-0.230	-0.211	-0.300	0.267	0.233	0.289	0.556	0.325	0.292	-0.302	0.358	0.634	0.288	0.320	0.288	-0.194	-0.231	0.799	
URL	0.211	0.365	0.163	-0.259	-0.195	-0.142	-0.243	0.255	0.158	0.208	0.265	0.250	0.767	-0.249	0.872	0.339	0.791	0.249	0.230	-0.165	-0.186	0.375	0.763

Source: Author's Analysis using SmartPLS 3.0 (2021)

Table 10.28: Heterotrait-Monotrait Ratio (HTMT) for Measuring the Discriminant Validity of the *Hangwurian* City Development in North-Central Nigeria

	ATC	CRF	CSP	EA	ECP	ENV	ENVK	EQJ	EQY	HCDM	HNS	IPD	LVC	MVA	PLS	POP	QoL	RES	SAF	SOC	SUD	UMG	URL
ATC																							
CRF	0.359																						
CSP	0.812	0.314																					
EA	0.204	0.392	0.203																				
ECP	0.209	0.324	0.119	0.296																			
ENV	0.167	0.297	0.092		0.817																		
ENVK	0.207	0.386	0.190	1.043	0.309	0.297																	
EQJ	0.254	0.331	0.235	0.183	0.115	0.098	0.179																
EQY	0.890	0.279	0.740	0.158	0.143	0.097	0.150	0.197															
HCDM	1.119	0.345	0.826	0.187	0.194	0.148	0.182	0.270	1.037														
HNS	0.241	0.652	0.228	0.228	0.140	0.128	0.211	0.295	0.181	0.221													
IPD	0.262	0.379	0.208	0.201	0.213	0.186	0.208	0.820	0.203	0.265	0.372												
LVC	0.240	0.338	0.200	0.172	0.115	0.099	0.160	0.321	0.199	0.241	0.312	0.258											
MVA	0.190	0.377	0.205	1.027	0.266	0.246	0.899	0.176	0.158	0.182	0.234	0.183	0.175										
PLS	0.217	0.470	0.203	0.332	0.229	0.183	0.313	0.292	0.163	0.213	0.324	0.292	0.771	0.334									
POP	0.223	0.793	0.274	0.337	0.200	0.217	0.327	0.306	0.172	0.207	0.620	0.366	0.346	0.328	0.431								
QoL	0.232	0.372	0.206	0.246	0.205	0.178	0.234	0.308	0.175	0.228	0.289	0.274	0.853	0.245	0.876	0.364							
RES	0.266	0.373	0.183	0.203	0.222	0.180	0.211	0.811	0.190	0.256	0.354	1.076	0.265	0.183	0.294	0.371	0.264						
SAF	0.224	0.367	0.205	0.188	0.184	0.149	0.190	0.857	0.199	0.247	0.352	1.067	0.257	0.174	0.301	0.314	0.314	0.907					
SOC	0.141	0.271	0.094	0.292	0.890	0.861	0.312	0.059	0.108	0.139	0.085	0.134	0.082	0.255	0.192	0.190	0.169	0.135	0.113				
SUD	0.176	0.308	0.106	0.306	1.021	0.986	0.323	0.090	0.122	0.166	0.118	0.179	0.101	0.269	0.211	0.209	0.191	0.180	0.150	1.044			
UMG	0.338	1.114	0.295	0.344	0.265	0.249	0.333	0.324	0.274	0.331	0.656	0.371	0.342	0.336	0.435	0.784	0.356	0.364	0.359	0.217	0.251		
URL	0.264	0.476	0.225	0.305	0.243	0.181	0.293	0.334	0.198	0.256	0.335	0.306	0.974	0.301	1.139	0.450	1.049	0.306	0.311	0.198	0.218	0.455	

Source: Author's Analysis using SmartPLS 3.0 (2021)

Table 10.29: Collinearity Statistics (VIF) *Hangwuri* City Development in North-Central Nigeria

	ATC	CRF	CSP	EA	ECP	ENV	ENVK	EQJ	EQY	HCD	HNS	IPD	LVC	MVA	PLS	POP	QoL	RES	SAF	SOC	SUD	UMG	URL
ATC																							
CRF																							
CSP																							
EA							1.000			1.111				1.000								1.155	
ECP																							
ENV																							
ENVK																							
EQJ																							
EQY																							
HCDM	1.000		1.000						1.000														
HNS																							
IPD				1.082				1.000										1.000	1.000			1.094	1.027
LVC																							
MVA																							
PLS																							
POP																							
QoL																							
RES																							
SAF																							
SOC																							
SUD				1.051	1.000	1.000														1.000		1.114	1.027
UMG		1.000								1.111	1.000					1.000							
URL				1.092									1.000		1.000		1.000					1.134	

Source: Author's Analysis SmartPLS 3.0 (2021)

10.5.2 Structural model results for *Hangwurian* city development in North-Central Nigeria

The assumptions posited using the outcomes of the structural model developed were then evaluated, given that its reliability and validity had been established. Similar to the typical beta values in regression analysis, the PLS model path coefficients were used in the same way. However, the structural model developed was first examined for collinearity because ordinary least square regression was used to estimate the coefficients of the model's pathways, and Hair et al. (2014) cautioned that bias could be inferred if collinearity was present between the constructs. The same approach as that of Sarstedt et al. (2014); and Wong (2013) was taken. Using the latent variable scores for multiple regression, the exogenous latent variables (EA, UMG, SUD, URL, and IPD) were generated as independent variables. *Hangwurian* City Development was deemed to be the dependent variable in the experiment.

10.5.2.1 Path Model for *Hangwurian* City Development in North-Central Nigeria

A regression analysis was conducted using the PLS model path coefficients, but the model was first examined for collinearity as per Mooi and Sarstedt (2011); and Sarstedt et al. (2014), because the estimation of the path coefficients was based on ordinary least squares regression (OLS). To eliminate possible bias if collinearity was present in the findings of the analyses (Hair et al., 2014), a multiple regression analysis was carried out to determine if the two constructs were related (Sarstedt et al., 2014; Wong, 2013). The scores of the latent variables were used as the inputs for that regression analysis' independent variables (URL, SUD, IPD, EA, and UMG).

HCD was used as the dependent variable. The exogenous latent variables and their related effects on the dependent variable, HCD, are depicted in Figure 10.16. Environmental Awareness (EA), Urban Management and Governance (UMG), Urban liveability (URL), sustainable urban development (SUD), inclusive physical development (IPD), and their effect on the *Hangwurian* city development were found to have a positive and statistically significant association (HCD). The EA-HCD and UMG-HCD paths were both examined in detail. There was evidence for the hypothesised paths from ATC to HCD (ATC – HCD: path = 0.954; $t=299.267$; $p=0.000$); CSP to HCD (CSP – HCD: path = 0.631; $t = 30.621$; $p=0.000$); and from EQY to HCD (EQY – HCD: path = 0.858; $t=85.662$). Table 10.30 and Figure 10.16 illustrate the hypothesised routes for the *Hangwurian* city development and its endogenous latent

variables. The first three hypotheses regarding the HCD's endogenous variables were examined in this study. In addition, the path coefficient, t-statistics, and p-values for each of the exogenous and endogenous variables were shown in the table. Therefore, the null hypothesis was rejected as the alternative hypothesis supported by the path coefficients of the exogenous latent variables in North-Central Nigeria, as seen previously.

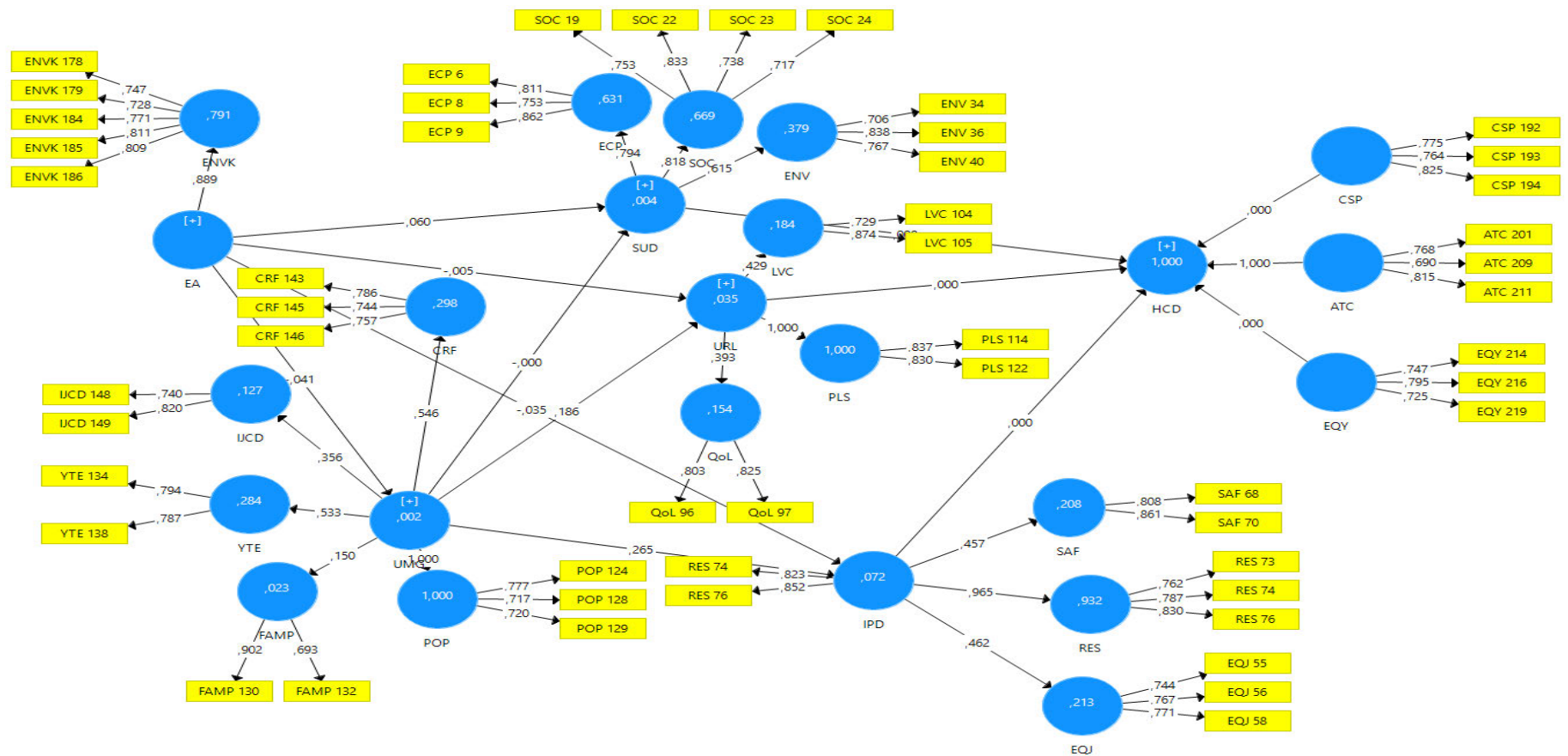


Figure 10.16: Path Coefficient and Analysis for North-Central Nigeria

Source: Author's Analysis SmartPLS 3.0 (2021)

Table 10.30: Path Coefficients for the *Hangwurian* City Development in North-Central Nigeria

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T (O/STDEV)	Statistics	P Values	Decision
EA -> ENVK	0.953	0.954	0.004	255.691		0.000	Supported
EA -> HCD	-0.086	-0.086	0.035	2.439		0.015	Supported
EA -> MVA	0.950	0.951	0.004	258.618		0.000	Supported
EA -> UMG	-0.183	-0.183	0.032	5.684		0.000	Supported
HCD -> ATC	0.954	0.955	0.003	299.267		0.000	Supported
HCD -> CSP	0.631	0.634	0.021	30.621		0.000	Supported
HCD -> EQY	0.858	0.858	0.010	85.662		0.000	Supported
IPD -> EA	-0.099	-0.097	0.033	3.002		0.003	Supported
IPD -> EQJ	0.673	0.674	0.020	33.598		0.000	Supported
IPD -> RES	0.952	0.952	0.003	368.881		0.000	Supported
IPD -> SAF	0.860	0.860	0.009	92.828		0.000	Supported
IPD -> UMG	0.212	0.210	0.034	6.237		0.000	Supported
IPD -> URL	0.226	0.224	0.035	6.541		0.000	Supported
SUD -> EA	0.233	0.236	0.036	6.542		0.000	Supported
SUD -> ECP	0.893	0.893	0.008	109.702		0.000	Supported
SUD -> ENV	0.851	0.852	0.013	67.109		0.000	Supported
SUD -> SOC	0.948	0.949	0.004	253.664		0.000	Supported
SUD -> UMG	-0.097	-0.100	0.032	3.026		0.003	Supported
SUD -> URL	-0.149	-0.151	0.034	4.399		0.000	Supported
UMG -> CRF	0.971	0.971	0.002	530.053		0.000	Supported
UMG -> HCDM	0.262	0.265	0.035	7.427		0.000	Supported
UMG -> HNS	0.556	0.557	0.027	20.585		0.000	Supported
UMG -> POP	0.634	0.636	0.025	25.612		0.000	Supported
URL -> EA	-0.191	-0.193	0.032	5.917		0.000	Supported
URL -> LVC	0.767	0.769	0.015	52.360		0.000	Supported
URL -> PLS	0.872	0.873	0.008	103.716		0.000	Supported
URL -> QoL	0.791	0.792	0.012	64.851		0.000	Supported
URL -> UMG	0.256	0.256	0.036	7.109		0.000	Supported

Source: Author's Analysis using SmartPLS 3.0 (2021)

10.5.3 Analysing the predictive relevance (Q^2) of the *Hangwurian* city development in North-Central Nigeria

Q^2 was used to evaluate the ability of the research model to generate a prediction and how reliable it was, as per Duarte and Raposo (2010); and Götz et al. (2010). The Q^2 was determined via a blindfolding process. The predictive significance of a model is shown by a Q^2 larger than 0, according to Hair et al. (2014), and a score below zero shows that the model is not predictively relevant. The predictive relevance for a given endogenous component for an external construct is 0.02, 0.15, and 0.35, for the various levels of relevance (Hair et al., 2014). As per Hair et al. (2013), a significant coefficient of determination and a medium level of predictive significance provide statistical support for a model's fit.

Finally, the predictive capacity of the endogenous latent variables was investigated, and the structural model linkages were shown to be significant (see Table 10.31 and Figure 10.19). According to a study by Elbanna et al. (2013), the R^2 values of a structural model are acceptable when they exceed the recommended threshold of 10 per cent. In this study, CRF $R^2 = 94.2$ per cent; ECP $R^2 = 79.8$ per cent; ENV $R^2 = 72.5$ per cent; EQY $R^2 = 73.6$ per cent; LVC $R^2 = 58.8$ per cent; and CSP $R^2 = 39.9$ per cent. Table 10.31 and Figure 10.17 present the R^2 and Q^2 values for all of the endogenous variables.

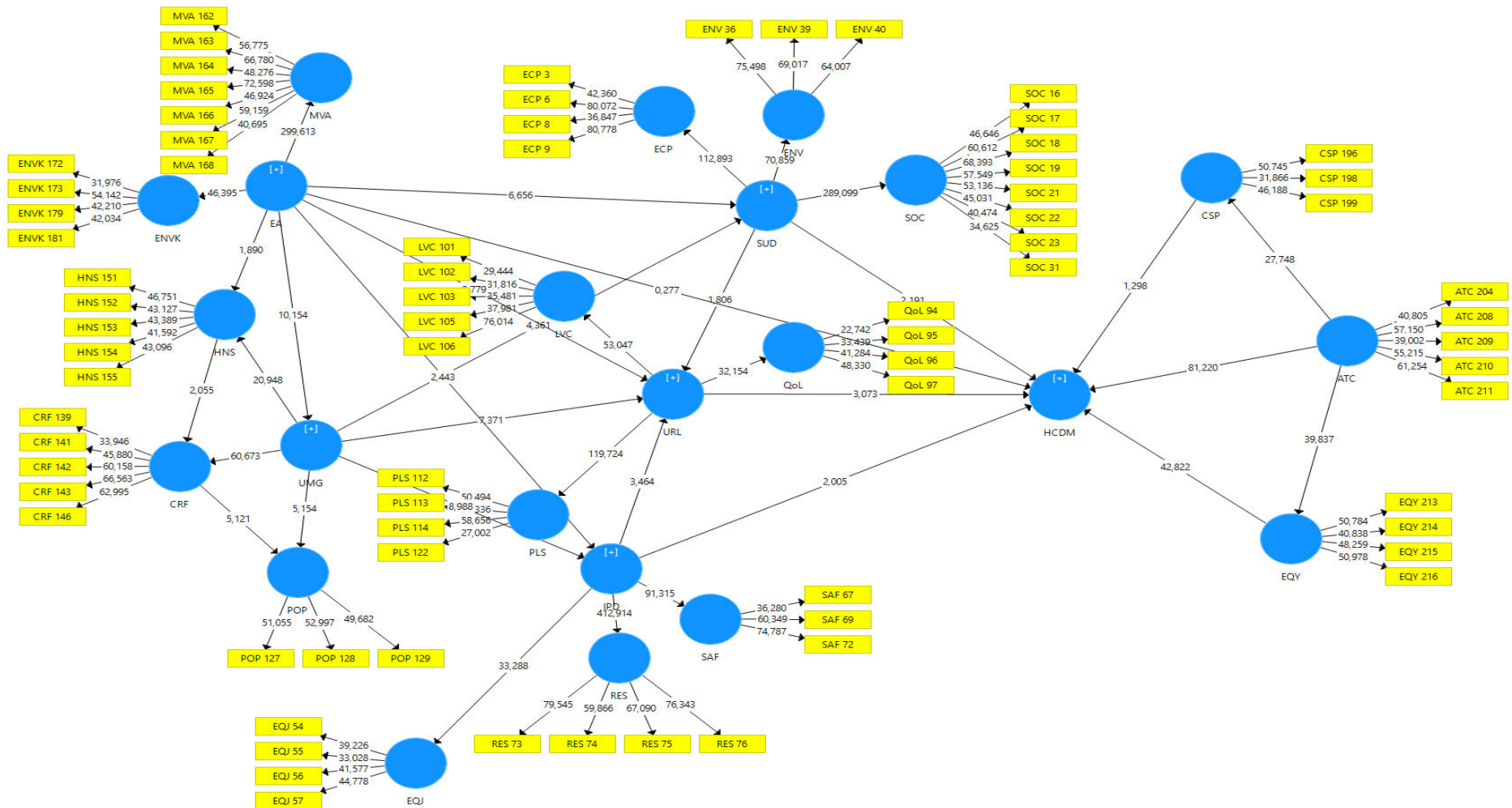


Figure 10.117: Structural Model Analysis in North-Central Nigeria

Source: Author's Analysis using SmartPLS 3.0 (2021)

10.5.3.1 Predictive relevance of the endogenous variables for Hangwurian City Development in North-Central Nigeria

According to Table 10.31, the predictive relevance of the endogenous variables ranged from values less than zero to values that exceeded the threshold set by Sarstedt et al. (2014), who used blindfolding to determine the predictive relevance of both the exogenous and endogenous variables of a model's construct. The predictive relevance of the endogenous variables of the model's constructs was supported by the predictive relevance of the structural model, and the positive values of the predictive relevance of the endogenous variables indicated an increase in the direction of the forecast.

Table 10.31: Predictive Relevance Analysis for *Hangwurian* City Development in North-Central Nigeria

	RMSE	MAE	MAPE	Q ² _predict	R ² Coefficient Determinant	Result of
ATC 204	1.052	0.849	43.202	0.015	0.911	
ATC 208	1.112	0.936	49.781	0.030		
ATC 209	1.012	0.856	48.416	0.029		
ATC 210	1.065	0.904	50.400	0.031		
ATC 211	1.080	0.922	51.087	0.035		
CRF 141	1.134	0.917	46.782	0.082	0.942	
CRF 142	1.035	0.857	49.811	0.075		
CRF 143	1.100	0.900	49.382	0.098		
CRF 144	1.107	0.918	52.287	0.083		
CRF 145	1.124	0.932	52.700	0.079		
CRF 140	1.227	1.045	44.189	0.013	0.399	
CSP 192	1.180	1.001	54.593	0.013		
CSP 193	1.128	0.936	48.885	0.016		
CSP 196	1.111	0.892	45.832	0.006		
MVA 162	1.039	0.868	30.023	0.058		
MVA 163	1.144	0.956	36.677	0.047	0.903	
MVA 164	1.031	0.843	29.431	0.040		
MVA 165	1.133	0.943	36.418	0.039		
MVA 166	1.142	0.954	36.202	0.026		
MVA 167	1.161	0.969	39.900	0.074		
MVA 168	1.061	0.876	31.113	0.033	0.909	
ENVK 169	1.148	0.955	38.513	0.069		
ENVK 170	1.131	0.933	37.616	0.053		
ENVK 175	1.063	0.883	31.767	0.048		
ENVK 182	1.158	0.958	40.518	0.063		
ENVK 185	1.143	0.933	40.754	0.058	0.798	
ENVK 186	1.076	0.882	34.633	0.076		
ENVK 187	1.030	0.867	30.666	0.054		
ENVK 189	1.042	0.870	32.022	0.036		
ECP 3	0.834	0.622	23.763	0.448		
ECP 6	0.857	0.645	26.383	0.593	0.725	
ECP 8	0.861	0.664	24.563	0.419		
ECP 9	0.828	0.632	27.309	0.618		
ENV 36	0.801	0.631	26.540	0.529		

ENV 39	0.815	0.623	24.261	0.524	
ENV 40	0.765	0.584	21.806	0.496	
EQJ 54	0.953	0.760	36.639	0.236	0.453
EQJ 55	0.905	0.709	36.253	0.276	
EQJ 56	0.954	0.759	36.350	0.281	
EQJ 57	0.912	0.711	34.586	0.269	
EQY 213	1.063	0.864	44.635	0.026	0.736
EQY 214	1.039	0.839	42.029	0.013	
EQY 215	1.036	0.869	45.954	0.021	
EQY 216	1.077	0.861	43.230	0.007	
HNS 151	0.986	0.785	39.246	0.046	0.309
HNS 153	0.971	0.791	39.995	0.038	
HNS 154	0.978	0.798	39.729	0.044	
HNS 155	1.015	0.803	37.827	0.067	
LVC 102	0.980	0.801	39.481	0.017	0.588
LVC 103	1.001	0.819	41.312	0.010	
LVC 105	1.012	0.791	37.438	0.024	
LVC 106	1.058	0.877	46.981	0.039	
PLS 112	1.025	0.857	47.911	0.061	0.761
PLS 113	1.007	0.808	40.098	0.042	
PLS 114	0.981	0.804	42.525	0.043	
POP 127	1.105	0.922	49.432	0.068	0.403
POP 128	1.057	0.895	49.312	0.066	
POP 129	1.010	0.838	45.165	0.050	
QoL 93	1.071	0.886	47.538	0.058	0.625
QoL 96	0.986	0.770	37.805	0.016	
QoL 97	1.040	0.875	48.349	0.033	
RES 73	0.683	0.525	22.755	0.699	0.907
RES 74	0.649	0.488	24.565	0.607	
RES 75	0.622	0.465	22.358	0.647	
RES 76	0.695	0.544	23.147	0.657	
RES 78	0.928	0.693	32.906	0.340	
RES 84	0.876	0.690	35.364	0.325	
SAF 67	0.924	0.720	35.415	0.310	0.739
SAF 69	0.770	0.604	27.207	0.491	
SAF 72	0.694	0.540	25.371	0.598	
SOC 16	0.795	0.633	24.097	0.519	0.900
SOC 17	0.750	0.581	25.758	0.647	
SOC 18	0.736	0.564	21.283	0.602	
SOC 19	0.739	0.546	21.539	0.603	
SOC 21	0.745	0.571	20.460	0.540	
SOC 22	0.779	0.592	22.847	0.523	

Source: Author's Analysis using SmartPLS 3.0 (2021)

10.5.4 Importance-performance map (IPMA) for the *Hangwurian* city development

This research used the IPMA (Ringle & Sarstedt, 2016) to determine how to improve the study's analysis results. The IPMA evaluates the performance level of latent and manifest variables in a PLS-SEM analysis, according to Ringle and Sarstedt (2016). In other words, using the IPMA instead of path coefficients provides insight into the importance of the variables to the target construct rather than just the importance of the latent and manifest

variables. This ability to prioritise variables makes IPMA so effective at improving a target variable. As a result, researchers can find the most important activities for improving the dependent variable by studying the indicator level. To put it simply, IPMA is a valuable tool for prioritising how to manage actions when evaluating a model.

The index values and performances of the constructs' importance-performance analysis are shown in Table 10.32 (generated according to Ringle & Sarstedt [2016]). Besides ATC, CSP, and EQY, other variables were likely crucial for the intended *Hangwurian* City Development. High outer loadings of the first-order constructs on the second-order HCD reflected the mutually supportive nature of the linkages (i.e., complementarity) among the indicator variables, in keeping with their relevance (see also Figure 10.18).

Table 10.32: Importance-Performance Analysis of the *Hangwurian* City Development in North-Central Nigeria

	LV Performances
ATC	39.365
CRF	37.927
CSP	43.125
EA	65.678
ECP	63.563
ENV	61.374
ENVK	63.192
EQJ	44.309
EQY	43.448
HCDM	40.989
HNS	44.342
IPD	43.478
LVC	42.244
MVA	68.415
PLS	40.014
POP	39.267
QoL	41.675
RES	42.572
SAF	43.971
SOC	63.778
SUD	63.116
UMG	36.658
URL	40.917

Source: Author's Analysis using SmartPLS 3.0 (2021)

In furtherance of the underlining values of the importance-performance map analysis, this research presents the graphical display of the endogenous variables in a spot map indicating the importance and the percentage performances of the various endogenous variables underlining the *Hangwurian* city development and the other exogenous variables of the model. The graph indicated earlier and reiterated in Figure 10.19 shows that the endogenous variables' performance was clustered between the 55 per cent to 75 per cent range, while the importance of the endogenous variables was dispersed across the graph. This analysis showed more interrelatedness in the performance of the endogenous variables but more disparity in the importance of the endogenous variables.

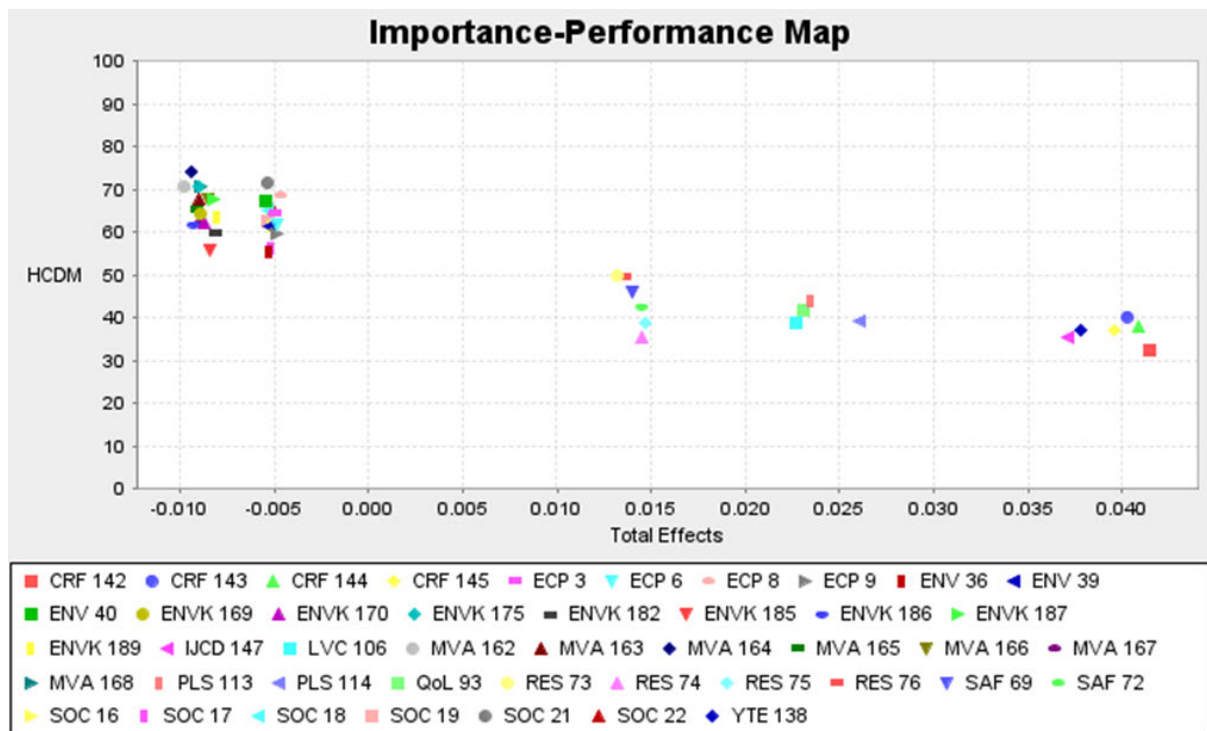


Figure 10.19: Endogenous Variable Importance Performance Map for North-Central Nigeria

Source: Author's Analysis using SmartPLS 3.0 (2021)

Additionally, Figure 10.20 shows the importance-performance map of the exogenous variable of the analysis in this research as it concerned the model's constructs for city development in North-Central Nigeria. The analysis of the IPMA for the exogenous latent variables showed that the performance of the variables ranged from 40 per cent to 65 per cent. In contrast, the importance of the variables ranged between -0.12 to 0.10, indicating a closer interrelatedness

of the performance of the variables but a disparity in the importance of the exogenous latent variables.

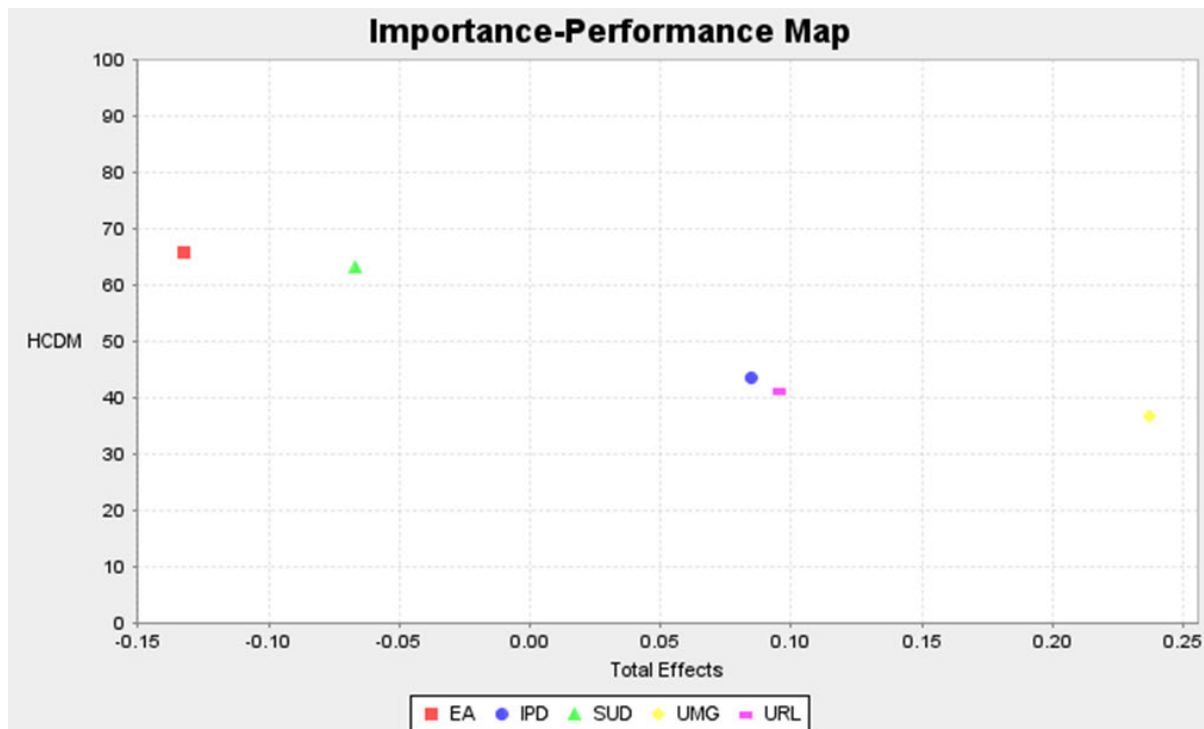


Figure 10.130: Exogenous Variable Importance Performance Map for North-Central Nigeria

Source: Author's Analysis using SmartPLS 3.0 (2021)

10.5.5 Confirmatory tetrad analysis final results for North-Central Nigeria

As a superior statistical measure, the CTA-PLS is used in addition to theoretical support in order to evaluate if the latent/higher-order concept is reflecting or formative (Hair et al., 2017). The tetrad-based evaluation of construct indicators is used in this method. When all of the tetrad values are non-significant, the latent concept reflects (Hair et al., 2017; Svensson et al., 2018). According to the CTA-PLS data, there were no significant tetrads in Table 10.33 that supported reflective models in North-Central Nigeria.

Four items were used for the CTA-PLS requirement for the construct, as previously explained (Bollen & Ting, 2000; Gudergan et al., 2008). The CTA-PLS tested the null hypothesis that all of the indicators in the model reflected light and hence that all of the tetrads vanished (Bollen & Ting, 2000; Gudergan et al., 2008). Assuming that each of the four items of interest was reflective, the entire set of four would still be considered a reflective model. The CTA-PLS

would reject the null hypothesis if any of the four items were formative. SmartPLS 3 software was utilised for this analysis (Gudergan et al. (2008; Ringle et al., 2015).

The CTA-PLS results for the *Hangwurian* city development in North-Central Nigeria are summarised in Table 10.33. The analysis showed that although most of the CTA results favoured the formative model, the constraints measure exhibited acceptable reliability and validity scores if the model was assumed to be reflective. In North-Central Nigeria, all of the constructs measured had Cronbach's alpha values of 0.71 or greater, indicating good reliability. The AVE was 0.56 or more significant in the region's cities, which suggested good convergent validity.

Table 10.33: Confirmatory Tetrad Analysis Final Results for the *Hangwuri* City Development in North-Central Nigeria

HCD	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values	Bias	CI Low	CI Up	Alpha adj.	z(1- alpha)	CI adj.	Low	CI Up
1: ATC 204, ATC 208, ATC 210, ATC 211	-0.029	-0.030	0.034	0.852	0.395	-0.001	-0.094	0.039	0.006	2.785	-0.121	0.066	
2: ATC 204, ATC 208, ATC 211, ATC 210	0.051	0.051	0.030	1.713	0.087	0.000	-0.007	0.109	0.006	2.785	-0.032	0.133	
4: ATC 204, ATC 208, ATC 210, EQY 213	-0.036	-0.036	0.030	1.212	0.226	0.000	-0.094	0.023	0.006	2.785	-0.119	0.047	
6: ATC 204, ATC 210, EQY 213, ATC 208	0.032	0.032	0.030	1.064	0.288	0.000	-0.027	0.091	0.006	2.785	-0.052	0.115	
7: ATC 204, ATC 208, ATC 210, EQY 215	-0.095	-0.095	0.029	3.277	0.001	0.000	-0.152	-0.038	0.006	2.785	-0.175	-0.014	
10: ATC 204, ATC 208, ATC 211, EQY 213	0.034	0.035	0.031	1.108	0.268	0.001	-0.027	0.094	0.006	2.785	-0.052	0.120	
16: ATC 204, ATC 208, EQY 213, EQY 215	0.018	0.019	0.032	0.577	0.564	0.001	-0.045	0.081	0.006	2.785	-0.071	0.107	
22: ATC 204, ATC 210, ATC 211, EQY 215	0.111	0.112	0.030	3.703	0.000	0.001	0.052	0.170	0.006	2.785	0.027	0.194	

Source: Author's Analysis using SmartPLS 3.0 (2021)

10.5.6 Discussion

To determine the best indicator for the individual construct, exploratory factor analysis was conducted to ascertain the number of indicators to be retained for each of the six latent variables included in this study, namely urban liveability (URL), sustainable urban development (SUD), inclusive physical development (IPD), environmental awareness (EA), urban governance (UMG), and *Hangwurian* city development (HCD). For the URL construct 15 indicators were retained. For the SUD construct ten indicators were retained. For the IPD construct 16 indicators were retained. For the EA construct 11 indicators were retained. For the urban management and governance construct 22 indicators were retained, and lastly for the HCD construct 14 indicators were retained. The factor loadings, indicator reliability, internal consistency reliability, convergent validity, and discriminant validity criteria were examined when assessing the model using the PLS results.

For the indicator reliability, the square of the factor loadings of each indicator was examined, and it was observed that almost all of the indicators had values near the acceptable minimum value of 0.7 (Oke & Ogunsemi, 2016). These values were more significant than 0.4, which is considered as the minimum threshold for exploratory research of this nature (Hulland, 1999). The model showed that all the individual constructs had an internal consistency higher than the acceptable 0.70, and the composite reliability values ranged from 0.824 to 0.925 for the latent constructs. The composite items of the measurement model thus had adequate internal consistency reliability. The convergent validity of the model was evaluated, and the values of the average variance (AVE) explained were higher than 0.5. These were acceptable according to Bagozzi and Yi (1988).

As previously explained, two main criteria were used in the PLS analysis to evaluate the model's discriminant validity. The square root of each average variance explained by the reflective construct had to be larger than the level of correlations involving the latent variable (Chin, 1998) and the items had to load more strongly on their corresponding construct than on other constructs (Elbanna et al., 2013). The latent variables indicators had loadings greater than their cross-loading, and the constructs had more variance with their items (AVE) than the other constructs. Hence, the measurement model possessed the required validity and reliability to assess the predictive and explanatory power of the structural model.

The convergent validity of the measures used in this research was examined using the outer loadings and the average variance extracted (AVE) value. An AVE value of 0.5 and higher would prove that the latent variable explained more than half of its indicators' variance (Hair et al., 2010), and all loadings below 0.5 were deleted. Resultantly, the final AVE and CR were above the benchmark value of 0.5 and 0.7, respectively.

In addition to the convergent validity and the CR, the discriminant validity was assessed to ensure that each construct was genuinely distinct from the other constructs (Hair et al., 2017). Assessment using the Fornell and Larcker (1981) criterion indicated that there was adequate discriminant validity as the square root of the AVE was greater than its highest correlation with any other constructs. The heterotrait-monotrait (HTMT) statistics (Henseler et al., 2015) were also determined as the HTMT was a more reliable criterion. As per Hair et al. (2017), the HTMT was an average heterotrait-heteromethod correlation (i.e., the mean of all correlations of indicators across constructs measuring different constructs) relative to the average monotrait-heteromethod correlation (i.e., mean of all correlations of indicators measuring the same constructs). The results of the HTMT statistics and the Fornell Larcker Criterion results indicated that the highest Fornell Larcker Criterion statistic was 0.845, lower than the threshold value of 0.850.

The HTMT confidence interval did not contain zero based on the consistent PLS bootstrapping, so the discriminant validity was deemed satisfactory. In conclusion, the measurement model had adequate construct validity. The reliability and validity of the construct measures were established, and the next step was to test the postulated hypotheses by evaluating the developed structural model's results. The path coefficients of the PLS model were interpreted the same way as the standardised beta weights in the regression analysis, following tests for collinearity in the results to rule out possible bias (Hair et al., 2014; Mooi & Sarstedt, 2011; Sarstedt et al., 2014). Estimation of the coefficients of the paths was hinged on ordinary least square regression. This research followed the approach used by Sarstedt et al. (2014); and Wong (2013) to look for collinearity between the constructs. To evaluate the possible collinearity of the inner model, the latent variable scores were used as the inputs for the multiple regression. *Hangwurian* City Development was configured as the dependent variable, while the exogenous latent variables (i.e., EA, UMG, SUD, URL, and IPD) were configured as the independent variables.

The path coefficients of the PLS model were interpreted the same way as the standardised beta weights in a regression analysis are. Prior to that, the model was examined for collinearity because the estimation of the coefficients of the paths was hinged on ordinary least square regression. Mooi and Sarstedt (2011); and Sarstedt et al. (2014) suggested examining the model for this. Hair et al. (2014) asserted that collinearity in the results of these analyses could be interpreted as bias. As such, this research followed the approach used by Sarstedt et al. (2014); and Wong (2013) to check for collinearity between the constructs of the model. This evaluation was explained above.

The results confirmed that a positive and significant relationship existed, EA, UMG, URL, SUD, IPD and their corresponding effect on HCD were examined. Several paths were analysed from the EA to HCD and from UMG to HCD.

The results of the hypothesised path for ATC – HCD: path = 0.954; $t=299.267$; $p<0.000$ indicated support for the hypothesised path. The path for CSP – HCD: path = 0.631; $t = 30.621$; $p < 0.000$ also showed a supported hypothesised path, and the hypothesised path for EQY – HCD: path = 0.858; $t = 85.662$; $p< 0.000$ was also supported. These described the hypothesised paths for *Hangwuri* city development and its endogenous latent variables. These hypothesised paths for HCD and its endogenous variables represent the first three hypothesised paths analysed. At the same time, other variable analyses between the exogenous variables and their endogenous variables are also presented alongside their path coefficients, t-statistics, and p-values. The null hypothesis was rejected for all of the paths mentioned above analysis, as the alternative hypothesis was supported by the path coefficients for the exogenous latent variables in North-Central Nigeria.

The predictive relevance of Q^2 was employed to assess the capability of the research model to make a prediction (Duarte & Raposo, 2010; Götz et al., 2010). The blindfolding procedure was performed to obtain the value of Q^2 . According to Hair et al. (2014), a Q^2 greater than 0 implies that the model has predictive relevance, while a value less than 0 indicates a lack of predictive relevance. Values of 0.02, 0.15, and 0.35 suggest that an exogenous construct has a small, medium, and high predictive relevance respectively for a specific endogenous construct (Hair et al., 2014). Hair et al. (2013) explain that substantial results for the coefficient of determination and a medium level of predictive relevance provide sufficient statistical support for the model to fit.

Afterward, the predictive power of the endogenous latent variables was examined, and the significance of the structural model relationships was established. The results of the structural model showed that the R^2 values of the model were acceptable because the values were more significant than the recommended threshold of 10 per cent, as set by Elbanna et al. (2013). Credit facilities (CRF $R^2 = 94.2\%$); economic prosperity (ECP $R^2 = 79.8\%$); environmental awareness (ENV $R^2 = 72.5\%$); equity (EQY $R^2 = 73.6\%$); liveable communities (LVC $R^2 = 58.8\%$); and consumption pattern (CSP $R^2 = 39.9\%$). The R^2 values of each endogenous variable and the corresponding predictive relevance were computed and presented.

The predictive relevance of the endogenous variables indicated that the R^2 values of most of the exogenous latent variables were within the substantial range, with the predictive relevance of the Q^2 of the endogenous variables ranging from values of < 0 to values greater than > 0 , as benchmarked by Sarstedt et al., (2014) in their use of blindfolding to determine the predictive relevance of both exogenous and endogenous variables of the model construct. A substantial number of the endogenous variables had values ranging from -0.013 to +0.699, indicating that the predictive relevance of the endogenous variables of the model constructs provided support for the predictive relevance of the structural model and the positive values of the predictive relevance of the endogenous variables pointed to an increase in the direction of the prediction.

In attempting to enrich the analysed results of the present study, an IPMA was applied. According to Ringle and Sarstedt (2016), an IPMA considers the performance level of the latent and manifest variables in a PLS-SEM analysis. Thus, besides the importance of the latent and manifest variables usually presented (i.e., path coefficients), applying the IPMA also provided insight into the importance of the variables to the target construct. Consequently, the IPMA allowed for prioritising of the variables to improve the targeted variable. In addition, analysing the indicator level helped the researchers identify the most critical activities for enhancing the dependent variable. In short, the IPMA is valuable and particularly important in prioritising managerial actions.

Following the guidelines provided by Ringle and Sarstedt (2016), the latent variable (LV) index values and performance of the constructs' importance-performance were exhibited. This analysis revealed that small lot production was less essential and offered slower performance than the other constructs. Other constructs tended to be equally crucial for the targeted

Hangwurian city Development, where ATC, CSP, and EQY were the variables of the constructs. In line with their importance, the high outer loadings of the first-order constructs on the second-order construct, HCD, demonstrated the mutually supportive nature of the relationships (i.e., complementarity) among the indicator variables.

Following the guidelines provided by Ringle and Sarstedt (2016), the latent variable (LV) index values and performance of the constructs' importance-performance were exhibited, with HCD showing significant importance. Other constructs tended to be equally crucial for the targeted *Hangwurian* Development, where ATC, CSP, and EQY were the variables of the constructs. In line with their importance, the high outer loadings of the first-order constructs on the second-order construct, HCD, demonstrated the mutually supportive nature of the relationships (i.e., complementarity) among the indicator variables.

More importantly, the IPMA revealed that most variables exhibited moderate to relatively large importance and performance, such as ECP where importance = 0.580 and performance = 53.051; ENV where importance = 0.466 and performance = 64.521; ATC where the importance = 0.383, and the performance = 47.84; CRF where importance = 0.973, performance = 45.169). The summary of the analysis showed that the importance levels of the indicators of the endogenous variables range from 0.109 to 1.014, which showed a significant divergence in the importance of the variables, while the performance ranged from 42.075 to 69.154 - indicating a closer interrelatedness of the performance of the indicators than of their importance.

In furtherance of the underlining values of the importance-performance map analysis, this research presented a graphical display of the endogenous variables in a spot map indicating the importance and the percentage performance of the various endogenous variables underlining the *Hangwurian* city development and the other exogenous variables of the model. The endogenous variables' performance was clustered between 55 per cent and 75 per cent, while the importance of the endogenous variables was dispersed across the graph. This analysis showed greater interrelatedness in the performance of the endogenous variables, but more disparity in the importance of the endogenous variables.

Additionally, the importance-performance map of the exogenous variable of the analysis in this research concerned the model's constructs for city development in North-Central Nigeria. The

analysis of the IPMA for the exogenous latent variables showed that the performance of the variables ranged from 40 per cent to 65 per cent. In contrast, the importance of the variables ranged between -0.12 to 0.10, indicating a closer interrelatedness of the performance of the variables but a disparity in the importance of the exogenous latent variables.

In addition to the theoretical support, a CTA-PLS analysis provided a better statistical measure to determine whether the latent/higher-order construct was reflective or formative (Hair et al., 2017). This approach was based on evaluating the construct indicators in the tetrad form. The latent construct was reflective when all of the tetrad values were non-significant (Hair et al., 2017; Svensson et al., 2018). The CTA-PLS results for the HCD in North-Central Nigeria were also provided, explaining that none of the tetrads were significant in providing empirical support to reflective models.

The CTA-PLS tested the null hypothesis that all model-implied tetrads had the value of zero or “vanished”. A tetrad (s) is the difference between two covariances (r) products among four associated indicators. For example, the reflective model implied a tetrad of $atc\ 201, 202, 204, 208 \frac{1}{4} r_{201,202} - r_{204,208}$. If the reflective model was true and all of the indicators represented the latent variable equally, then all factor loadings would be the same value: $atc\ 201 \frac{1}{4} atc\ 202 \frac{1}{4} atc\ 204 \frac{1}{4} atc\ 208$. Then There was $r_{201,202} \frac{1}{4} atc\ 201 atc\ 202 \frac{1}{4} r_{204,208} \frac{1}{4} atc\ 204 atc\ 208 \frac{1}{4} r_{208,204} \frac{1}{4} atc\ 204 atc\ 208$. Of course, in real-world data, it was unlikely that $atc \frac{1}{4} atc\ 202 \frac{1}{4} atc\ 204 \frac{1}{4} atc\ 208$. Therefore, the CTA-PLS analysis employed the bootstrapping procedure in which several pseudo-samples were created from an original sample. In this research the sample was 5,000, and this applied to this statistical test regarding whether the mean of the model-implied tetrads across thousands of cases was significantly different from zero. The reflective model had to be retained if it did not depart from zero by chance.

The CTA-PLS analysis required at least four items per construct, as discussed previously, so four items were used (Bollen & Ting, 2000; Gudergan et al., 2008). Because the CTA-PLS analysis tested the null hypothesis that all of the indicators were reflective and thus all tetrads vanished, adding another reflective did not impact the results (Bollen & Ting, 2000; Gudergan et al., 2008). If the four items of interest were reflective, then the whole set of four items would still qualify as a reflective model. If some of these four items were formative, this would be enough for the CTA-PLS to reject the null hypothesis. The SmartPLS 3 software was used for

this statistical analysis, and to generate the 5,000 bootstrap sub-samples required for the analysis.

The CTA-PLS analysis showed that although most of the CTA results favoured this model being a formative model, the constraints measure exhibited acceptable reliability and validity scores if it was assumed that this was the reflective model. In North-Central Nigeria, all of the measured constructs had Cronbach's alpha values of 0.71 or greater, indicating that the model showed good reliability. The AVE was 0.56 or more significant in the region's cities, which suggested that this model for *Hangwurian* city development had good convergent validity.

CHAPTER ELEVEN: SUMMARY OF FINDINGS, CONCLUSION, RECOMMENDATIONS, AND AREAS OF FURTHER RESEARCH

11.1 Introduction

The analysis of the growth and development in North-Central Nigeria, depicted in the three cities of Lafia, Lokoja and Minna, have been presented thus far. This chapter summarises the research's findings, and conclusions are drawn. Recommendations are then made for further possible areas of research.

11.2 Summary of the Findings

The findings in the three selected cities in North-Central Nigeria showed similar land cover/land use change patterns. They showed that several factors led to the loss of large expanses of vegetal cover annually to built-up areas. These factors included urbanisation, the centralisation of government activities in these state capitals, and population explosions in these cities.

The large chunks of vegetal land lost to the built-up areas occurred because of the concentration of people in the urban areas of these cities. The urbanisation process favoured the development of better housing, more infrastructure, and more social amenities in the cities that attracted the population to these cities. This affected the need for more residential, commercial, recreational, and educational land uses and the loss of these vegetal land areas to develop dwellings and this other infrastructure to accommodate the teeming population.

Another factor was the political stability brought about by the fourth republic government in the country since independence. The politicians were developing several housing estates and many infrastructures in these cities because they were the capitals of their respective states. The centralisation of the local governments in these state capitals led to the migration of people to these state capitals in search of better opportunities, and this placed pressure on the land uses/land covers in these areas. The pressure was so enormous that several villages on the fringes of the cities become part of the cities as they grew. A good example was the town of Maikunkele on the fringe of Minna City, which subsequently became a neighbourhood in the suburb of the city. Another attendant effect was the development of slums, ghettos, and shanty

areas in the cities because of the massive population explosion. All of the areas set aside as playgrounds were converted to built-up areas in Minna and Lokoja cities.

Furthermore, the quest for more space for built-up areas in Lokoja led to landfilling of the watershed area, for the construction of houses. This reduced the ability of the river to absorb carbon dioxide, which then had a knock-on effect on the city and the health of the population living there. In addition, the landfilling for housing construction blocked the water channels, exposing the city to the risk of flooding. The severe flooding that occurred in 2011 was still affecting the residents some ten years after the incident. The use of non-conventional energy sources also became part of the problem that changes to the land use/land cover had brought to these cities.

The poverty level was high in these cities, and people cut down trees and shrubs to cater for their domestic energy needs for cooking, leading to further loss of vegetal cover. Evident on the 2019 maps of the cities was that all of the pockets of land were fully occupied, and gentrification was not a known phenomenon in these cities. This turned the cities into concrete jungles and increased the urban temperatures.

The political class also created a problem for the cities by centralising all of the government's activities in these capital cities. All of the appointments into government offices, admissions into tertiary education, and secondary and tertiary health care facilities in the state capitals forced the people from the hinterland to move to these capital cities so that they could enjoy these services, and this exacerbated the population explosion. Aside from in these capital cities, no development was taking place in the states' hinterlands, and this further encouraged the population drift into the cities, causing urban poverty, crime, and the illegal conversion of vegetal areas to built-up areas in the cities.

The cities were developing haphazardly, because the planning authorities tasked with the responsibility of managing the cities found it difficult to manage the urban sprawl, and the infrastructure was thus seen to be grossly inadequate. The significant challenges for these cities included urban poverty, the mismanagement of resources, inadequate infrastructure, liveability problems, poor manageability, poor housing, and the development of slums in the cities.

The growth and changes seen in these three cities since 1999 were residential developments, the development of commercial centres, infrastructure development (albeit inadequate), and the formation of administrative centres. Their designation as capital cities made them the centres for growth in their respective states, and this drawing card as capital cities promoted significant increases in the sizes of their built-up areas. The commercial activities identified during the field surveys were located along the regional and transportation axes, and in the city centres.

The gradual loss of vegetal land was linked to the expanding cities' development, as it placed pressure on the agricultural land, and the construction of transport networks, shopping centres, and residential areas transformed these agricultural areas over time. Unfortunately, as in other sub-urbanised areas, this development took place at the expense of the existing "greenfields". The increasing density of the built-up areas in the inner-cities further highlighted that the construction of the new housing units in the cities had usurped the public greenery and urban gardens. Although these green areas were increasingly appropriated for transport and parking networks, they could not meet the demand for this land use change.

There was thus a need to **promote integrated spatial planning in these cities** to maintain and sustain the urban growth. This is because spatial planning is the key instrument for achieving systematic urbanisation that will not affect land use/land cover to the detriment of the population and the land. The primary role of spatial planning is integrating various land uses/land covers, achieving strategic and urban infrastructure development, and improvement in local governance. Such efforts are necessary to facilitate the rational use of land and water resources on a sustained basis in the long run.

Another requirement noted was need for **increased urban greenery**, because vegetation is a natural cooling mechanism. It encourages evapotranspiration, and energy is dissipated through latent heating rather than sensible heating. It can also be a sink for CO₂. This is expected to help in groundwater recharging and conservation of the soil. However, the type of vegetation is significant in this regard. The respective government departments and agencies should guide the areas' households regarding the appropriate mix of vegetables and vegetation to be cultivated.

Furthermore, the **wetlands and water bodies needed to be conserved**. Retaining water in the urban landscape enhances evaporation. Similarly, as the vegetation and wetlands tend to absorb heat, the ambient air temperatures are likely to decrease. This is especially true in the case of daytime (maximum) temperatures. Hence, **water-sensitive urban design** is necessary to sustain the urban climate. There should be an appropriate regulatory structure for conserving and restoring wetlands and water bodies.

Also, a **sustainable groundwater management plan** has to be promoted and put in place. Sustainable planning must be designed and put in place in each ward in the cities to mitigate the “alarming” condition of the groundwater. The sustainable groundwater planning should be done with careful consideration of each ward's physical and socio-economic characteristics. The ward-wide sustainable groundwater planning should emphasise judicious use and promote surface water conservation; introduce a progressive water tariff structure; enhance people's awareness of the vital importance of managing the groundwater; employ scientific planning for water distribution; and promote domestic and industrial water saving practices.

A **training and awareness programme** were deemed necessary to make the people aware of the fact that the social, economic, and environmental changes over the years in the area have mainly been caused by rapid, unplanned, and unsystematic urbanisation, and that this has led to the inefficient use of critical natural resources like land and water. The local government bodies and NGOs should initiate proper capacity building and awareness programmes, and the NGOs must be used to disseminate the information about the adverse effects of rapid urbanisation on the various socio-economic and environmental aspects of living in the cities.

From the discussion above, it was evident that there had been a massive improvement in these selected cities' outlooks since 1999. This had resulted from massive government expenditure and political drives to make these cities more liveable. However, these cities did not show consistent improvement or have conditions that would allow urban dwellers to live sustainably. It was observed that there was a sense of enabling environments to improve the liveability status of the cities.

The city of Lokoja presented a scenario where the development was impeded by the geographical features of Mount Pate and the confluence of the Niger and Benue rivers. The city's development gravitated towards the lowland area along the riverbank. The city had shown

improvement in the provision of infrastructure. The government had modernised the market, which had led to the emergence of many shopping complexes that catered to the city's commercial needs. The presence of significant players in the banking sector had also improved the general outlook of the city.

The availability of road infrastructure and its facilities (traffic lights, pavements, etc.) had helped with the development of a smooth transportation network, but more was required and desired. The facilities were not well maintained, and the clogging of the drains could cause damage to the transportation infrastructure. The improved recreational infrastructure was still not adequate as only a few active recreational facilities were available. Mount Pate Park had to be improved upon to meet international standards. The educational infrastructure needed concerted upgrading to protect the learners, especially the primary school facilities that needed perimeter fencing and security for the students and staff.

The case of Lafia City also provided a similar scenario to that of Lokoja City. Lafia City was not limited in terms of space by geographical features of rivers and large hills. Although the city has improved its livelihood potential, the arrangement or distribution of the infrastructure was not optimal.

The educational infrastructure was inadequate and poorly maintained, especially the primary schools. The transportation infrastructure also left much to be desired as the majority of the local access roads were left unmaintained. The larger roads, although they had pavements, lacked essential streetlights and traffic lights. The active recreational infrastructure present in the city was deficient as there was only one sports stadium for the large population. This did not work well with the liveability potential of the city. The commercial infrastructure indicated that improvements had been made, but more needed to be done on that aspect by the government, because much of the commercial infrastructure was privately owned and unsuitable for the emerging city.

The city of Minna showed better management in comparison to the other two cities studied. Although it had excellent transportation infrastructure (good arterial roads and roads fixtures), it could also be improved upon as some of the transport infrastructures needed more investment for maintenance and upgrades. The educational infrastructure in the city of Minna presented a paradox. The privately-owned infrastructure was well maintained, while the public schools

(mainly primary and secondary) were poorly maintained. The tertiary education infrastructure in the city was in better condition.

The active recreational infrastructure in Minna had better-organised venues than those in the other two cities. This did not, however, imply that it had reached its threshold and more could be done to improve them. The availability of passive recreation facilities in the city ensured that the city's residents had better liveability potential. The health care facility in the city of Minna was in good condition as it was maintained, and it was available to the people. The only aspect that could be investigated was the adequacy of the staff and other ancillary variables.

The analysis of the findings from the three cities selected indicated that proper planning and standards were not employed when providing opportunities for liveable cities in North-Central Nigeria. The cities did have critical infrastructure, but its spatial distribution was uneven. The provision of educational infrastructure was predominantly left to private entrepreneurs who provided better infrastructure to the residents. The effect of this was that the cost of educating the youth was becoming exorbitant, and made basic education and literacy beyond the means of many of the urban poor who could not afford the schooling fees. There were not enough government schools to cater for the entire population. This was a sign of the non-inclusiveness and polarity of society, and had negative implications for the liveability potential of these cities.

The improvement of the commercial infrastructure would enable more people to participate in the activities of trading and banking and provide more opportunities for them to make ends meet. However, this would affect the town planning activities as the proliferation of these commercial activities would distort the plans already approved for the cities' development. Many open spaces had already been converted for commercial land use and distorted the cities' images.

Analysing the performance of the proposed model's indicators, as obtained from the viewpoints of the residents sampled in North-Central Nigeria, added another dimension to my understanding of the concepts investigated and their variables in the cities. The analysis compared the index values and the Cronbach's alpha results of these indicators to the established benchmarks of the Human Development Index (HDI) and the tolerable level of internal reliability of the indicators prescribed by Chew et al. (2008); Creswell and Plano Clark (2011); and Nandakumar (2008). This next section summarises the research findings for the

indicators of sustainable urban development (SUD), which were evaluated using a tripod of **economic prosperity and social and environmental dimensions**. According to my analysis, the mean values of the measured variables of **economic prosperity** ranged between 0.58 and 0.77, indicating a **‘high impact’ on the HDI scale** for the index. Cronbach's alpha values between 0.67 and 0.71 indicated that the indicator variables for economic prosperity had **extreme internal reliability**.

The **social dimension indicator for the measured construct of SUD** showed that the variables had index values ranging from 0.63 to 0.77, which was classified as **‘high to very high’ on the HDI scale**. The indexes of the social dimensions of SUD had a Cronbach's alpha range of 0.92 to 0.93, indicating **solid internal reliability of this construct of SUD** in North-Central Nigeria. The third component of SUD, the **environmental dimension**, also demonstrated **significant internal reliability**, as evidenced by Cronbach's alpha values above the 0.7 threshold and with most index values ranging between 0.52 and 0.79, which fell within the **‘high and very high’ HDI benchmarks for significant index values for SUD in North-Central Nigeria**.

Inclusive physical development (IPD) was the second layer of constructs examined in this research, looking at the challenge of inclusivity in providing infrastructure and development in North-Central Nigeria. The analysis presented showed that the challenge of inclusivity was predicated on the tripod of **equity/justice, safety, and resilience**. The indicators of equity/justice evaluated showed that the index values of the measured indicators ranged between 0.53 and 0.61, putting these indicators in the **‘high’ category on the HDI scale** according to the UNDP (2006). The internal reliability (Cronbach’s alpha) of the indicators also showed that all the indicators reached the 0.70 mark prescribed by Chew et al. (2008); Creswell and Plano Clark (2011); and Nandakumar (2008). All the Cronbach’s alpha values of the indicators ranged from 0.85 to 0.86, indicating a **significantly high sense of understanding of the indicators by residents in North-Central Nigeria**.

Safety was another factor of concern in the evaluation of inclusive infrastructure development. Most of the variables of safety from SAF 61 to SAF 71 had index values of 0.48 to 0.59, which spoke to issues such as safety at night and safety on the roads within the residential area, and fell in the **‘low to high’, rating on the HDI index**. An internal reliability value of 0.86 to 0.87 showed that the respondents clearly understood what this index was examining. Fundamental

amongst the indexes evaluated were road safety improvement, expansion of public transport with consideration for people living with disabilities, and the positive environmental link between urban and peri-urban areas within the cities in the North-Central Region.

Building resilient infrastructure is also very important in achieving inclusive physical development. The outlook for the measured index of **resilience** as the third leg of the tripod upon which inclusive physical development was built revealed that this indicator performed half-decently in North-Central Nigeria. This was because most of the computed indexes of the construct had index values ranging between 0.46 and 0.63, which fell between **the 'low' and 'high' HDI scales** for development in developing countries (UNDP, 2006). On the other hand, the Cronbach's alpha for the indicators showed a substantial value of 0.91 for the resilience of the urban infrastructure in North-Central Nigeria.

Urban liveability is a sought-after state in city development, premising on the triad of quality-of-life, liveable communities, and placemaking. This research examined urban liveability using this triad and presented the findings. The research showed that for **quality-of-life as an indicator of urban liveability** in North-Central Nigeria, its index values were within the **'low and high' scale of the HDI** as its values ranged between 0.49 and 0.59. The **Cronbach's alpha value was significant**, ranging from 0.84 to 0.85.

Every urban setting needs a liveable community. Communities must provide appropriate support for human existence. This research demonstrated that the indexes used to measure **liveable communities as an indicator of urban liveability** had index values ranging from 0.50 to 0.58, placing them as a **high** index on the HDI scale, with Cronbach's alpha ranging from 0.86 to 0.87, indicating a **high level of internal reliability and relevance of the indexes in the determination of urban liveability**.

Place-making also plays a significant role in establishing urban liveability. Urban liveability was thus further strengthened by the measured indexes of place-making and its Cronbach's alpha. The index values of the indicators of place-making ranged from 0.49 to 0.68, situating the indexes within the **'low' and 'high'** index values as stipulated in the set HDI index (UNDP, 2006). The internal reliability (Cronbach's alpha) value stood at 0.84, which put the **internal reliability of the indicators significantly above the set threshold of 0.70** stipulated by Chew et al. (2008); and Creswell and Plano Clark (2011).

At the core of the link within the concepts appraised were the twin issues of **environmental awareness and urban governance**, and the moderators and mediators in the concepts' interactions. The **environmental awareness component was assessed using motivation/value and environmental knowledge**. The **indicator for the motivation/value**, which acted as a moderator of the interactions between SUD, UL, and IPD, revealed that the eight measured indices of motivation and value had index values ranging from 0.70 to 0.80 and Cronbach's alpha values ranging from 0.89 to 0.90, which was '**high to very high**' for developing countries (UNDP, 2006). Furthermore, **the indicator for environmental knowledge** had index values ranging from 0.50 to 0.79, indicating that it ranked as '**high to very high**' on the HDI scale. This demonstrated that the dual indicators of **motivation/value and environmental knowledge were significant in North-Central Nigeria**.

This research also showed that **urban governance moderated several urban activities** within the cities' spaces. This moderator was evaluated based on the three critical criteria of population management: credit facilities, family planning, and the hospital network system. All these variables were observed to have measured variables with index values ranging between 0.46 and 0.67, which were adjudged as '**low to high**' on the HDI scale. All of the variables also had internal reliability above 0.70, which showed a **substantial understanding of the issues relating to the measured variables by the sampled residents**. These analyses showed that the measured construct of **urban governance was significant** in North-Central Nigeria and was consistent **in testing the proposed model**.

The proposed **Hangwurian City Development model** was evaluated based on the triad of **consumption patterns** as a link between sustainable urban development and urban liveability; **access to the city**, the link between urban liveability and inclusive physical development; and **equity**, which is the link between sustainable urban infrastructure development and inclusive physical development. The research findings showed that the **consumption patterns and their measured variables** had index values between 0.50 and 0.56, which were deemed as '**high**' on the evaluation scale and had a Cronbach's alpha value higher than 0.70. **Access to the city** had a computed index value range of 0.47 to 0.58, and thus ranged from '**low to high**' on the HDI scale, and a Cronbach's alpha above 0.70, thereby establishing significant internal reliability. Finally, **equity** had measured variables with index values ranging from 0.52 to 0.56 (**high**) and Cronbach's alpha values ranging from 0.84 to 0.85, above the set threshold of 0.70 in North-Central Nigeria.

To determine the best indicator for the individual construct, exploratory factor analysis was conducted to ascertain the number of indicators to be retained for each of the six latent variables included in this study: urban liveability (URL), sustainable urban development (SUD), inclusive physical development (IPD), environmental awareness (EA), urban governance (UMG) and *Hangwurian* city development (HCD). For URL construct, 15 indicators were retained; 10 indicators were identified concerning SUD, 16 were retained for IPD, 11 for EA, 22 for urban management and governance, and 14 for HCD. In assessing the measurement model from the PLS results, the following criteria were examined: factor loadings, indicator reliability, internal consistency reliability, convergent validity, and discriminant validity.

For the indicator reliability, the square of the factor loadings of each indicator was examined, and it was observed that almost all of the indicators had values nearer to the acceptable minimum value of 0.7 (Oke & Ogunsemi, 2016). However, the values were more significant than 0.4, which was considered as the minimum threshold for exploratory research of this nature (Hulland, 1999). The model showed that all of the individual constructs had an internal consistency higher than the acceptable 0.70; the composite reliability values ranged from 0.824 to 0.925 for the latent constructs. Therefore, the composite items of the measurement model had adequate internal consistency reliability. The convergent validity of the model was evaluated, and the values of the average variance (AVE) explained were higher than 0.5 (Bagozzi & Yi, 1988).

Two main criteria were used in the PLS analysis to evaluate the discriminant validity. First, the square root of each average variance explained by the reflective construct had to be larger than the level of correlations involving the latent variable (Chin, 1998) and, second, the items had to load more strongly on their corresponding construct than on other constructs (Elbanna et al., 2013).

The latent variables' indicators had loadings greater than the cross-loading, and the constructs had more variance with their items (AVE) than with other constructs. Hence, it was inferred that the measurement model presented here has the satisfactory validity and reliability required to assess the predictive and explanatory power of the structural model.

Convergent validity refers to how multiple items used in a study to measure the same concept agree (Hair et al., 2014). The **convergent validity** of the measures used in this research was

examined through outer loadings and the average variance extracted (AVE) value. An AVE value of 0.5 and higher should prove that the latent variable explains more than half of its indicators' variance (Hair et al., 2010). Any loadings below 0.5 were deleted. Resultantly, the final AVE and CR were above the benchmark values of 0.5 and 0.7, respectively.

The CR and discriminant validity were also tested to ensure that each construct was genuinely unique from other constructs (Hair et al., 2017). The Fornell and Larcker (1981) criterion, which states that AVE's square root should be more significant than its highest correlation with any other construct, was used. There was sufficient discriminant validity in the assessments based on the Fornell and Larcker criterion. The heterotrait-monotrait (HTMT) ratio was also determined to counteract any problems arising from the analysis using Fornell and Larcker's criterion. The HTMT is an average heterotrait-heteromethod correlation. It measures the mean of the correlations across the indicators measuring distinct constructs, compared to the average monotrait-heteromethod correlation, which is the mean of the correlations across the indicators measuring the same construct, or the mean of all the correlations of the indicators measuring the same constructs (Hair et al., 2017). Concerning the Fornell Larcker criterion derived data, the most significant value was 0.845, which fell below the threshold value of 0.850 (Fornell & Larcker, 1981).

The HTMT confidence interval did not contain zero, based on the consistent PLS bootstrapping performed. As a result, **the discriminant validity of the model was acceptable**. The model's construct validity was sufficient; hence it was considered adequate. When evaluating the assumptions posited using the outcomes of the structural model developed, which had proven its reliability and validity, the following steps were followed. The model was examined for collinearity because ordinary least square regression was used to estimate the coefficients of the pathways (Mooi & Sarstedt, 2011; Sarstedt et al., 2014), and PLS model path coefficients were used to conduct a regression analysis.

In order to eliminate possible bias caused by the presence of collinearity (Hair et al., 2014) in the findings of these analyses, further testing was done to determine if the two constructs were related (Sarstedt et al., 2014; Wong, 2013). Using the latent variable scores for multiple regression analysis, the exogenous latent variables (EA, UMG, SUD, URL, and IPD) were used as the independent variables, and *Hangwurian* city development was used as the dependent variable in the testing.

Environmental awareness (EA), urban management and governance (UMG), urban liveability (URL), sustainable urban development (SUD), inclusive physical development (IPD), and their effect on *Hangwurian* city development (HCD) were found to have a positive and statistically significant association. The EA-HCD and UMG-HCD paths were both examined in detail.

There was evidence for the hypothesised path from ATC to HCD (ATC – HCD: path = 0.954; $t=299.267$; $p=0.000$); from CSP to HCD (CSP – HCD: path = 0.631; $t = 30.621$; $p=0.000$); and for the hypothesised path from EQY to HCD (EQY – HCD: path = 0.858; $t=85.662$. This outlined the hypotheses for the development of the *Hangwurian* City Development Model and its endogenous variables. The first three hypotheses regarding HCD's endogenous variables were examined in this study. Along with the path coefficients, t-statistics, and p-values, other analyses between the exogenous and endogenous variables were also performed. The null hypothesis was ultimately rejected as the alternative hypothesis supported by the path coefficients for the exogeneous latent variables in North-Central Nigeria.

Using the predictive relevance of Q^2 , the study model's ability to forecast was evaluated (Duarte & Raposo, 2010). The Q^2 was determined via a blindfolding process. A model's predictive significance is shown by a Q^2 larger than 0, according to Hair et al. (2014). A score below zero shows that the model is not predictively relevant. The predictive relevance of given endogenous components for an external construct is 0.02, 0.15, and 0.35, respectively (Hair et al., 2014). It is explained by Hair et al. (2013) that a significant coefficient of determination and a medium level of predictive significance provide statistical support for a model's fit.

The endogenous latent variables and the structural model linkages were explored to determine their predictive potential. According to a study by Elbanna et al. (2013), the R^2 values of a structural model are acceptable if they exceed the recommended threshold of 10 per cent. In this study, the credits facilities' R^2 value was 94.2%, economic prosperity's R^2 value was 79.8%, environmental awareness' R^2 value was 72.5%, equity's R^2 value was 73.6%, liveable communities R^2 value was 58.8% and consumption patterns' R^2 value was 39.9%. It was possible to calculate the predictive value of each endogenous variable and the R^2 value.

Using Sarstedt et al.'s (2014) blindfolding method, the predictive relevance (Q^2) of the endogenous variables was found to range from values = 0 to values greater than >0 . As a result, the predictive importance of the endogenous variables of the model's constructs was supported

by the predictive relevance of the structural model, and the positive values of the predictive relevance of the endogenous variables indicated an increase in the prediction direction.

The study used Ringle and Sarstedt's (2016) IPMA to determine how to improve the study's analysis results. The IPMA evaluates the performance level of latent and manifest variables in a PLS-SEM analysis, according to Ringle and Sarstedt (2016). In other words, using IPMA instead of path coefficients provides insight into the importance of the variables to the target construct rather than just the importance of the latent and manifest variables. This ability to prioritise variables makes the IPMA so effective at improving a target variable. As a result, researchers can find the most important activities for improving the dependent variable by studying the indicator level. The IPMA is thus a valuable tool for prioritising managerial actions.

The LV index values and performance of the importance-performance of the constructs were shown, as per the recommendations established by Ringle and Sarstedt (2016). The consumption pattern was less critical compared to the other designs and had slower performance. Besides ATC, CSP, and EQY, other variables were likely crucial for the intended *Hangwurian* City Development Model. High outer loadings of the first order constructs on the second order HCD reflected the mutually supportive nature of the linkages (i.e., complementarity) among the indicator variables, in keeping with their relevance.

With the HCD demonstrating considerable importance, the latent variable index values and the performance of the constructs' importance-performance were also presented according to the criteria stated by Ringle and Sarstedt (2016).

The IPMA further showed that the importance levels of the indices were moderate to relatively large, such as economic prosperity (ECP) with importance = 0.580 and performance = 53.051; environmental dimension (ENV) with importance = 0.466 and performance = 64.521; access to the city (ATC) with importance = 0.383 and performance = 47.84; and credit facilities (CRF) with importance = 0.973 and performance = 45.169.

The endogenous variables and the other exogenous variable in this research were displayed graphically on spot maps to show the importance and percentage of performance of the various

endogenous and exogenous variables underlying the development a *Hangwurian* city. Between 55 per cent and 75 per cent of the endogenous variables' performance was concentrated, while their importance was spread across the graph. The endogenous variables' performance was more interdependent, but their relative importance was more disparate. There were two critical aspects of this study's exogenous variable related to the model's constructs for city development in North-Central Nigeria. There was a 40 per cent to 65 per cent range in the exogenous latent variable's IPMA analysis performance. The relevance of the variables varied from -0.12 to 0.10, and this suggested that the variables' performance was more closely linked but that the exogenous latent factors had a more significant impact.

As a superior statistical measure, the CTA-PLS was also used in order to evaluate if the latent/higher-order concept was reflecting or formative (Hair et al., 2017). The tetrad-based evaluation of construct indicators was used for this. When all of the tetrad values are non-significant, the latent concept is a reflecting one (Hair et al., 2017; Svensson et al., 2018). In this study, there was no significant tetrad providing empirical evidence for a reflecting model for *Hangwurian* city development in North-Central Nigeria, thus the model was a formative one.

All model-implied tetrads are hypothetically zero or they vanish in the CTA-PLS. A tetrad (s) is the difference between two covariances' (r) products among four linked indicators. A tetrad for a reflecting model is, for example, $201-202-r_{201}-r_{202}-r_{204}-r_{208}$. No matter how many indicators are included in a latent variable model, there should be no difference between the factor loadings, and the result should be $Atc\ 202\ 14\ Atc2041\ 14\ Atc208$. There are four ways to do this: $r_{203,20214}astc201atc2021$; $r_{203,2021}astc2031$; and $r_{203,2021}aastc2031$. The last one, $Atc14\ atc20214\ atc20414\ atc208$, is unlikely to occur in real-world data. The statistical CTA-PLS' bootstrapping process is used to determine whether a model-implied tetrad' mean across thousands of cases is substantially different from zero. Many pseudo-samples are constructed from an original sample in this bootstrapping process, and in this study's case 5,000 were constructed. The CTA-PLS should be kept if the reflecting model does not deviate from zero by chance.

If I only had two or three items, I could have used another item available to augment the CTA-PLS requirement for a construct, but this was not strictly necessary (Bollen & Ting, 2000; Gudergan et al., 2008). As a reflective model is global in scope, this argument made sense

(Hair et al., 2017). Adding another reflective item would not have affected the results of the CTA-PLS because it tested the null hypothesis that all indicators were reflective and hence all tetrads vanished (Bollen & Ting, 2000; Gudergan et al., 2008). Assuming that each of the four items of interest was reflective, the entire set of four would be considered a reflective model. The CTA-PLS would reject the null hypothesis if any of the four items were formative. I generated 5,000 bootstrap sub-samples with the SmartPLS 3 software (Ringle et al., 2015), following Gudergan et al.'s (2008) protocols.

CTA-PLS research demonstrates that, despite most CTA results favouring a formative model, the restrictions measure will show adequate reliability and validity scores if one assumes the reflecting model. A Cronbach's alpha value of 0.71 or higher was found for all of the constructs assessed in Lafia, indicating high reliability. This capital city in the region had an AVE of at least 0.56, indicating strong convergent validity.

11.3 Research Conclusion

The *Hangwurian* City Development Model aimed to describe a city without worries. Urbanisation, centralisation of government activities, and population explosion were the primary factors accused of being responsible for the land use/land cover changes seen in these cities over time. Politicians were developing several housing estates and infrastructure in these cities because they were the capitals of their respective states. These capital cities were the growth centres that promoted the most significant increases in the built-up areas. The gradual loss of vegetation was linked to the expanding cities' development pressure on agricultural land. Lokoja and Lafia had similar scenarios in terms of geographical impact as Mount Pate and the River Niger impeded their development.

In analysing the provision and condition of the infrastructure in North-Central Nigeria, the educational infrastructure was observed to be grossly inadequate and poorly maintained, especially the primary schools. The transportation infrastructure also left more to be desired as the majority of the local access roads were not catered for, while the larger roads were paved but lacked the necessary streetlights and traffic signals. The active recreational infrastructure present in the cities was deficient as only one stadium had been developed and was being maintained. Furthermore, the commercial infrastructure was largely privately owned and this was only suitable for emerging cities on a small scale. The privately-owned infrastructure was

also better maintained, while the cities' public schools and tertiary education infrastructures were better in terms of their conditions. The active recreational infrastructure in the region was poor in Lafia and Lokoja. Minna had better organised venues but there were still too few of them. The health care facilities in the region were better organised and more provided in Minna than in Lafia and Lokoja.

Furthermore, this research examined the positioning and efforts by significant stakeholders and urban gatekeepers on their actions concerning the procedures for infrastructure provision and development using a word frequency query. The word 'infrastructure' was found to dominate the outcome, followed by words that seemingly depicted the types of infrastructure, the challenges associated with some of the infrastructure, and the gender of the people who were primarily on the receiving end of poor infrastructure. Some urban liveability enhancement and sustainable urban infrastructure targets in the selected cities were more and better educational infrastructure, a better water supply, more and better health care, skills acquisition, and more and better road infrastructure. Female respondents/participants emphasised infrastructure sustainability and the drive towards inclusivity in North-Central Nigeria.

Urban infrastructure and its supply were a significant aspect of this research work. The outcome of a detailed thematic analysis of the interviews showed that four important thematic areas were identifiable: description, challenges, motivation, and expected outcomes. The description of the infrastructure provision showed that most of the state governors prioritised specific developmental projects, according to the various stakeholders interviewed. This situation of project prioritisation was observed to be a global matter and could also be seen in other parts of Africa (Pyne-Mercier, 1998). Pyne-Mercier (1998) examined the development in Maputo as a highly prioritised project and a complex one bringing together a variety of actors from South Africa, Mozambique, and beyond. The project includes the rehabilitation and upgrading of primary transport and communications infrastructure between Witbank in South Africa and Maputo in Mozambique, institutional reform to expedite border-crossing, and incentives for labour-intensive investment in the areas adjacent to the transport corridor.

The process of urban infrastructure development in North-Central Nigeria was associated with several challenges. As observed from the interviews, the challenges included the breakdown of agreements in various public-private partnership projects or developments. Zhang (2005) argues that cumulative efforts must be put in place for practical public-private partnership

projects. The PPP arrangements in infrastructure provision and development have failed in most parts of North-Central Nigeria, especially in the cities where it has been attempted. This was corroborated by Abdul-Aziz and Kassim (2011), who posited that several housing projects involving PPP arrangements had also failed in Malesia owing to the absence of complete and transparent agreements. However, the biggest challenge in North-Central Nigeria was related to the lack of financing. Most private sector participants did not want to invest earnestly in physical infrastructure projects. This lethargy in investing in infrastructure development was not unconnected to the challenge of poor returns on their investments.

Infrastructure overuse was considered a significant challenge, and inadequate budgetary allocations exacerbated the problem of urban infrastructure overuse and overstretching. Illegal developments that often overtook sites reserved for infrastructure development, lack of funding, vandalism, and poor project continuity were also cited as critical factors. To deal with the infrastructure issues in North-Central Nigeria, various government ministries in the selected cities had implemented several initiatives. Increased participation, public education, public awareness, and continued infrastructure provision were just some of the initiatives pursued. A study conducted by Adisa (2011) found that farmer-herdsmen conflicts in Nigeria did not have to become as rigid as they appeared. If these attitudes toward spatial development plans were maintained, achieving urban liveability and sustainability could be extremely difficult. Martens (2006) examined the limitations inherent in a functional (objective) notion of liveability that underpinned governments' policy directions. The analysis further investigated the applicability of planning standards in the selected cities and there was almost a complete absence of Master Plans and up-to-date plans.

For urban designers, it is essential to know and understand the origins and impacts of the many different forms that make up today's cities. This research established from the responses of the stakeholders interviewed that they involved urban residents during the lifecycle of a development project. The research also sought to establish the extent of inclusion of the urban residents in the projects and planning. The various stakeholders argued these positions to support inclusivity in project development and planning in North-Central Nigeria. The location of the urban infrastructure within the spaces of the selected cities was another concrete issue raised. Political motivation and population size played the most significant roles in the region's urban infrastructure or project development. Infrastructure maintenance was generally poor across all three cities in North-Central Nigeria. The infrastructure that suffered the highest

maintenance neglect was the urban water supply, educational infrastructure, and health care facilities. The aim was to provide evidence on building resilience in the various infrastructures. The triad of consumption, access, and equity were used to evaluate the *Hangwurian* City Development Model's proposed plan for sustainable urban infrastructure development. A Cronbach's alpha score of 0.70 for the residents' consumption pattern indicated that the consumption pattern and its measured variables had high internal dependability. The HTMT was used support for the hypothesised path, and the *Hangwurian* City Development Model's hypothesised path of access to the city (ATC) to the consumption pattern (CSP) similarly showed support for the hypothesised path.

11.4 Research Recommendations

11.4.1 Urban growth and compact development

Cities in North-Central Nigeria have been growing at an alarming rate, necessitating a coordinated effort to slow the out-of-control expansion down. A compact development model is recommended as a valuable indicator for qualifying some cities for sprawl, after calculating the rate of change in the land use/land cover between 1999 and 2019. A dense urban area is not all that a compact city is. When evaluating whether a city is close to the so-called compact city form, other factors, including public transportation, connection, open space, continuity, and mixed land use, come into play. Burton (2000); Galster et al. (2001) and Medayese et al., (2020) have highlighted them but they did not require precise measurement in this thesis. Table 11.1 shows the ten criteria that have been selected and estimated, based on the data available and the knowledge gained through interviews.

Table 11.1: Compact City Characteristics

Measuring Criteria	Evaluation Criteria
High residential and employment densities	Both residential and employment densities are highest in and around the city centre. Population density remains averagely high until the limit of the built-up area is reached. Employment density drops sharply.
A mixture of land uses	Mixed land uses in the city centre (retail, schools, restaurants, residential houses). Some residential areas on the peri-urban periphery should be homogeneous (mainly residential housing- condominiums) but always in the vicinity of public facilities or retail shops.
Spatial Array (proximity of varied uses and small relative size of a plot of land	The parcels of land should be smaller, especially in the traditional inner-city and older neighbourhoods. They tend to increase in size in the new residential areas built in recent times in the peri-urban areas but remain much smaller than what is the experience in other places.

Contiguous development	Only a few vacant spaces should be left undeveloped. The space must be filled up in the future. By design, no leapfrogging development should occur within the city's boundaries.
Contained urban development, demarcated by legible limits	The boundary between the city and the countryside should be sharp. Around the city itself, only a few roads should show the ribbon development of the past. Therefore, once one leaves the city, he should find himself in a rural landscape of open fields. The land use regulation through the Land Use Act and plans and the building permits acted as the best tool to draw limits around the cities in the past.
Multi-modal transportation	Everything must be done to limit the use of private cars in the inner-city. This will reduce the problem of parking and encourage the use of public transport.
The high degree of accessibility	All major public facilities (hospitals, schools, town halls, water supply mains, and transformers) should be accessible to residents using public transport.
The high degree of street connectivity, including sidewalks	The road network should be organised in a hierarchical order of primary, secondary, and collector roads so that the traffic in liveable neighbourhoods stays as low as possible.
Low open space retention	The cities should be surrounded by green agricultural land. Conscious efforts to conserve and create urban green spaces will improve the situation. This will make space for water storage to become a priority at the city level. Open recreational land and forest areas will be an advantage for the cities
Sufficient governmental fiscal capacity to finance urban facilities and infrastructure	The selected cities in North-Central Nigeria, and in Nigeria in general, should have different sources of revenue, such as local taxes collected from residents and firms, national subsidies, and surplus monies from the role played by the land market.

Source: Author's Construction (2022)

11.4.2 Infrastructure provision and development

The findings showed that adequate master plans and planning standards were not developed, followed, and kept updated in the evolution of the cities in North-Central Nigeria, which was consistent with earlier studies on Nigerian infrastructure development (Agbola, 2005; Gift et al., 2020; Makinde, 2014; Medayese et al., 2021). To ensure the equitable redistribution of urban infrastructure, extensive evaluation and non-political consideration must be used in educational infrastructure to ensure that this critical infrastructure is distributed legally and equitably. The Planning Commission (2008); and Porter and Kramer (2019) emphasised that primary and secondary education has been shifted from public to private hands, leaving residents with a lack of options. It is also necessary to prioritise commercial infrastructure development so that the public has access to banking services and the ability to do business. Regulating the provision of this infrastructure is also necessary to ensure the implementation of town planning standards so that illegal commercial activities are eliminated through effective plan approval in these cities' development.

11.4.3 Enhancement of infrastructure development in North-Central Nigeria

The research findings established a very significant failure in the public-private-partnership arrangements in infrastructure provision in North-Central Nigeria, thereby reducing the infrastructure upgrade and modernisation rate in this region in Nigeria. Infrastructure and modernisation are viewed as a twine that cannot be separated, as modernisation depends solely on infrastructure provision within a city (Calhoun, 1992; Edwards, 2003; Gandy, 2008). It is therefore instructive to note that the challenge of the PPP infrastructure provision failure in North-Central Nigeria can be mitigated through the elimination of the various issues which often lead to the failure of these PPP projects, and these include the challenges of political interference, poor human capacity, risks associated with financing, and official bureaucracy. Therefore, this research recommends that these challenges be addressed effectively by financing the projects adequately and making the public and private sector promoters and participants in projects stick to their parts of the bargain. Above all, the challenge of political interference must be addressed through precise documentation and legal instrumentation of the PPP agreements, eliminating the political interference, and removing all forms of corruption and external influence.

To address the challenges associated with financing infrastructure in North-Central Nigeria, conscious efforts must be made and plans put in place to ensure that critical plans such as the town planning masterplan, zoning plans, strategic plans, and action plans are duly prepared and gazetted for the cities, with appropriate institutional control and enforcement of the planning regulations and standards. City branding and marketing are followed by the plan production and implementation for the selected cities in North-Central Nigeria. The cities' branding and marketing can leverage the display of the various plans and development undertakings, proposals, and intensions on various websites and social media platforms to encourage and attract external funding and private investor inputs in urban infrastructure development and provision. This recommendation is to help the cities leverage the external process of city modernisation, which ensures that cities are interdependent and can relate to the strengths of comparative advantages (Bibri, 2021; Feser, 1998; Mayer & Knox, 2010).

Finally, on the infrastructure provision and development, the cities in North-Central Nigeria must undertake citizen-focused infrastructure planning and development through effective consultation and citizen delegated power to enhance the cities' ownership and maintenance of

their urban infrastructure. This citizen ownership of the urban infrastructure will help to guide against abuse, misuse, and over intensification of urban infrastructure and promote community collaboration in the protection and provision of such infrastructure.

11.4.4 Hangwurian City Development Model indicators

The performance of the proposed model's indicators was analysed, based on the residents' viewpoints in North-Central Nigeria. The analysis compared the index values and Cronbach's alpha of these indicators to the established benchmarks of the Human Development Index (HDI) and the tolerable level of internal reliability of the indicators. The Cronbach's alpha values of the indicators ranged from 0.85 to 0.86, indicating a significantly high sense of understanding by the residents in North-Central Nigeria. Road safety, expansion of public transport with consideration for people living with disabilities, and the positive environmental link between urban and peri-urban areas must be prioritised in development.

The indexes used to measure the liveable communities as an indicator of urban liveability have index values ranging from 0.50 to 0.58, placing them as having a '**high**' index on the HDI scale. The internal reliability (Cronbach's alpha) value was 0.84, which put the internal reliability of the indicators significantly above the set threshold. The proposed *Hangwurian* City Development Model was evaluated based on the triad of the consumption pattern, access to the city, and equity. The consumption pattern and its measured variables had index values between 0.50 and 0.56. Equity also had Cronbach's alpha values above 0.70 in North-Central Nigeria. Hence, the *Hangwurian* model can be operationalised if examined on consumption patterns, city access, and equity.

11.4.5 Hangwurian City Development Model

In this study, urban liveability (URL), sustainable urban development (SUD), inclusive physical development (IPD), environmental awareness (EA), urban management and governance (UMG), and *Hangwurian* City Development (HCD) were measured. The evolved model (*Hangwurian Model*) showed that all of the individual constructs had an internal consistency higher than 0.70. Convergent validity and CR were also assessed to ensure that each construct was genuinely distinct from the other constructs. The assessments using the Fornell and Larcker criterion indicated adequate discriminant validity, and the heterotrait-monotrait ratio suggested by Henseler et al. (2015) was also applied. The path coefficients of

the PLS model were interpreted the same way as the standardised beta weights in a regression analysis, and the results confirmed that a positive and significant relationship existed between environmental awareness (EA), urban management and governance (UMG), urban liveability (URL), sustainable urban development (SUD), and their effect on *Hangwurian* City Development (HCD).

The null hypothesis was rejected as the alternative hypothesis supported by the path coefficients for the exogenous latent variables in North-Central Nigeria. The structural model's results showed that the R^2 values of the model were acceptable because the values were more significant than the recommended threshold of 10 per cent. An IPMA (Ringle & Sarstedt, 2016) considered the performance level of the latent and manifest variables. This analysis revealed that small lot production was less essential and offered slower performance. Other constructs tended to be equally crucial for the targeted *Hangwurian* Development, in which ATC, CSP, and EQY were the variables of the constructs.

The importance levels of the indicators of the model's exogenous variables ranged from 0.109 to 1.014, which showed a significant divergence in the importance of the variables. The analysis of the IPMA for the exogenous latent variables showed that the performance of the endogenous variables ranged from 40 per cent to 65 per cent. The CTA-PLS tested the null hypothesis that all of the model-implied tetrads had the value of zero or vanished. Therefore, this research recommends the *Hangwurian* City Development Model for city development, infrastructure provision, and urban growth, shaping the ideological shifts for the cities in North-Central Nigeria.

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APPENDICES

APPENDIX 1: RESEARCH OBJECTIVES AND PAGES

S/N	OBJECTIVES	PAGES
1	Analyse the land use land cover changes in the selected cities in North-Central Nigeria between 1990 and 2020.	217-254
2	Examine the spatial dimensions of the physical development projects implemented by the government in the selected cities in North-Central Nigeria from 2000 to 2020.	255-337 338-360
3	Develop a matrix of indicators to appraise the extent of the sustainable urban development, urban liveability, and inclusive physical developments in the selected cities in North-Central Nigeria.	362-374
4	Evolve an integrated model for sustainable urban development, urban liveability, and inclusive physical development for the selected cities (<i>Hangwurian City Development Model</i>).	375-492

APPENDIX 2: GATEKEEPER'S LETTER

DEPARTMENT OF URBAN AND REGIONAL PLANNING SCHOOL OF ENVIRONMENTAL TECHNOLOGY FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA	
	
Vice Chancellor: PROF. Abdullahi Bala, Bac, Msc, PhD, PSSSN	PMB 65, Minna, Nigeria
Director: Prof. J.J. Dukiya, BURP, MTech, PhD, RTP, MCILT	Email: urp.set@futminna.edu.ng
Email: duksat2000@futminna.edu.ng	

21st March, 2020

Dear Medayese Samuel,

**RE: REQUEST FOR RESEARCH DATA COLLECTION LINKAGE WITH
GOVERNMENT AGENCIES, MINISTRIES AND DEPARTMENTS**

Sequel to your letter dated 20th November, 2019 on the above subject matter, I wish to convey to you the approval of the Department willingness to assist in linking you up with all the relevant government ministries and agencies that are connected with your research interest. It is believed that your final research finding that is currently being undertaking at the University of KwaZulu Natal, Durban South Africa would boost the Departmental image in solving major national environmental issue.

We look forward to hearing from you for necessary actions, while wishing you a fruitful academic exercise over there.

Regards,



APPENDIX 3: ETHICAL CLEARANCE



09 February 2021

Mr Samuel Medayase (220110998)
School Of Built Env & Dev Stud
Howard College

Dear Mr Medayase,

Protocol reference number: HSSREC/00001760/2020

Project title: Assessing Nexus of Sustainable Urban Development; Urban Liveability and Inclusive Physical Development in Selected Cities in North-central, Nigeria

Degree: PhD

Approval Notification – Expedited Application

This letter serves to notify you that your application received on 25 July 2020 in connection with the above, was reviewed by the Humanities and Social Sciences Research Ethics Committee (HSSREC) and the protocol has been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. **PLEASE NOTE:** Research data should be securely stored in the discipline/department for a period of 5 years.

This approval is valid until 09 February 2022.

To ensure uninterrupted approval of this study beyond the approval expiry date, a progress report must be submitted to the Research Office on the appropriate form 2 - 3 months before the expiry date. A close-out report to be submitted when study is finished.

All research conducted during the COVID-19 period must adhere to the national and UKZN guidelines.

HSSREC is registered with the South African National Research Ethics Council (REC-040414-040).

Yours sincerely,



Professor Dipane Mlalele (Chair)

/ds

Humanities and Social Sciences Research Ethics Committee

Postal Address: Private Bag 914001, Durban, 4000, South Africa

Telephone: +27 (0)31 260-8350/4157/3587 Email: hssrec@ukzn.ac.za Website: <http://research.ukzn.ac.za/research-ethics>

Residing Campuses: Durbanville Howard College Medical School Pietermaritzburg Westville

INSPIRING GREATNESS

APPENDIX 4: INFORMED CONSENT LETTER

**Department of Town and Regional Planning.
School of Built Environment and Development Studies, College of Humanities.
The University of KwaZulu-Natal, Durban, South Africa.**

Department of Town and Regional Planning,
School of Built Environment,
University of KwaZulu Natal, Durban
South Africa.
March 2020

Dear Madam/Sir,

Assessing the Nexus of Sustainable Urban Development, Urban Liveability and Inclusive Physical Development in Selected Cities in North-Central Nigeria

This questionnaire is part of my PhD. study in Town and Regional Planning with the aim of developing a conceptual model for sustainable urban liveability and inclusive physical development in North-Central Nigeria. Your responses to this questionnaire are essential in better understanding this contemporary issue.

The questionnaire should take you about 15 minutes to complete. Please tick as appropriate in the spaces provided. You are free to add or make further comments to assist the research. The information provided by you will be treated in the strictest confidence. It can be seen in the questionnaire that no space is provided for the respondents' individual names or addresses.

The responses from your questionnaire and others will be used as the primary data set for my research project for the PhD degree in Town and Regional Planning at the University of KwaZulu Natal, Durban.

I hope that you will find completing the questionnaire very interesting and involving. Please kindly return the completed questionnaire to me, Samuel Medayese, or to my research assistant as soon as it is completed. Should you have any question(s) or like further information, please do not hesitate to contact me on 08033033184 or 09098973764.

Thank you for your assistance.

Mr Medayese, Samuel
(PhD Research Student)

Prof. H.H Magididmisha-Chipungu
Student's Main Supervisor)

APPENDIX 5: HOUSING SURVEY QUESTIONNAIRE

**Department of Town and Regional Planning.
School of Built Environment and Development Studies, College of Humanities.
University of KwaZulu-Natal, Durban, South Africa.**

Department of Town and Regional Planning,

School of Built Environment,

University of KwaZulu Natal, Durban

South Africa.

March, 2020

Dear Madam/Sir,

Assessing the nexus of sustainable urban development, urban liveability and inclusive physical development in selected cities in North-Central Nigeria.

This questionnaire is part of PhD (Town and Regional Planning) study, developing a conceptual model for sustainable urban liveability and inclusive physical development in North-Central Nigeria. Your responses to this questionnaire are essential in enabling me to have a better understanding of this contemporary issue.

The questionnaire should take you about 15 minutes to complete. Please tick as appropriate in the spaces provided. You are free to add or make further comments that will assist the research. The information provided by you will be treated in the strictest confidence. This can be seen on the questionnaire as no space is provided for individual names or addresses.

The responses from your questionnaire and that of the others will be used as the main data set for my research project for my PhD degree in Town and Regional Planning, at the University of KwaZulu-Natal in Durban, South Africa.

I hope that you will find completing the questionnaire very interesting and involving. Please kindly return the completed questionnaire to me, Medayese, Samuel or to my research assistant as soon as it is completed. Should you have any question(s) or would like further information, please do not hesitate to contact us on 08033033184 or 09098973764.

Thank you for your assistance.

Mr Medayese, Samuel
(PhD Research Student)

Dr. H.H Magididmisha
(Student's Main Supervisor)

**Survey on Assessing the Nexus of Sustainable Urban Development, Urban Liveability
and Inclusive Physical Development in Selected Cities in North-Central Nigeria**

SECTION A: GENERAL INFORMATION

SECTION A: Household Socio-Economic, Building and Health Information

1. Name of Community.....
2. Sex of respondent (1) Male (2) Female
3. Age of respondent in years.....
4. Marital status (1) Single (2) Married (3) Separated (4) Divorced (5) Widowed
5. Ethnicity? (1) Yoruba (2) Igbo (3) Hausa (4) Others
6. What is your household size?
7. How many dependents are in this household?
8. Main type of occupation (1) Farming (2) Non-farming (3) Both
9. **If both**, type of non-farming activity? (1) Trading (2) Sand mining (3) Civil service (4) Artisan (5) Retiree (6) Driver (7) Others (Specify).....
10. Type of home? (1) Polygamous (2) Monogamous
11. Highest educational status in the household (1) No formal education (2) Primary (3) Secondary (4) Tertiary
12. Average monthly income in Naira.....% from remittance.....
13. Do you have access to any credit facility? (1) Yes (2) No
14. If yes, from where and for how much?.....
15. How long have you been living here? (1) < 5yrs (2) 6-10yrs (3) >11yrs
16. Type of household? (1) Indigenous dweller (2) Migrant dweller
17. Can any of your family members be considered skilled? (1) Yes (2) No
18. **If Yes**, what kind?.....
19. Household financial head? (1) Father (2) Mother (3) Children (**highest income earner**)
20. Do you engage in family planning? (1) Yes (2) No
21. Will you describe this household as a regular hospital visitor? (1) Yes (2) No
22. **If Yes**, what instance?
23. Do you know your HIV/AIDS status? (1) Yes (2) No
24. Average life expectancy in this area? (1) >45 (2) 46 – 60 (3) 61- 75 (4) < 75
25. Dwelling ratio per room (1) <2 (2) 3-5 (3) >5.
26. Which household expenses do you spend more on?

S/N	Type of Expenses (Average per Month)	Amount (#)
i.	Medical expenses	
ii.	Social expenses(recreational)	
iii.	Educational expenses	
iv.	Other miscellaneous and household expenses	

Please choose from among the options supplied for each of the following 1 to 5 and place a tick (✓) in front of any of the options that expresses your choice.

**SECTION B: SUSTAINABLE URBAN DEVELOPMENT, INCLUSIVE PHYSICAL DEVELOPEMNT
AND URBAN LIVEABILITY**

27. Please (tick) as appropriate to indicate your assessment of the level of impact of sustainable urban development in your area, as defined below, and its effect on the environment using the following scale significance of impact:

Very high	High	Moderate	Low	Very low
5	4	3	2	1

Very low = very low on the environment; low = low threat to environmental sustainability; moderately low = reduces attainment of environmental sustainability objectives significantly; high= high impact on environmental sustainability objectives; and very high=very high impact on environmental sustainability objectives.

No	Sustainable Urban Development	Impact				
		5	4	3	2	1
	Economic Prosperity					
SUD1	Rate the actions of companies towards their employees, suppliers and customers.					
SUD2	How do you perceive the fair distribution of goods and services among people in the world?					
SUD3	How do you rate the necessity to wiping out poverty in the world for sustainable development?					
SUD4	How do you perceive the sustainable development demand that people understand how the economy functions?					
SUD5	How do you perceive the responsibility of companies to reduce the use of packaging and disposable articles?					
SUD6	Rate your level of desire for a reduction in poverty.					
SUD7	Do you think that companies in rich countries must give employees in poor nations the same conditions as in rich countries?					
SUD8	How do you rate your desire for the people who pollute land, air or water to pay for the damage they cause to the environment?					
SUD9	Rate your willingness to do things which help poor people.					
SUD10	Rate how often you purchase second-hand goods over the internet or in a shop.					
SUD11	How do you perceive buying goods from companies with a bad reputation for looking after their employees and the environment?					
SUD13	Rate how often you watch news programmes or read newspaper articles to do with the economy?					
	Social					
SUD14	Improving people's chances for a long and healthy life contributes to sustainable development.					
SUD15	A culture where conflicts are resolved peacefully through discussion is necessary for sustainable development.					
SUD16	People who exercise their democratic rights are necessary for sustainable development (for example, they vote in elections, involve themselves in social issues, and express their opinions)?					
SUD 17	Reinforcing girls' and women's rights and increasing equality around the world is necessary for sustainable development.					

SUD 18	Respecting human rights is necessary for sustainable development.					
SUD 19	To achieve sustainable development, all the people in the world must have access to good education.					
SUD 20	Having respect for other cultures is necessary for sustainable development.					
SUD 21	For sustainable development, major infectious diseases such as HIV/AIDS and malaria must be stopped.					
SUD 22	Rate your desire for everyone to be given the opportunity to acquire the knowledge, values and skills that are necessary to live sustainably.					
SUD 23	Rate you desire for we who are living now to make sure that people in the future enjoy the same quality of life as we do today or better.					
SUD 24	Rate your desire for the government to provide financial aid to encourage more people to make the shift to green cars.					
SUD 25	Rate your desire for government to make all its decisions on the basis of sustainable development.					
SUD 26	Do you rate it as important that people in society exercise their democratic rights and become involved in important issues?					
SUD 27	Rate your desire for women and men throughout the world to be given the same opportunities for education and employment.					
SUD 28	Rate how often you use a computer or mobile to chat, to text, to play games and so on. Do you always treat others as respectfully as you would in real life.					
SUD 29	Rate how often you make lifestyle choices which are not good for your health.					
SUD 30	Rate your treatment of people in terms of the respect shown, even if they have a different cultural background than yours.					
SUD 31	Rate your support of aid organisations or environmental groups.					
SUD 32	Rate your show of respect to men and women, and boys and girls.					
	Environmental					
SUD 33	Reducing water consumption is necessary for sustainable development.					
SUD 34	Preserving nature is <i>not</i> necessary for sustainable development.					
SUD 35	Sustainable development demands that we humans reduce all sorts of waste.					
SUD 36	Preserving the variety of living creatures is necessary for sustainable development (preserving biological diversity).					
SUD 37	Sustainable development requires a shift to renewable natural resources.					
SUD 38	For sustainable development, people need to be educated on how to protect themselves against natural disasters.					

SUD 39	Do you think that using more natural resources than we need does not threaten the health and well-being of people in the future?					
SUD 40	Do you think that we need stricter laws and regulations to protect the environment?					
SUD 41	Do you think that it is important to take measures against problems which have to do with climate change?					
SUD 42	Rate if you think it is OK that each one of us uses as much water as we want.					
SUD 43	Where possible, do you choose to cycle or walk when going somewhere, instead of travelling by motor vehicle.					
SUD 44	Rate your perception of water wastage.					
SUD 45	Rate your ability to recycle materials in your city.					
SUD 46	Rate how often you pick rubbish up when you see it out on the streets or in public places.					
SUD 47	Rate how often you think about how your actions may damage the natural environment.					
SUD 48	Rate how often you separate food waste before putting the rubbish out when you have the chance.					
SUD 49	Will you consider a change of personal lifestyle in order to reduce waste (e.g., throwing away less food or not wasting materials)?					

28. Within your environment and by virtue of your experience so far, kindly indicate the extent of inclusive physical development in your city to improve social inclusion in the city, using the scale below:

Always	Very Often	Sometimes	Rarely	Never			
5	4	3	2	1			
	INCLUSIVE PHYSICAL DEVELOPMENT		Frequency Level				
			5	4	3	2	1
	Equity/Justice						
IPD50	Describe the access to housing in your area.						
IPD 51	Describe the process of upgrading of slums in your area.						
IPD 52	How would you describe the provision of basic services in your area?						
IPD 53	Do you have access to affordable transportation?						
IPD 54	How would you describe your access to sustainable transportation?						
IPD 55	How would you describe your access to transport infrastructure for the aged?						
IPD 56	How will you describe access to public spaces for disabled people in your area?						
	Safety						
IPD 57	How would you describe the level of improving road safety in your area?						
IPD 58	Is there expansion of public transport with the special needs of vulnerable groups such as women, children and PLWD in mind?						

IPD 59	How is the government in your area safeguarding the cultural heritage in your area?					
IPD 60	Do you support positive environmental and social links between urban and peri-urban areas within your city?					
	Resilience					
IPD 61	Describe the level of disaster education and awareness programmes in your area.					
IPD 62	How will you describe early warning programmes and orientation in your area?					
IPD 63	How would you describe building disaster resilience in your area?					
IPD 64	Do you have a culture of providing disaster preparedness infrastructure in your area?					

29. Please rate how the following defines the level of importance of the key indicators of urban environmental liveability, their level of importance, and their impact on the urban environment.

No	URBAN LIVEABILITY	Level of Importance				
	Quality of Life	5	4	3	2	1
UL65	What is your assessment of your current city in relation to perfect city conditions?					
UL66	What is the condition of the roads in your city?					
UL67	What is the condition of the health infrastructure?					
UL68	How would you rate your comfort in your current residential area?					
UL69	How satisfied are you with your current residential area?					
UL70	How attached are you to your current residential location?					
UL71	How will you rate your love for your current city?					
UL72	How will you rate your love for your current workplace?					
UL73	How will you rate your love for your current recreational areas?					
UL74	How will you rate your love for your current marketplaces?					
UL75	How will you rate your love for your current source of water?					
UL76	How will you rate your love for your current transport infrastructure?					
UL77	How will you rate your love for your waste disposal?					
	Liveable Communities	5	4	3	2	1
UL78	How will you rate the land use types in your area?					
UL79	How would you describe the cultural inclusion in your city?					
UL80	How will you rate the social interaction in your area?					

UL81	How abundant are the cultural opportunities in your area?					
UL82	How abundant are the social opportunities in your area?					
UL83	Do you consider your area as rich in cultural resources?					
UL84	Do you consider your area as rich in social resources?					
UL85	Do you consider your area as rich in cultural opportunities?					
UL86	Do you consider your area as rich in recreational resources?					
UL87	Do you consider your area as rich in agricultural resources?					
UL88	Do you consider your city or area accessible in terms of transportation?					
UL89	Do you consider your area aesthetically pleasing?					
UL90	Do you consider your area properly linked to others by transport infrastructure?					
	Place Shaping	5	4	3	2	1
UL91	How would you describe your connectivity in your city?					
UL92	How easy is it for you to obtain financial help in your city?					
UL93	How easy is it for you to get help in terms of health care?					
UL94	How easy is your financial flow network in case of need in your city?					
UL95	How willing will you be to change your location if your financial status changes in this city?					
UL96	Will you be willing to remain here, even when your educational status changes?					
UL97	Would you be willing to receive or accommodate more people in your city?					
UL98	How much attraction does your city have for tourists and visitors?					
UL99	How easy is it for visitors to find accommodation in your city?					
UL100	How attractive is your city to skilled workers from other locations?					
UL101	How receptive is your city to unskilled workers from other locations?					
UL102	How often do you follow up with people who visit your community?					
UL103	How frequently are you willing to receive visitors in your home?					
UL104	How long are you willing to accommodate visitors in your home for?					

30. SECTION C: URBAN MANAGEMENT AND GOVERNANCE

The research combines the elements of urban management and urban governance as moderators of urban sustainability, urban liveability, and inclusive physical development in order to be able to attain the benchmark of a new paradigm in physical and infrastructure development in the North-Central region of Nigeria. The questions provide feedback around both the internal workings of planning governance processes and their external outcomes in order to improve continuously the drive towards acceptable physical infrastructure development and results.

Please (tick) as appropriate to indicate your assessment of the level of effectiveness of the urban management and governance in your community considering your experience in the community, using the following scale:

Very Effective	Effective	Somehow Effective	Slightly Effective	Not Effective
5	4	3	2	1

	URBAN MANAGEMENT AND GOVERNANCE	Impact				
		5	4	3	2	1
	Population					
UMG 105	Does the government provide orientation on population management?					
UMG 106	Do you believe in regulation of family size?					
UMG 107	Are you aware of the challenges of over-population in your city?					
UMG 108	Do you think the infrastructure in your city is able to support the population?					
UMG 109	Do you think the population of your city is distributed evenly?					
UMG 110	Are you able to access development potentials for your city?					
UMG 111	Family Planning					
UMG 112	Are you aware of the need for family planning within your city?					
UMG 113	Do you view the birth rate in your city as high?					
UMG 114	Do you think that the high birth rate has an effect on development?					
UMG 114	Do you think that the high birth rate has an impact on infrastructure?					
	Youth Employment					
UMG 115	Are you aware of any youth employment training in your city?					
UMG 116	Do you participate in any employment training?					
UMG 117	Would you support any effort to improve training and employment of youths in your city?					
UMG 118	Do you think the government has the political will to facilitate training and employment for youths?					
UMG 119	How would you rate the efforts of the government in your city in terms of employment?					
	Credit Facilities					
UMG 120	Do you have information on credit facilities for business development?					
UMG 121	Does the issue of unemployment in your city worry you?					
UMG 122	Do you think the various credits and funds for business development are achieving their purpose?					
UMG 123	Do you find it easy to borrow money for your business activities?					
UMG 124	How would you rate the efforts of government at ensuring financial support for youths?					

UMG 125	How would you rate the efforts of government at ensuring financial support for women?					
UMG 126	How would you rate the efforts of government at ensuring financial support for PLWDs?					
UMG 127	How would you rate the efforts of government at ensuring financial support for the aged?					
	Information on Jobs and Commodities widely Disseminated					
UMG 128	Are you in any way informed of any awareness programme on financial expenditure of the government in your city?					
UMG 129	Have you ever been involved in any awareness programme for funding and finance in your city?					
UMG 130	Do you ever feel that your spending ability is impaired at any point in your city?					
	Hospital Network System					
UMG 131	Do you think the hospital in your area has the required facilities to provide treatment?					
UMG 132	Do you think the hospital has the requisite manpower?					
UMG 133	To what extent do you trust the services of the health facilities available in your city?					
UMG 134	How well do you think the medical facilities in your cities can care for PLWD?					
UMG 135	How well do you think the health facilities can cater for women in your city?					
UMG 136	How well do you trust the health facilities in your city to care for children?					
UMG 137	Do you trust the health facilities in your area to manage the care for pregnant women effectively?					

Q31. In the community where you live, do you have a Local Planning Authority?

(a) Yes ☐ (b) No ☐

Q32. Rate the availability of building planning permits?

Very High	5
High	4
Moderate	3
Low	2
Very Low	1

Q33. How long ago was the building plan approved?

Very High	
High	
Medium	
Low	
Very Low	

Q34. Have you had any alterations made to the original building plan? (Please tick all that are applicable)

No Alteration	

Very Slight Alteration	
Slight Alteration	
Major Alteration	
Other (please specify)	

Q35. If your building has no building plan and development permit, please rate how important you perceive building plan permits and approval to be.

Highly Related	Related	Slightly Related	Unrelated	Not Applied
5	4	3	2	1

Q36. Please rate the following performance measurement models using the following scale according to purpose of use and level of effectiveness of the local planning authorities in your area.

Effectiveness:

Very Effective	Effective	Somehow Effective	Slightly Effective	Not Effective
5	4	3	2	1

SECTION D: ENVIRONMENTAL AWARENESS

37. Please rate the perception of the residents in your city, based on their knowledge of environmental awareness. Please note that the rating is on a scale of 5-1, where 5 is the best rating and 1 is the poorest rating on the scale.

	ENVIRONMENTAL_AWARENESS	Impact				
		5	4	3	2	1
	Motivations, Values and Attitudes					
EA138	All forests of the world are suffering from the problem of deforestation.					
EA139	Deforestation occurs due to need for land, trees and other human requirements.					
EA140	Deforestation has adverse effects on the environment.					
EA141	Deforestation without sufficient reforestation has resulted in damage to habitats, biodiversity loss and aridity.					
EA142	Due to deforestation, the most dramatic impact is a loss of habitat for millions of species.					
EA143	Trees support the water cycle by returning water vapour back into the atmosphere.					
EA144	Deforestation increases the soil erosion.					
EA145	Trees also play a critical role in absorbing the greenhouse gases that fuel global warming.					
	Environmental Knowledge					
EA146	Burning of fossil fuels is one of the causes of air pollution.					
EA147	Sulphur dioxide is one of the greenhouse gases.					
EA148	Acid rain does not corrode metals.					
EA149	High concentrations of nitrogen dioxide result in respiratory distress.					
EA150	Industries must treat their waste products before discharging them into water.					
EA151	Potable water causes water-based diseases.					
EA152	Bad tasting water indicates the presence of pollutants.					

EA153	The water that looks clean is safe for drinking purposes.					
EA154	We should always bathe in rivers.					
EA155	Smog leads to diseases relating to lungs.					
EA156	Melting of glaciers leads to a rise in the level of the sea.					
EA157	Global warming is causing a gradual increase in the temperature of the earth's atmosphere.					
EA158	The underground water gets polluted through agricultural wastes like pesticides & fertilisers.					
EA159	Water must be sterilised by chlorination.					
EA160	Occurrence of earthquakes beneath the ocean floor can (sometimes) lead to tsunamis.					
EA161	Install dimmers to reduce the amount of energy your lights use, when you do not need bright light.					
EA162	Should use energy saving lights in outdoor fixtures.					
EA163	Use solar lights wherever possible.					
	Motivations, Values and Attitudes					
EA164	Clearing heavy curtains from windows for natural light is a useful idea.					
EA165	Replace your regular lights with compact fluorescent lights.					
EA166	Look for energy stars on products when buying electronic devices.					
EA167	Low-flow taps, showerheads and commodes reduce water wastage at home.					
EA168	Arrange your garden in such a way that water runoff reaches all of your plants without excessive wastage.					
	Skills and Abilities					
EA169	Did you try to count stars at night in your childhood?					
EA170	Do you enjoy sunrise and sunset?					
EA171	Do you like birds chirping?					
EA171	Do you water plants daily?					
EA172	Do you switch electricity off when leaving a room?					
EA173	Do you defrost your refrigerator regularly?					
EA174	Do you unplug your mobile charger after full charging?					
EA175	Do you always shut your computer/laptop down after job completion?					
EA176	Do you always buy star rated electrical items?					
EA177	Do you travel by public transport in your daily life?					
EA178	Do you use a bicycle for nearby destinations?					
EA179	Would you prefer CNG vehicles to diesel-engine vehicles, if available?					
EA180	Do you have a vehicle?					
EA181	Do you have a proper drainage system at your home?					
EA182	Do you use dustbins at every place?					
EA183	Do you use natural waste as manure?					
EA184	Do you maintain the drainage system at your home regularly?					

SECTION E: Hangwurian City Development (HCD)

One of the key objectives is to develop an urban development model whose indicators shall emanate from an aggregate of indicators for sustainable urban development, urban liveability, and inclusive physical development. This section tests the knowledge of the residents of the selected cities about the proposed model and how to pre-empt their acceptance of the proposed model.

38. Please rate your responses from 1 – 5 on the Likert Scale, with 5 being a very high level of impact and 1 being the least impact.

INTEGRATED URBAN DEVELOPMENT MODEL (IUDM)		Purpose				
		5	4	3	2	1
Consumption Pattern						
CSP184	Do you engage in training in your city?					
CSP185	Do you have participated in any infrastructure projects?					
CSP 186	Do you have any information on child labour within your area?					
CSP 187	How do you describe work safety in your area?					
CSP 188	How would you describe your satisfaction with the utilisation of environmental resources in your area?					
CSP 189	Do you feel a sense of safety and health in your area?					
CSP 190	Do you feel safe within your local community?					
CSP 191	Have you ever been involved in any form of reuse/recycling of resources?					
Accessibility to the City						
ATC192	Rate your access to various parts of the city generally?					
ATC193	Rate your access to housing and mortgage facilities in the city?					
ATC194	Rate your access to business finance and intervention?					
ATC195	Rate your access to urban public transportation?					
ATC196	Rate the access by women to housing and business finance in the city.					
ATC197	Rate the access by women to public transport.					
ATC198	Rate the access by migrants to land in the city.					
ATC199	Rate the access by migrants to transport infrastructure?					
ATC200	Rate your perception of access to infrastructure by people living with disability (PLWD).					
ATC201	Rate the access by PLWD to public transport.					
ATC202	Rate the access by PLWD to land and housing.					
ATC203	Rate the access by PLWD to education infrastructure.					
Equality						
EQY204	Rate the level of gender equality in your city.					
EQY205	Rate the level of equality for all classes of people in the city.					
EQY206	Rate the level of equality enjoyed by migrant groups in the city.					
EQY207	Rate the extent of equality between PLWD and other people in the city.					

EQY208	Rate the level of equality in the access to transport infrastructure in the city.					
EQY209	Rate the level of equality in housing infrastructure amongst all groups in the city.					
EQY210	Rate the extent of equality enjoyed amongst children in the city.					

APPENDIX 6: INTERVIEW GUIDE FOR STAKEHOLDERS

**Department of Town and Regional Planning
School of Built Environment and Development Studies
College of Humanities
University of KwaZulu-Natal**

**TOPIC: Assessing the Nexus of Sustainable Urban Development, Urban
Liveability and Inclusive Physical Development in
Selected Cities in North-Central Nigeria
Semi-Structured Interview Guide for
Stakeholders**

Dear Sir/Madam

These interview questions are purely for academic research purposes and all information supplied shall be used strictly for that purpose. Please fill in the correct responses in the spaces provided or tick as appropriate. Thank you for your cooperation.

- 1) What is your name?
- 2) Type of occupation?
- 3) What is your view of urban development?
- 4) Do you feel city people are developing?
- 5) Do you think city people are poor or rich?
- 6) What is your view about urban areas and poverty?
- 7) Do you feel cities will continue to expand beyond the city limits in the face of urbanisation?
- 8) Do you feel that the continued uncoordinated urbanisation will continue to spread and lead to the disappearance of green spaces?
- 9) What are the noticeable effects in the development of this city?
- 10) How will you describe this city in relation to infrastructure provision?
- 11) Do you feel that the infrastructure provision has anything to do with household liveability?
- 12) How will you rate urban governance as relating to urban infrastructure provision?
- 13) What is your take on the relationship between urban management and infrastructure provision?
- 14) What infrastructure do you want to see or have provided in this city?
- 15) How are the neighbourhoods and the residents integrated into infrastructure planning?
- 16) What are the roles of the residents in infrastructure provision and planning?
- 17) What is your view about the LGA's autonomy and infrastructure provision?

- 18) How does your agency try to maintain a balance between the urban and rural communal infrastructure demand?
- 19) What are your department's/agency's ways of ensuring urban residents' capacity building?
- 20) How much PPP exists in terms of the city's infrastructure?
- 21) How can the private sector be integrated?
- 22) What do you consider to be the greatest asset (s) of this community that should be considered for development?
.....
- 23) How many of the people living with disabilities are incorporated into infrastructure provision?
- 24) Thank you!!!!"

APPENDIX 7: INFRASTRUCTURE CHECKLIST

Department of Town and Regional Planning
School of Built Environment and Development Studies, College of Humanities.
University of KwaZulu-Natal

TOPIC: Assessing the Nexus of the Sustainable Urban Development, Urban Liveability and Inclusive Physical Development in Selected Cities in North-Central, Nigeria
Infrastructure Inventory Checklist

Dear Sir/Madam

This interview question is purely for academic research purposes and all information supplied shall be used strictly for that purpose. Thank you for your cooperation.

S/N	Infrastructure	Space Allocation	Location Coordinates	Public/ Private/ PPP	If Private, Name of Institution	Year Constructed/ Perceived Amount Invested	Maintained By? Public/Private
1	Open Green Spaces						
2	Recreational Spaces						
3	Road						
4	Road Signals on Road						
5	Ramps for PLWD						
6	Zebra Crossing						
7	Pedestrian Bridge						
8	Walk Path on Road Shoulder						
9	Green Belt Along Major Roads						
10	Hospital						
11	Road Signs						
12	Police Post/Station						

13	Organised Market						
14	Open and Informal Market						
15	Shopping Mall						
16	Speed Limiting Device						
17							
18							
19							
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