Journal of Urban Development and Management
https://www.acadlore.com/journals/JUDM

From Traditional to Smart: Embedding Human-Centric Principles into Urban Facility Planning for Inclusive Development in African Cities

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Received: 05-09-2025 **Revised:** 06-16-2025 **Accepted:** 06-20-2025

Citation: J. O. Egharevba, "From traditional to smart: Embedding human-centric principles into urban facility planning for inclusive development in African cities," *J. Urban Dev. Manag.*, vol. 4, no. 2, pp. 120–140, 2025. https://doi.org/10.56578/judmjudm040204.

Abstract: Both traditional urban planning and smart cities in many African cities has failed to address the needs of all residents, particularly those in informal settlements, resulting in exclusionary infrastructure and socio-spatial inequalities. This study, with case studies of Benin Metropolis and Warri City, explored how human-centric principles could be embedded into urban planning for inclusive development. Based on thematic analysis of qualitative data obtained from planning professionals, the study identified key barriers such as limited community participation, inadequate infrastructure for vulnerable groups, weak institutional capacity, and low digital integration. Findings demonstrated that current planning frameworks often neglected accessibility for people with disabilities and the needs of informal settlement dwellers. The study recommended that Edo and Delta State governments should revise existing policies to mandate inclusivity, participatory governance, and data-driven decision-making. It proposed targeted investments in inclusive infrastructure such as ramps and communal water points, as well as increased funding for human-centric and digital planning tools like geographic information system (GIS). Decentralized governance, transparent procurement processes, and ethical guidelines for digital engagement were emphasized to promote trust and accountability. To ensure inclusivity across all social groups, the study underscored the requisites for co-design workshops, community forums, and non-digital communication channels such as radio and feedback kiosks. Specific local realities such as flooding in Benin and ethnic diversity in Warri should be factored into planning frameworks to ensure relevance and sustainability. Overall, this research presented a context-sensitive framework that aligned with the trends of global smart cities, while addressing the socio-cultural and infrastructural realities of African cities. By embedding human-centric principles into policy and practice, Benin and Warri could transition from traditional to smarter urban planning models that are inclusive, participatory, and sustainable, thus ensuring that urban development could meet the diverse needs of all residents..

Keywords: Human-centric planning; Inclusive development; Urban governance; Smart cities; African urbanisation

1 Introduction

In contemporary urban planning, smart city as a dominant paradigm, is defined by the integration of interconnected information and communication technologies (ICTs) to monitor, optimise, and manage urban systems more effectively. The aim of developing a smart city is to enhance the quality of life, improve the efficiency of service delivery, and ensure the sustainable utilization of limited resources [1]. Central to this model is a digital infrastructure that enables innovative responses to complex urban challenges, thus facilitating the development of data-driven, sustainable, and responsive city systems. Smart urban facility planning encompasses a wide range of initiatives from intelligent transportation and energy management to public safety and waste handling, hence leveraging real-time data, automation, and analytics to streamline operations and enhance urban living conditions [2].

More importantly, contemporary smart city frameworks often emphasize participatory governance and citizen engagement through digital platforms that foster transparency, inclusiveness, and accountability [3]. By aligning technological innovation with inclusive urban policies, smart cities seek to achieve resilience, equitable resource management, and sustainable development goals. Practical applications include smart traffic control systems to

mitigate congestion, smart energy grids for efficient load management, and interactive digital portals to facilitate community feedback and decision-making.

In African cities, the transition from traditional urban and facility planning toward smart initiatives is gaining a high level of acceleration. This is driven by the pressing challenges of rapid urbanisation, infrastructural deficits, and environmental pressures [4]. While smart city initiatives such as Kenya's Konza Technopolis, Nigeria's Eko Atlantic City, and Rwanda's Kigali Innovation City showcase the continent's embrace of digital urbanism, significant barriers seem to persist. Prevailing issues such as inadequate funding, fragmented governance, spatial inequalities, and limited digital access threaten to undermine the inclusivity and sustainability of smart city projects [5, 6]. Thus, there is a critical need to move beyond technology-centric approaches and embed human-centric principles, specifically accessibility, equity, utilisation, and participatory design into smart urban facility planning. Addressing this gap is essential for ensuring that smart city development in Africa advances inclusive, context-sensitive, and sustainable urban futures.

To incorporate human-centred design (HCD) into the planning for African smart cities, non-smart cities like Benin Metropolis and Warri City should achieve the following objectives: (i) to assess the integration of human-centric principles into urban facility planning; (ii) to examine barriers to inclusive and sustainable infrastructure in a non-smart city context; (iii) to explore opportunities for embedding digital and ethical approaches; and (iv) to propose a context-sensitive framework to guide their transition toward smarter and more inclusive urban governance.

1.1 Literature Review

Africa is rapidly urbanising, with over 50% of its population projected to reside in cities by year 2035 [1]. This rapid urbanisation is fuelling the rise of smart city initiatives in response to tackling infrastructural deficits, climate change, and urban dynamics. Smart city paradigms require integrating human and social capital with ICTs to drive sustainable growth, hence emphasizing participatory governance and community-led processes [5]. Projects such as Kenya's Konza Technopolis, Nigeria's Eko Atlantic City, and Rwanda's Kigali Innovation City utilise internet of things (IoT), renewable energy, and e-governance to create sustainable and tech-driven urban hubs [4]. Supported by government policies, private sector investment, and international partnerships like the African Union's Agenda 2063 [7], these initiatives aim to enhance economic growth and quality of life. However, challenges such as funding limitations, digital divides, and social inequality pose risks to inclusivity [2], thus necessitating innovative and equitable policies for success.

As many African cities adopt smart urban initiatives, they tend to overemphasize technology such as sensors, data platforms, and automation at the expense of human-centred approaches that prioritise accessibility, equity, and community participation [6, 8, 9]. This tech-centric focus often overlooks the complex social realities of urban residents, especially marginalised groups, resulting in "smart" projects that fail to meet basic needs or exacerbate existing inequalities [5]. Scholars argued that truly sustainable urban development required embedding human-centric principles like participatory planning and equitable service delivery into smart infrastructure projects, rather than treating technology as an end in itself [5, 10–12].

Access to urban facility in African cities faces significant challenges due to spatial inequalities and digital exclusion, limiting equitable access to essential services like healthcare, education, markets, and transport [13]. It is projected that over 50% of Africans will have lived in urban areas by year 2035; according to a 2020 estimate, informal settlements house about 60% of urban residents. These residents often lack basic infrastructure such as water, sanitation, and reliable transport, perpetuating long travel time and poor service delivery [1, 14]. Historical segregation and poor urban planning exacerbate these disparities, leaving low-income and peri-urban communities underserved [15]. Additionally, there is the case of digital exclusion, with only 39% of internet penetration in Sub-Saharan Africa in year 2022. This restricts access to smart city initiatives, particularly for women, youth, and informal settlers who face barriers in digital literacy and connectivity [3, 16]. Addressing these challenges demands policies that integrate spatial justice and digital inclusivity to ensure equitable urban development [17].

The push for urban digital transformation in African cities must be inclusive, ethical, and context-sensitive to avoid reinforcing existing inequalities and marginalising vulnerable populations [18]. Many digital initiatives are imported models that fail to account for local, social, economic, and spatial complexities, leading to exclusionary outcomes [19–21]. Ethical urban digitisation requires participatory governance, protection of data rights, and prioritising community needs over commercial interests [22–24]. Context-sensitive approaches ensure that technological solutions are adapted to local capacities, infrastructure conditions, and cultural dynamics, thereby promoting more equitable and sustainable urban futures [8].

While smart city models exist, few embed human-centric principles tailored to the socio-cultural and infrastructural realities of African cities. Therefore, there is a pressing need for research that advocates and advances an inclusive, ethical, and context-sensitive approach to the planning of smart urban facilities in Africa. Accessibility, equity, utilization, and participatory design were emphasized as core pillars for urban digital transformation, which could be integrated into the design of African smart city initiatives to promote equitable and sustainable urban development.

Inclusive planning tools, such as participatory geographic information systems (PGIS), foster equity by incorporating local knowledge into land-use decisions, while HCD and participatory workshops enhance collaboration and occupant satisfaction in projects like the smart city initiatives in Accra [25, 26]. Analytical tools like geographic information system (GIS) based spatial accessibility analysis and transit-oriented development (TOD) strategies further support equitable facility planning by identifying facility service gaps and improving walkability or sustainable transport [27]. The guidelines of universal accessibility stipulated by The United Nations Children's Fund (UNICEF) and World Bank also promote inclusive infrastructure design [28], which emphasized that smart infrastructure should be co-designed with communities using PGIS, HCD, and accessibility assessments to ensure equity, accessibility, and inclusion.

1.2 Theoretical and Conceptual Framework

Under this section, the following key theories and concepts were discussed to provide a foundation for understanding the dynamics of technology and urban transformation, such as HCD, smart city ecosystem, and the right to the city. HCD emphasises designing urban technologies and systems with the needs, experiences, and participation of people at the core. It advocates inclusive planning processes that prioritised accessibility, usability, and responsiveness to diverse urban populations. The concept of the smart city ecosystem provides a perspective through which to view cities as interconnected networks of digital infrastructure, governance, stakeholders, and data flows working together to enhance urban life. It highlights the importance of innovation, data integration, and collaborative partnerships in building sustainable and efficient cities. Finally, the right to the city serves as a normative and political concept that underscores the rights of all urban dwellers particularly marginalised groups to access, shape, and benefit from the city. Together, these concepts offer a layered approach to examining how urban development and technological innovation can be aligned with equity, participation, and sustainability. Concepts of inclusivity, urban equity, digital resilience, local innovation systems and integration of indigenous knowledge were also discussed.

1.2.1 HCD

HCD is defined as an iterative and problem-solving approach that seeks to involve end-users directly in the design process to ensure solutions are tailored to their real needs, contexts, and experiences [29]. Theoretically, HCD is rooted in design thinking, participatory planning, and systems theory. It draws its principles from cognitive psychology and human-computer interaction to create solutions that balance functionality, usability, and socio-cultural relevance [25, 30]. It emphasizes empathy, co-creation, and iterative prototyping, thereby positioning people, but not technology, as the central drivers of innovation.

HCD is a user-focused framework that prioritises the needs, experiences, and socio-cultural contexts of individuals in developing accessible and equitable urban solutions. As part of African smart city initiatives, HCD emphasizes iterative processes such as community engagement through interviews, focus groups, and co-design workshops to ensure technologies address local challenges from healthcare and transport access [29]. For instance, in Accra, HCD has been applied to co-create smart city projects, integrating resident feedback to enhance occupant satisfaction and sustainability, particularly for marginalised groups [26]. Centring on users, HCD counters the tech-centric bias of many smart city models, so as to ensure that infrastructure aligns with the lived realities of diverse urban populations.

This approach is particularly vital in African cities, where 60% of urban residents live in informal settlements with limited access to basic services [13]. The participatory methods of HCD, such as co-designing charrettes, empower underserved communities to shape urban planning via addressing issues like long travel time to schools and clinics [31]. By fostering collaboration between planners and residents, HCD ensures smart city initiatives are inclusive and responsive, thus reducing the risk of elitist developments that exacerbate inequalities. Its adaptability to local contexts makes it a critical tool for sustainable urban transformation in Africa.

1.2.2 Smart city ecosystem framework

The smart city ecosystem framework is defined as a holistic approach to urban development that conceptualises the city as a complex adaptive system, where technology, governance, economy, and society interact dynamically to foster sustainability and resilience [32]. Theoretically, it is underpinned by systems theory, socio-technical systems thinking, and urban governance theory, which together highlight the interdependencies between digital infrastructures, institutional arrangements, and citizen participation [33, 34]. By viewing cities as ecosystems, the framework stresses balance between technological innovation, human well-being, and environmental sustainability rather than treating technology as the sole driver of progress.

This framework integrates technology, governance, and people to create sustainable and resilient urban environments. The framework emphasizes the synergy of ICTs (e.g., IoT, smart grids, etc.), participatory governance, and human capital to enhance the quality of life and economic growth [35]. In the African contexts, projects like Kenya's Konza Technopolis and Rwanda's Kigali Innovation City leverage IoT and e-governance to address challenges of urbanisation, but often lack robust community involvement and risk exclusionary outcomes [4]. This framework advocates collaboration of multi-stakeholders to balance technological innovation with social equity, ensuring smart cities serve all residents.

However, the success of the framework in Africa hinges on addressing digital divides, with only 39% of internet penetration in Sub-Saharan Africa, thus limiting access to the benefits of smart city [16]. Effective governance within the ecosystem requires policies that prioritise inclusivity, such as involving local communities in decision-making to align projects with socio-economic realities [3]. By fostering partnerships among governments, private sectors, and citizens, the framework can mitigate funding constraints and cultural misalignments, thus creating smart cities that are both technologically advanced and socially inclusive.

1.2.3 Henri Lefebvre's right to the city

The right to the city is defined as both a normative claim and a political framework that assert that all urban inhabitants, not just elites, should have equal rights to access, use, and shape urban spaces [36]. Theoretically, the concept was grounded in critical urban theory and Marxist political economy, which viewed urban space as socially constructed and contested [37, 38]. Right to the city also drew from democratic theory and participatory governance, positioning cities as arenas where citizenship extended beyond legal status to include active engagement in decision-making about urban resources and development [39]. The concept is, therefore, both a critique of exclusionary and market-driven urbanism, and a call for transformative and inclusive planning practices.

The concept of right to the city was developed by Henri Lefebvre, to advocate inclusive urbanism where all residents, particularly marginalised groups, have a right to participate and shape their urban environments [36]. In African cities, this framework criticised tech-centric smart city models, such as Nigeria's Eko Atlantic City, which often prioritize commercial interests over the needs of low-income communities, thereby exacerbating spatial inequalities [37]. By emphasising participatory planning, the right to the city calls for urban development that ensures equitable access to services like healthcare, education, and transport, hence addressing the needs of 60% of the urban residents in informal settlements [13].

This framework is particularly relevant in African urban contexts, where historical segregation and inadequate planning have left peri-urban areas underserved, with many residents spending over 30–60 minutes to travel to essential services [31]. The right to the city promotes tools like community mapping and participatory governance to empower residents, so as to ensure urban policies reflect local priorities and cultural dynamics [40].By challenging exclusionary smart city paradigms, this framework supports the creation of urban spaces that are democratic, accessible, and socially just, hence aligning with the urgent need for inclusive urban transformation in Africa.

1.2.4 Interrelatedness of the theories

HCD, smart city ecosystem framework, and the right to the city concept are deeply interconnected in their collective support for inclusive, equitable, and context-sensitive urban development in African smart cities. The user-focused design of HCD complements the emphasis of smart city ecosystem on integrating people with technology and governance, in order to ensure that smart infrastructure aligns with community needs [29, 35]. The right to the city is reinforced by demanding participatory processes that empower marginalised groups to align with the co-design methods of HCD and the call for multi-stakeholder collaboration by the ecosystem [26, 36]. Together, these frameworks address the gap in African smart city initiatives where tech-centric models often overlook socio-cultural realities by promoting participatory governance, equitable service access, and localised solutions, hence fostering sustainable urban futures that prioritize both human and technological dimensions [3]. More specifically, they provide the analytical lens for this study by (i) guiding the assessment of how human-centric principles are integrated into urban facility planning in Benin Metropolis and Warri City; (ii) framing the identification of barriers such as financial, institutional, and governance constraints; and (iii) illuminating opportunities for embedding digital and ethical approaches into planning processes [33, 34]. By synthesising these perspectives, the study proposed a context-sensitive framework that advanced inclusive, participatory, and technologically adaptive governance models, to enable the transition of Benin and Warri from traditional to smarter and more inclusive cities [32].

Figure 1 demonstrates the interrelatedness of HCD, the smart city ecosystem, and the right to the city in embedding human centricity (an approach that places peoples' needs, experiences, and well-being at the centre of design, decision-making, and development processes) within urban planning in Benin Metropolis and Warri City. At its core, HCD promotes user-focused and co-design approaches that align with community needs while addressing socio-cultural realities such as religious and traditional believes, ethnic diversity, and socio-economic inequalities. This framework ensures that the planning process is rooted in empathy, promotes inclusivity, and encourages co-creation, thereby leading to outcomes that advance fairness and equity. By engaging diverse social groups in the design process, planners gain insight into varying needs and constraints. Such as, those faced by women, informal settlers, persons with disabilities, or minority ethnic groups and can design interventions that distribute resources and opportunities more fairly. Inclusivity ensures that no group is overlooked in decision-making, while empathy fosters understanding of how different populations experience the urban environment. Co-creation, in turn, transforms communities from passive recipients into active partners in shaping their spaces. Together, these attributes lead to equity-oriented outcomes by ensuring that urban policies, services, and facilities respond proportionally to different levels of need. This will systemically reduce disadvantages and promote fairness across social groups. The smart city ecosystem

complements this by linking people, technology, and governance, while also identifying barriers such as financial, institutional, and governance constraints. Through digital infrastructure, multi-stakeholder collaboration, and ethical opportunities, it provides the structural and technological foundation for implementing human-centric principles in practice.

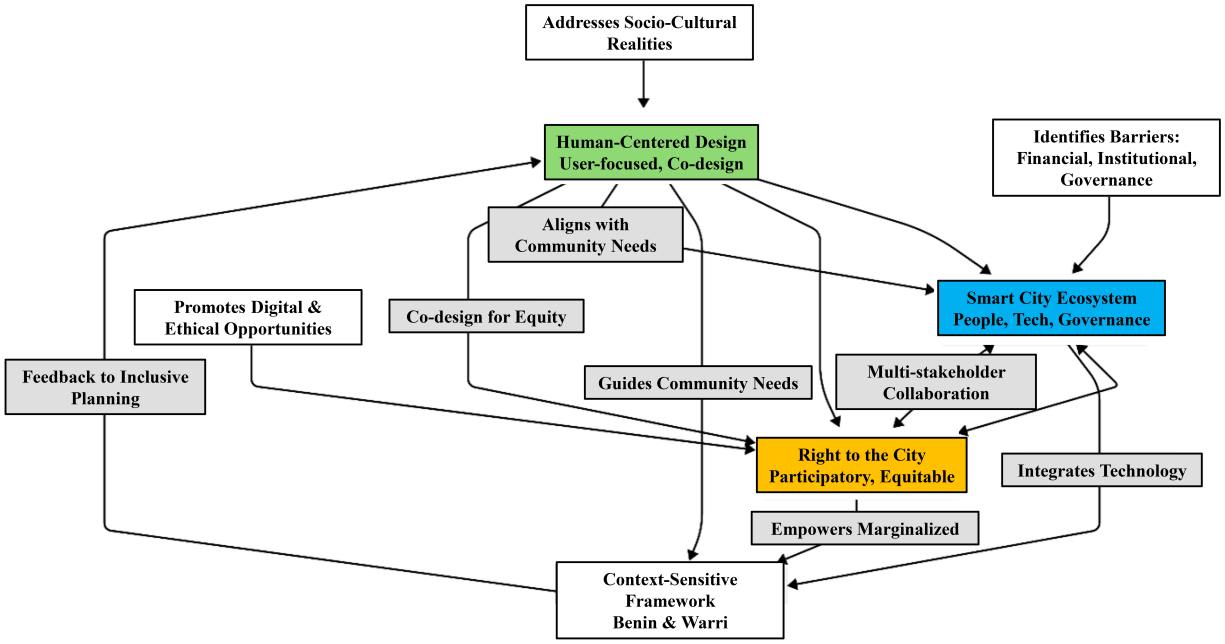

Figure 1. Interrelatedness among human-centred design (HCD), smart city ecosystem, and the right to the city in addressing human centricity in the study areas

The right to the city functions as the ethical and participatory foundation of urban governance, ensuring that inclusivity and the empowerment of marginalised groups remain at the heart of planning and decision-making processes. The right to the city reinforces equity by emphasising community participation, co-design, and fair access to urban resources, thereby grounding technology and governance with a framework of social justice. It asserts that all urban residents especially the marginalised should have not only access to the city's facilities, services and spaces but also a voice in shaping how those spaces are planned, managed, and governed. In this way, planning becomes a collective process rooted in democratic participation rather than top-down decision-making. Feedback loops across the three frameworks illustrate how they mutually reinforce one another, creating a continuous process where each framework strengthens and complements the others in promoting human-centric urban development. HCD shapes inclusive designs; the smart city ecosystem operationalises these designs through digital and governance tools, and the right to the city ensures equitable distribution and citizen empowerment. Collectively, these interconnections offer a pathway to inclusive, adaptive, and sustainable urban development where human needs remain at the centre of planning and decision-making, hence producing a framework tailored to Benin and Warri.

1.3 Key Concepts

This section covered the following concepts: Accessibility, Inclusivity, Urban equity, Digital resilience, Local innovation systems, and Indigenous knowledge integration.

1.3.1 Accessibility

Accessibility is a core principle for human-centric planning of urban facilities, providing equitable access to healthcare, education, markets, and transport for all residents, including marginalised groups. In African cities such as Benin Metropolis and Warri, spatial inequalities, weak infrastructure, and poor transport often leave informal settlements home to over 60% of underserved urban residents [13, 14]. Given the low internet penetration of 39% in Sub-Saharan Africa meaning that approximately 61% of the population struggle to remain online. Smart city initiatives risk deepening existing inequalities if they prioritise technology without simultaneously addressing physical and digital access gaps [16]. Compared to regions such as Europe, where internet penetration exceeds 90%, and North America, with over 88%, this disparity highlights a significant digital divide that limits participation in technology-driven urban systems. These gaps refer not only to the uneven distribution of digital connectivity but also to disparities in affordability, skills, and accessibility, particularly for residents in informal settlements and

peri-urban areas. Embedding accessibility, therefore, requires the incorporation of universal design features, that is, design principles that make physical and digital infrastructure usable by all people, regardless of age, ability, or socio-economic background. This approach, combined with affordable digital tools and governance frameworks that mandate equitable service distribution and ensures that technological innovation contributes to inclusion rather than exclusion. By linking infrastructure, policy, and technology to residents' needs, accessibility transforms smart city initiatives into inclusive systems that advance equity and realize the right to the city [3, 17].

1.3.2 Inclusivity

Inclusivity in urban development emphasizes active participation and representation of all social groups in the design, planning, and governance of cities. It aims to ensure that access to urban services, infrastructure, and opportunities is equitably distributed, particularly among marginalised populations, thus bridging the gap created by historical inequalities [13]. Smart city initiatives embedding inclusivity recognise the need for participatory decision-making to create environments where diverse needs are acknowledged and addressed [41].

1.3.3 Urban equity

Urban equity focuses on fair access to resources, services, and opportunities across different social, spatial, and economic groups within a city [42]. In the context of smart urban planning, urban equity challenges projects to move beyond technological efficiency and ensures that the benefits of innovation are not concentrated in the elite group but are equitably distributed to include informal settlements, low-income communities, and vulnerable populations [43].

1.3.4 Digital resilience

Digital resilience of a city refers its ability to leverage technology while ensuring continuity, adaptability, and protection of residents' rights amidst digital disruptions, inequalities, and vulnerabilities [44]. In African cities, building digital resilience involves closing connectivity gaps, strengthening digital literacy, and safeguarding data rights to ensure that all residents can meaningfully participate in and benefit from digital urban transformations [3].

1.3.5 Local innovation systems

Local innovation systems emphasize the role of localized networks, including firms, government institutions, universities, and civil society in fostering context-appropriate technological and social innovations [45]. In African smart city initiatives, strengthening local innovation systems ensures that urban technologies and solutions are developed in ways that reflect indigenous needs, capabilities, and aspirations rather than importing models designed for European or Western contexts that may not suit local realities [46].

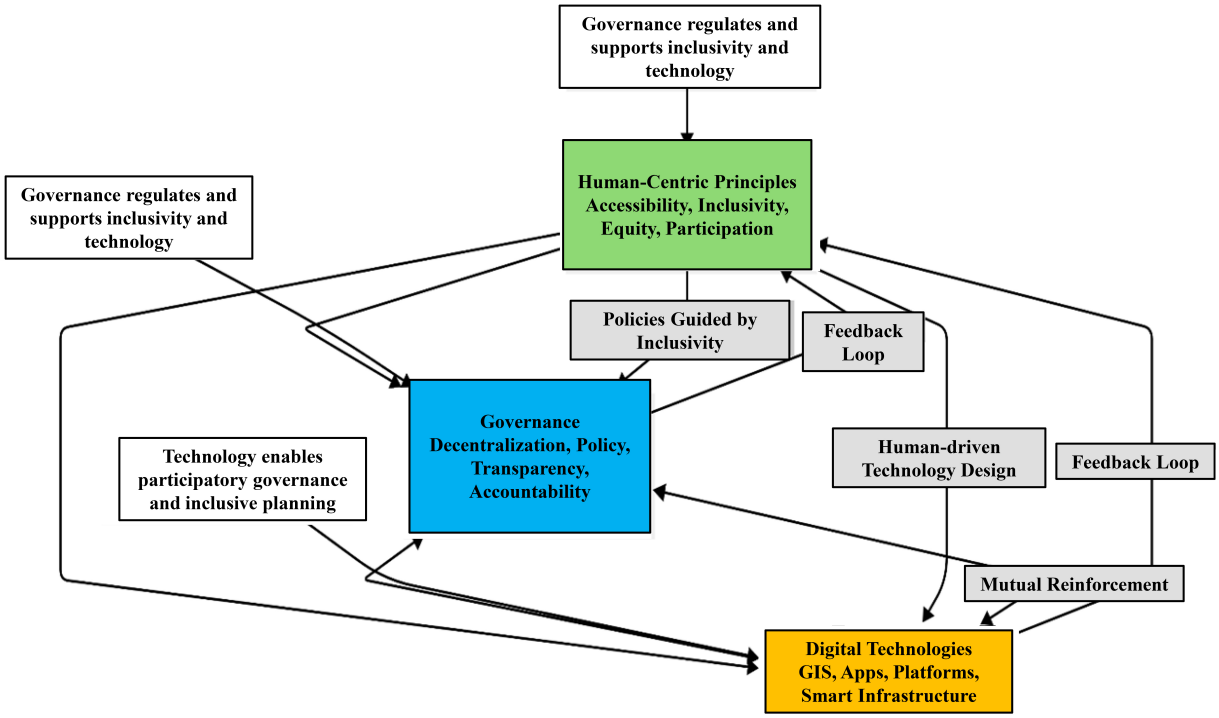

Figure 2. Interaction among human-centric principles, governance, and digital technologies

1.3.6 Indigenous knowledge integration

Indigenous knowledge integration recognises the value of traditional knowledge systems, practices, and cultural insights in shaping sustainable and resilient urban development [47]. In smart urban planning, leveraging indigenous knowledge offers pathways to contextually grounded solutions that are environmentally sustainable, socially inclusive, and culturally sensitive [48].

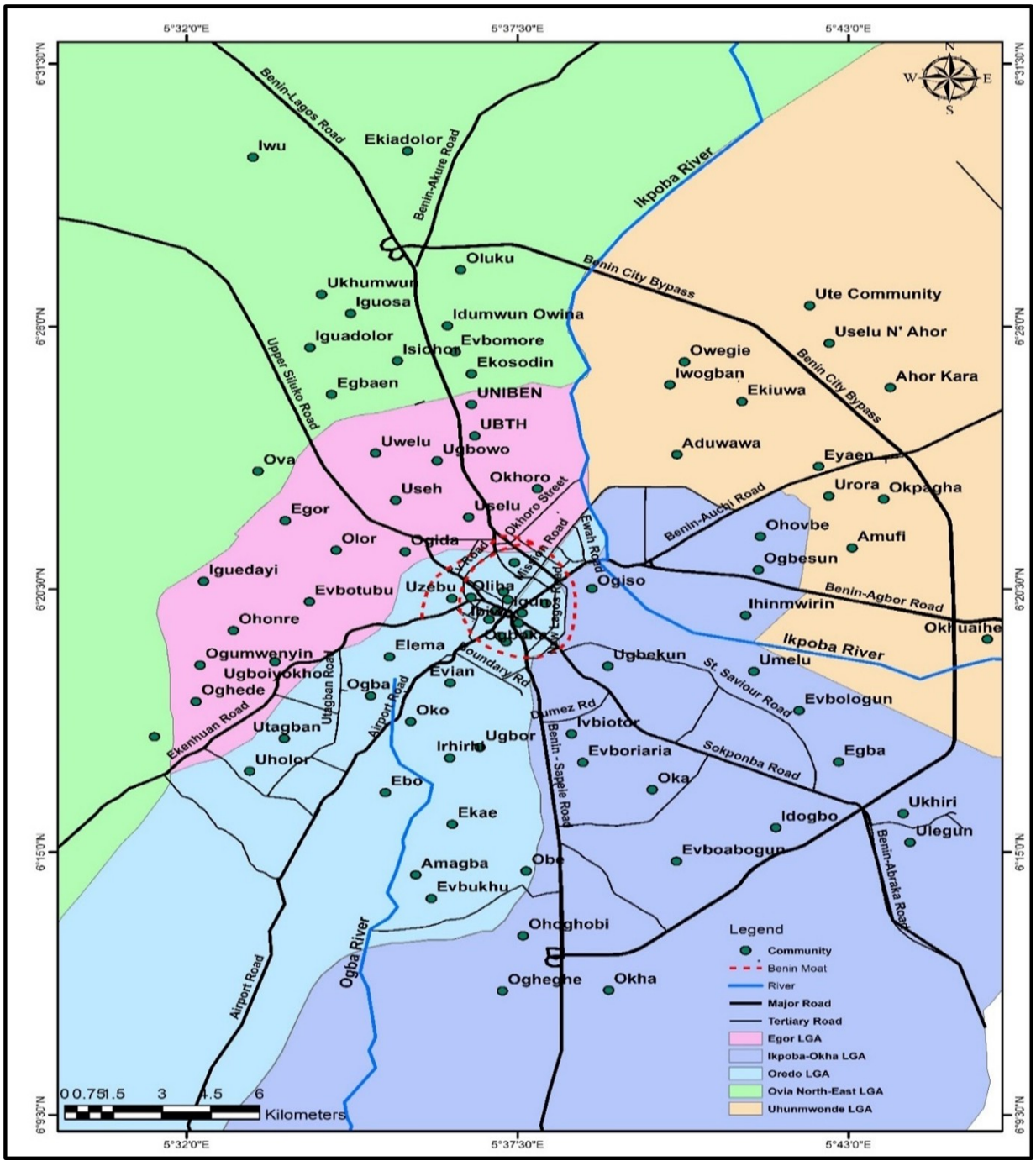

Figure 3. Urbanised communities in Warri City

1.3.7 Human-centric planning and digital governance

The interaction between human-centric principles, governance, and digital technologies has become a central concern in contemporary urban planning, particularly in the context of rapidly urbanising African cities. Human-centric principles such as accessibility, inclusivity, and equity provide the foundation for designing urban systems that address the diverse needs of residents and reduce socio-spatial inequalities [13]. Governance frameworks play a crucial role in institutionalising these principles by ensuring transparency, decentralisation, and participatory processes in

policy and planning [15]. Meanwhile, digital technologies, including GIS, citizen engagement platforms, and mobile applications, are increasingly deployed to enhance data-driven decision-making and community participation [3]. However, without integration, technology risks reinforcing exclusion, while governance mechanisms that ignore human needs may undermine the promise of smart urbanism. Understanding how these three elements interact offers valuable insights for embedding human-centric approaches into urban facility planning. Digital innovations should be aligned with governance structures and residents' needs to foster inclusive, equitable, and sustainable urban development [17, 49].

Figure 2 illustrates how accessibility, inclusivity, equity, and participation guide both governance and technology in urban facility planning. Governance establishes policies, decentralisation, and accountability mechanisms that support inclusivity and regulate technology, while digital tools such as GIS, apps, and smart infrastructure enable participatory planning and strengthen transparency. Feedback loops showed that governance and technology should remain human-driven, ensuring continuous alignment with citizens' needs. Together, these elements create a mutually reinforcing system that fosters inclusive, equitable, and sustainable urban development.

1.4 Study Area

Benin Metropolis is located in Edo State, Nigeria. It serves as the capital and largest metropolitan centre of the state, located between Latitudes 6°16'N and 6°33'N and Longitudes 5°31'E and 5°45'E, covering approximately 1,318 km^2 [50]. Geographically, it lies on a relatively flat terrain at about 78 meters above sea level, with fertile agricultural landscapes supporting the rubber and palm oil industries in Nigeria [51]. The metropolis comprises five local government areas, i.e., Oredo, Egor, Ikpoba-Okha, Ovia North-East, and Uhunmwonde in Figure 3. The metropolis is characterised by rapid urban sprawl along trunk transport corridors like Sokponba and Sapele roads, extending into peripheral areas [51]. Despite its economic vibrancy, with a well-planned urban core centred around the Oba's Palace and King's Square, the city faces challenges such as flooding due to poor storm drains, inadequate waste management, and urban sprawl, which exacerbate spatial inequalities and inadequate distribution of social facilities [52]. With 60% of its urban population residing in informal settlements, issues like limited access to healthcare, education, transport, and internet, highlight the need for inclusive urban planning to address digital and socio-economic divides [13, 16].

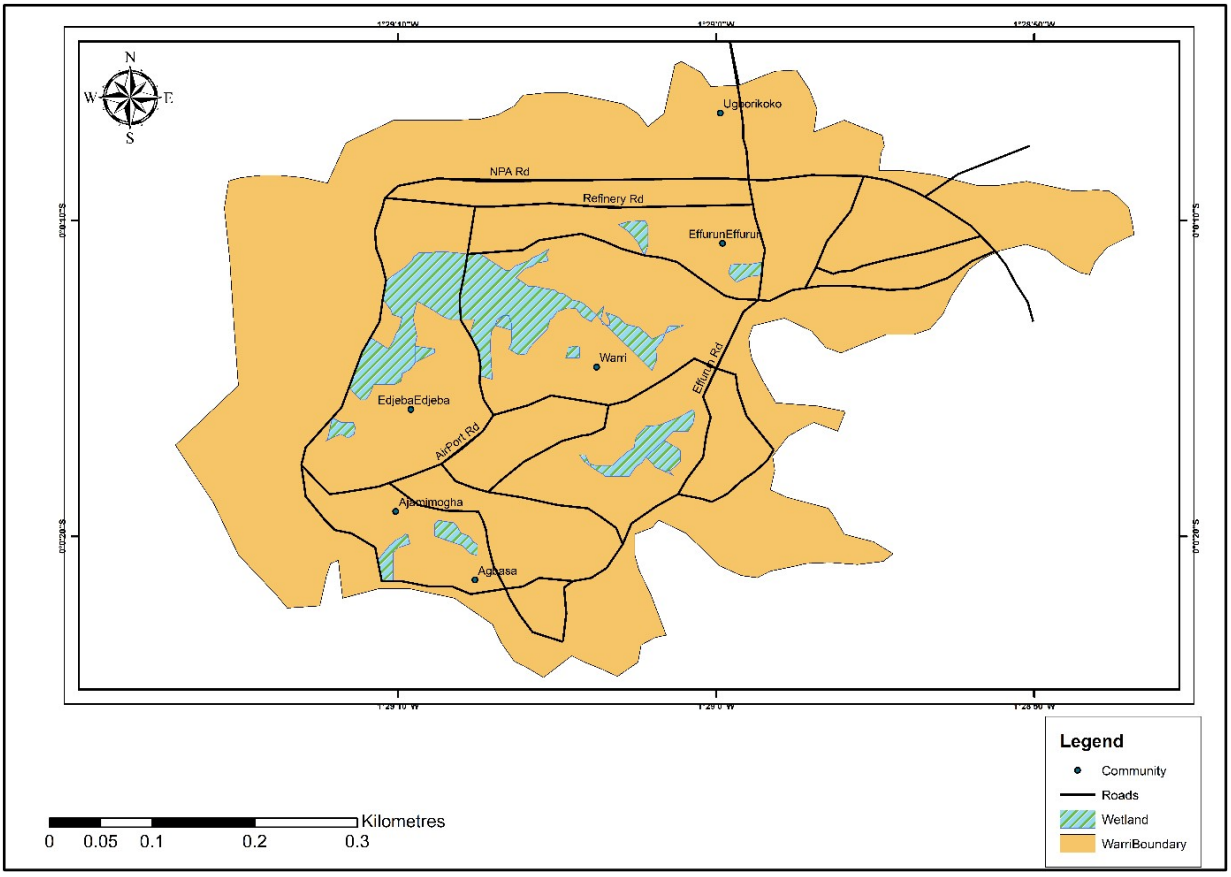

Figure 4. Urbanised communities in Benin Metropolis
Source: Google Earth (2025)

Warri City, located in Delta State of southern Nigeria, is a major urban and economic centre in the Niger Delta region, shaped by rapid urbanisation and oil-related industrialization. With a population exceeding 500,000, the city is marked by significant spatial inequalities, inadequate infrastructure, and widespread informal settlements. Public facilities such as transport, healthcare, and education are overstretched, particularly in low-income areas. Environmental degradation from oil exploration further compounds urban challenges. Despite these issues, Warri remains a strategic site for urban innovation due to its commercial relevance and population diversity. The city exemplifies the infrastructural and governance constraints common to many West African cities. These dynamics turn it into an appropriate case study for examining the role of human-centric principles such as equity, accessibility, and participatory planning in smart urban facility development. The context of Warri underscores the importance of inclusive and locally grounded approaches to smart city planning. See Figure 4.

2 Methodology

This study employed a qualitative research design to examine the integration of human-centric principles into urban facility planning to promote inclusive development in non-smart African cities, especially Benin Metropolis (Figure 3) and Warri City (Figure 4) in the case studies. These cities were selected because they are rapidly growing urban centres that have not yet adopted full smart city infrastructure but faced urgent challenges of inclusive urban development. A total of 40 participants were purposively selected: with 15 urban planners and 5 community leaders recruited from Benin Metropolis and Warri City each. All participants excluding the 10 community leaders were directly involved in urban development policies, design, and implementation through their respective city planning institutions. The sample size was guided by the principle of data saturation; as no new themes emerged after the 12th and 13th interviews in each city, the data collected were confirmed to be comprehensive for analysis. To enhance credibility and trustworthiness, the interviews were conducted by the researcher with the support of two trained research assistants in each city.

The interviews were semi-structured and guided by a well-developed interview protocol that aligned with the objectives in this study. This format allowed consistency across the interviews while providing flexibility for respondents to elaborate on context-specific challenges and strategies in planning. All interviews were hand-written as recording consent was not granted by respondents. The responses of the respondents were transcribed verbatim for analysis. The collected data provided a rich understanding of the current practices, perceived barriers, and potential strategies for embedding human-centric and inclusive approaches into urban facility planning in non-smart cities.

The data were analysed using thematic analysis, a robust and flexible qualitative analytic method that allows identification, interpretation, and reporting of patterns or themes within the dataset. Thematic analysis was chosen because it is particularly well-suited for exploring complex social phenomena such as planning practices, perceptions, and institutional constraints, especially within the context of urban governance. This method enabled the researcher to move beyond surface-level content and uncover underlying meanings and relationships within the urban planning narratives of the contextual cities (Benin Metropolis and Warri). To enhance reliability, two independent coders (the researcher and one assistant) reviewed a subset of transcripts. Inter-coder reliability was first assessed through a percentage agreement approach, which yielded an initial concordance rate of 85%. Any discrepancies were then resolved through consensus-building discussions until full agreement was reached on the coding schemes. This combined use of quantitative and qualitative validation strengthened the dependability and confirmability of the findings.

It also enabled a comparative exploration of the similarities and differences in planning practices between Benin Metropolis and Warri City. The themes were generated inductively, meaning they emerged directly from the data rather than being predetermined by existing theories or frameworks. In this approach, the researcher carefully examined the interview transcripts from urban planners and community leaders to identify recurring ideas, patterns, and meanings expressed in their own words. As similar views and experiences appeared across multiple responses, they were grouped together to form broader themes. This process allowed the findings to reflect the authentic perspectives of participants, ensuring that interpretations were grounded in their lived realities rather than imposed by external assumptions. This approach guaranteed that the analysis remained grounded in the participants' (30 urban planners and 10 community leaders) lived experience and professional experiences. Through iterative reading, coding, and refinement, the research identified key thematic categories, including limited integration of human-centric principles, financial and institutional constraints, digital divide, and technological barriers to address each of the objectives in this study. Other themes were governance and political challenges, social and community engagement barriers, context-specific needs and cultural relevance, and opportunities for inclusive and ethical digital integration. These themes, formed the basis for the discussing the findings in the findings and discussion sections, offered insights into how human-centric planning principles could inform a pathway toward smarter and more inclusive urban governance in non-smart African cities.

Table 1. Roles and responsibilities of urban planners and practitioners in Benin Metropolis and Warri City

Code	Role/Title	Main Responsibilities/Focus Areas
BMPO-1	Area Planning Officer, Edo State Urban Development Agency	Land-use zoning, infrastructure (e.g., roads), coordinating with communities and government
BMPO-2	Area Planning Officer, Quede Local Government	Reviewing building permits, enforcing master plan compliance, especially in Ekerway
BMPO-3	Town Planning Officer	Managing public space projects (e.g., markets), flood control advisory
BMPO-4	Town Planning Officer (Consultant Planner)	Assisting in private housing projects, promoting green spaces
BMPO-5	Area Planning Officer, Edo State Ministry of Physical Planning	Transport planning to reduce congestion around King's Square
BMPO-6	Boundary Men	Data collection on informal settlements, sanitation, and access solutions in Itpsha-Okia
BMPO-7	Boundary Men (Community Engagement Officer)	Engaging residents in urban renewal projects, e.g., in Egor
BMPO-8	Town Planning Officer (Public Infrastructure Specialist)	Improving water supply access in underserved areas
BMPO-9	Area Planning Officer (GIS Specialist)	Mapping urban sprawl for sustainable expansion
BMPO-10	Area Planning Officer	Drafting affordable housing policies for urbanizing areas like Sapele Road
BMPO-11	Town Planning Officer, Planner, Whumsonde	Strengthening rural-urban linkages via road and market planning
BMPO-12	Area Planning Officer	Addressing flooding with improved drainage in low-lying areas
BMPO-13	Town Planning Officer	Improving water and sanitation in slums like those in Ovia North-East
BMPO-14	Town Planning Assistant	Aligning development with Benin's cultural heritage and site preservation
BMPO-15	Town Planning Officer	Enhancing public transport near hubs like Ugbows
WCPO-1	Town Planning Officer, Delta State Urban Planning Board	Land-use planning and infrastructure projects in central Warri, e.g., Effurun
WCPO-2	Town Planning Officer, Utwie Local Government	Reviewing commercial development proposals for zoning compliance
WCPO-3	Area Planning Officer, Okere, Warri South Local Government	Focusing on public facilities (e.g., markets) and waste systems
WCPO-4	Town Planning Officer, Delta State Ministry of Urban Development	Advising housing for population growth due to oil activities
WCPO-5	Boundary Men	Planning roads to reduce congestion in Ubly
WCPO-6	Town Planning Officer (Freelance Planner)	
WCPO-7	Town Planning Officer (Infrastructure Project Manager)	Engaging communities in Warri South-West for projects like flood barriers
WCPO-8	Boundary Men (Community Engagement Officer)	Upgrading drainage systems in flood-prone areas of Warri
WCPO-9	Area Planning Officer (GIS Analyst)	Mapping urban growth near the port for sustainable expansion
WCPO-10	Area Planning Officer	Creating housing policies to support oil-sector workers
WCPO-11	Boundary Men (Transport Planner)	Improving transport links between Warri and Wowie
WCPO-12	Boundary Men	Managing pollution from oil activities through waste strategies
WCPO-13	Town Planning Officer (NGO Collaborator)	Improving sanitation in the informal settlements in Warri
WCPO-14	Area Planning Officer (Heritage Planner)	Ensuring urban development respects Warri's ethnic heritage (Itsekin, Urhobo, Ijaw)
WCPO-15	Area Planning Officer (Public Space Planner)	Upgrading parks and markets to enhance urban livability in Warri

Note: BMPO means Benin Metropolis Planning Officer whereas WCPO means Warri City Planning Officer

2.1 Presentation of Data

Table 1 provides an overview of the roles and responsibilities of urban planners and related professionals working in Benin Metropolis and Warri. The data in Table 1 highlighted the diverse range of planning functions carried out at local and state levels, including land-use management, infrastructure development, environmental planning, community engagement, policy formulation, and application of geospatial technologies. The roles/titles of these professionals reflect the nature of urban governance in both cities, shaped by rapid urbanisation. The code BMPO means Benin Metropolis Planning Officer whereas WCPO means Warri City Planning Officer.

Table 2 presents the assigned roles of community leaders in the selected communities in Benin Metropolis and Warri. These traditional, administrative, and youth leadership positions reflected the internal governance structures commonly found in the urban and peri-urban communities in southern Nigeria. The code BMCL means Benin Metropolis Community Leader whereas WCCL means Warri City Community Leader.

Table 2. Assigned roles of community leaders in the selected communities in Benin Metropolis and Warri City

Code	Role/Title	Community
BMCL-1	Youth Leader	Uselu
BMCL-2	Secretary	Oregbeni
BMCL-3	Youth Leader	Oluku
BMCL-4	Secretary	Uwelu
BMCL-5	Financial Secretary	Iguosa
WCCL-1	Chief (Traditional Leader)	Efurun
WCCL-2	Secretary	Okere
WCCL-3	Financial Secretary	Uvwie
WCCL-4	Public Relations Officer (PRO)	Ogunu
WCCL-5	Youth Leader	Okpe

Note: BMCL means Benin Metropolis Community Leader whereas WCCL means Warri City Community Leader

3 Results and Discussion

3.1 Limited Integration of HCD

Planners acknowledged that human-centric principles like accessibility, inclusivity, safety, and citizen well-being are often secondary to infrastructure-focused goals, resulting in planning practices that fail to fully address the needs of residents, particularly the marginalised groups.

The findings from urban planners in Benin Metropolis and Warri revealed a persistent gap in embedding human-centric principles, a concern that directly engaged the theoretical framework of HCD. HCD, emphasised user needs, empathy, and participatory processes as core of its design approach [29, 30]. Unfortunately, responses from participants highlighted significant disconnection from the planning process. For instance, BMPO-1 noted that "inclusivity for informal settlers is often an afterthought due to budget constraints", while WCPO-1 similarly observed that "inclusivity for informal settlers and well-being, like green spaces, are often side-lined". This reflected a broader prioritisation of physical infrastructure over social equity, as echoed by BMPO-2's comment that "citizen well-being is rarely a primary goal" and WCPO-3's statement that "inclusivity for disabled users is underdeveloped". The scarcity of specific human-centric policies reinforced this misalignment. BMPO-5 admitted, "I'm not aware of any specific human-centric policies", while WCPO-6 noted, "I do not know any human-centric policies; infrastructure is the priority". Similarly, BMPO-3 remarked that "The Benin Master Plan has sections on accessibility, but community-driven principles are not well-defined", and WCPO-3 added that "Warri's development plan mentions accessibility, but community-driven principles are vague". Despite these gaps, some initiatives demonstrated partial success, such as BMPO-7's youth center in Oredo, "co-designed with local groups", and WCPO-7's flood barrier in Warri South-West was "designed with community input". These examples suggested that human-centric integration was feasible but inconsistent, as it was often constrained by financial limitations and institutional priorities, hence underscoring the need for formalised frameworks to institutionalise user-centred practices [13].

BMPO-4 stated that "Inclusivity depends on the client's budget. Low-income areas are often ignored". At the same time, BMPO-10 opined that "Housing policies aim for inclusivity, but high costs mean low-income residents are rarely served". WCPO-5 was concerned about the road projects and stated that "Road projects aim for accessibility, but safety issues, like poor lighting, persist" while WCPO-10 said that "Housing policies aim for inclusivity, but high costs exclude most residents".

3.2 Financial and Institutional Constraints

Limited funding and institutional capacity significantly hinder the development of inclusive and sustainable infrastructure, with planners citing budget shortages and lack of expertise as major barriers.

Financial constraints are a recurring theme, with BMPO-1 stating, "Funding is a huge issue; we cannot afford inclusive features like ramps", and WCPO-1 similarly noting, "Funding shortages mean inclusive features are often cut". This was compounded by institutional barriers, such as BMPO-6's admission, "Low capacity in my team means we struggle to address inclusivity", and WCPO-6's comment, "My team lacks training in inclusive planning methods". Corruption further exacerbated financial limitations, as BMPO-8 highlighted, "Corruption diverts funds from inclusive infrastructure like water systems", and WCPO-8 noted, "Corruption reduces funds for inclusive drainage systems". Institutional silos also impeded progress, with BMPO-9 citing "institutional silos limit GIS use for inclusivity although it is available for use" and WCPO-9 echoing, "institutional silos hinder inclusive planning". These challenges reflected broader systemic issues in non-smart African cities, where resource scarcity and weak institutional frameworks undermined inclusive development [31]. Planners like BMPO-13 and WCPO-13 pointed to the short-term nature of non-governmental organization (NGO) funding as a further constraint, limiting sustainable inclusive projects.

Furthermore, BMPO-2 stated that "Institutional red tape delays inclusive projects" while BMPO-10 emphasised financial and political constraints, "Financial barriers and political focus on visible projects over inclusive housing". WCPO-3 said that "Funding shortages are major barriers" while WCPO-11 said that institutional disconnect was the main problem, "Institutional disconnect between Warri and suburbs, plus funding issues".

3.3 Digital Divide and Technological Barriers

The digital divide, characterised by low internet penetration and limited digital literacy, alongside outdated technological tools, restricts the adoption of digital technologies in urban planning, thus hindering inclusive outcomes.

The smart city ecosystem framework highlights both the potential and limitations of digital tools in non-smart cities, such as Benin Metropolis and Warri. A key challenge is the digital divide, with sub-Saharan Africa recording only 39% internet penetration [16]. Planners noted that poor internet access in peri-urban areas and slow connectivity in city centers limit the effectiveness of citizen apps that could otherwise engage young people (BMPO-6; WCPO-6). Technological shortcomings further constrain progress, as many planning institutions still rely on outdated GIS tools. BMPO-2 observed that "data-driven planning is feasible if we upgrade our GIS tools", a view echoed by WCPO-2, who remarked that "data-driven zoning is feasible with better GIS tools". At the same time, planners acknowledged the transformative potential of GIS if adequately resourced, with BMPO-9 stating, "I use GIS daily; expanding it for inclusivity is possible with investment", and WCPO-9 adding, "I use GIS for port planning; expanding it for inclusivity needs investment". These responses aligned with the vision of the ecosystem to develop technology-enabled urban solutions, but also pointed to structural gaps: limited funding, weak infrastructure, and inadequate digital literacy among both residents and planners. The absence of PGIS in both cities underscored these constraints, hence reinforcing the need for systemic investment and training to make digital tools genuinely inclusive [3].

The digital divide is stark, reflecting inequalities in access that disproportionately exclude low-income and peri-urban populations. While some central neighbourhoods enjoy limited connectivity, outlying areas remain underserved due to weak infrastructure and unaffordable services. Access is also shaped by social disparities, as women and older residents are less likely to own smartphones or have digital autonomy. Consequently, engagement tools risk amplifying the voices of younger and wealthier residents, while side-lining marginalised groups. Affordability further entrenches exclusion. The high cost of mobile data and internet-enabled devices discourages regular use, thus leaving many households unable to participate in digital platforms that require uploads, live mapping, or real-time interaction.

These challenges are worsened by poor infrastructure. Unreliable electricity supply forces many households to rely on costly alternatives like generators, while weak broadband networks cause frequent service interruptions. Planners confirmed that unreliable coverage limited the functionality of advanced tools such as GIS dashboards and digital forums; this constraint also prevented the effective integration of computer-based technology into urban decision-making. As BMPO-5 observed, "GIS for transport planning is promising, but we need better data and connectivity", while WCPO-8 similarly stressed that "GIS can map flood risks, but funding for tech is a barrier".

Institutional constraints deepen the divide. Many planning offices operate with outdated licenses, fragmented datasets, and non-interoperable systems, leaving them unable to generate accurate evidence for decision-making, especially in informal settlements where data gaps are greatest. While planners recognise the potential of tools like GIS for transport, flood management, and public space planning (BMPO-12, WCPO-15), they emphasise that these benefits remain unattainable without systematic investments in digital infrastructure, capacity building, and long-term institutional support.

Finally, digital literacy remains one of the most pressing obstacles. Residents often lack the skills or confidence to use apps, while planners need training to design inclusive and low-bandwidth platforms that are sensitive to language and literacy barriers. BMPO-3 and WCPO-3 both stressed that digital literacy gaps weakened the effectiveness

of engagement platforms. This underscored the importance of hybrid approaches that combined digital strategies with offline methods such as radio campaigns, town halls, and community kiosks to ensure inclusivity. Unless the structural, economic, and educational roots of the digital divide are addressed, smart city initiatives risk reinforcing inequality rather than enabling equitable and sustainable development [3, 14, 16].

3.4 Governance and Political Challenges

Top-down governance structures, political interference, and lack of inclusive policies prioritize elite or commercial interests over marginalised communities, thus limiting the integration of human-centric principles.

Governance in both cities is described as centralised, bureaucratic, and stifling inclusive planning. BMPO-1 noted, "Governance is top-down, limiting community input", while WCPO-1 echoed, "Top-down governance limits community input". Political favouritism further skewed priorities, with BMPO-4 stating, "Governance prioritises private developers, limiting inclusive public projects", and WCPO-4 agreeing, "Governance favours developers, limiting inclusive public infrastructure". Policies often lack inclusivity focus, as BMPO-2 observed, "Bureaucratic governance delays inclusive projects. Policies lack clear inclusivity goals", and WCPO-2 added, "Bureaucratic governance slows inclusive projects". Corruption also undermines inclusive efforts, with BMPO-10 noting, "Housing policies are ambitious but undermined by corrupt governance", and WCPO-10 stating, "Housing policies are undermined by corrupt governance structures". These governance challenges align with broader African urban trends, in which political and institutional barriers hinder equitable development [15]. Planners like BMPO-7 and WCPO-7 highlighted existing community engagement policies but noted poor enforcement, indicating a gap between policy intent and implementation.

3.5 Social and Community Engagement Barriers

When combined with limited engagement mechanisms, social barriers including community distrust, resistance to change, and ethnic tensions in Warri, hinder effective incorporation of citizen input into planning.

In HCD, successful integration of human-centric approaches in selected projects such as BMCL-1's Uselu market rehabilitation, "local women traders were part of the design discussions" and WCCL-1's Effurun health centre upgrade, "women's groups in the layout discussions" demonstrated the potential for co-creation when communities are actively engaged. These successes likely stemmed from the relevance of the facilities to local users and the cultural acceptance of participatory decision-making. However, broader application of HCD principles was undermined by persistent barriers, especially issues of trust and communication. Communication breakdowns, such as BMCL-2's "lack of access to official channels" and WCCL-5's "decisions are made in Asaba" reflected bureaucratic opacity and centralised decision-making that excluded the voices of grassroots. This structural disconnection was compounded by entrenched distrust, with BMCL-3 stating "people do not trust government", WCCL-3 affirming "trust is weak", and BMPO-7 emphasising that "social barriers like community distrust and political interference slow inclusive projects". The sentiment echoed by WCPO-7 was "social, ethnic tensions and political interference block inclusive projects". In Warri, ethnic divisions among Itsekiri, Urhobo, and Ijaw groups, as described by WCPO-7, further fractured community trust. Such distrust was deeply rooted in histories of unmet promises and top-down planning, where community input was often symbolic rather than substantive. These issues also fuelled resistance to development, as seen in fears of displacement articulated by BMCL-5's "fear of losing ancestral land" and WCCL-5's "fear of losing informal businesses". BMPO-1 and WCPO-3 explicitly signalled that infrastructure upgrades risked exclusion and harm when trust was absent. Nevertheless, practical strategies offered a way forward. BMPO-3 recommended to "hold regular town halls and use local leaders", while WCPO-1 advised to "organise community forums and use local chiefs" as both of which are aligned with HCD's foundational values of empathy, co-creation, and bottom-up engagement [29]. Though inconsistently applied, such practices highlighted the need for iterative and inclusive processes that rebuilt trust and empowered communities at every stage of urban transformation.

The smart city ecosystem framework revealed both progress and persistent constraints in the context of Benin Metropolis and Warri. Instances of participatory governance such as BMCL-3's Ovia Northeast water project in which "community members were involved in selecting borehole sites", WCCL-5's Okpe borehole project, "women and youth were consulted". BMPO-6 and WCPO -6 illustrated how local leadership enhanced resident participation in peri-urban water projects and demonstrated how community collaboration could improve outcomes and reflect smart governance in resource-constrained settings. These successes likely stemmed from the tangible and localised nature of the projects and the trust that communities placed in familiar leaders and grassroots actors. However, the broader implementation of citizen-driven smart systems remained constrained by the digital divide. BMCL-6's reliance on "radio and community meetings", WCCL-6's use of "town crier announcements", and similar feedback from BMPO-2, "use radio and community meetings to reach non-digital residents" and WCPO-2, "use radio campaigns to collect feedback" highlighted the limitations of digital engagement in the contexts of low digital literacy, limited infrastructure, and affordability challenges particularly in light of Nigeria's modest 39% internet penetration rate [16]. Moreover, poor attendance at town halls (BMCL-6) and the politicisation of the engagement processes (BMCL-4)

further revealed governance weaknesses, including lack of transparency and tokenistic participation. These gaps emphasised the fragility of relying solely on digital tools in non-smart city environments and highlighted the need for hybrid and culturally grounded communication strategies that blend traditional outreach mechanisms with emerging digital platforms to achieve inclusive and participatory planning [26].

From the right to the city perspective, the findings from Benin and Warri revealed deep systemic issues that undermined this entitlement, reflecting a legacy of non-inclusive governance, broken promises and limited citizen participation in urban decision-making. BMCL-2's "past promises were broken" and WCCL-1's "ignored our suggestions" have fostered widespread distrust, while WCCL-2's "no feedback loop" reflected the enduring perception that decisions were imposed rather than co-created. Ethnic and social tensions, as noted by BMCL-4's "tensions rise" and WCCL-4's "ethnic and religious divides", further fractured communities and often silenced already marginalised voices, particularly in diverse urban neighbourhoods. Displacement fears as stated by BMCL-5's "bulldozers without notice", WCCL-3's "past projects displaced families", and similar accounts from BMPO-3 and WCPO-3, illustrated how infrastructural development had been frequently prioritised over the people's need for shelter, thus stripping residents of both space and spatial identity. These barriers speak not only to governance failures but to a deeper exclusion where political interference and planning injustice deny citizens their right to determine the future of their cities. Yet, there are signs of transformation. Community leaders like BMCL-3, who was "mobilizing women," and WCCL-5, who facilitated "cross-group dialogues", showed that grassroots actors could reclaim participatory rights when empowered and supported. Likewise, co-produced efforts in BMPO-6 and WCPO-6 demonstrated that inclusive, culturally sensitive, and accessible strategies which were grounded in the lived realities of residents could restore trust and reshape engagement. Ultimately, weaving together the empathetic ethos of HCD, the systemic integration of the smart city ecosystem, and the justice-driven lens of the right to the city offered a transformative path: one that converted resistance into resilience and longstanding social barriers into foundations for inclusive urban futures in Benin and Warri.

The findings of Eisenhauer et al. [53] revealed that many climate resilience planning efforts still fall short of being fully human-centric, as they often fail to meaningfully incorporate the lived experiences, social vulnerabilities, and emotional realities of marginalised populations. Their study showed that while participatory methods such as storytelling and mapping capture local voices, engagement processes frequently overlook deeper social and psychological dimensions of resilience, particularly in smaller and resource-limited communities. These insights support the present study's argument that genuine inclusion in planning requires recognising both the physical and socio-emotional experiences of affected populations supported these findings.

3.6 Context-Specific Needs and Cultural Relevance

Effective urban planning requires models tailored to local socio-economic, cultural, and environmental realities, such as Benin's heritage and flooding risks and Warri's ethnic diversity and oil-driven economy.

The flooding risk in Benin Metropolis is one of the most pressing urban challenges influencing planning strategies. Poorly maintained or inadequate drainage systems, combined with uncontrolled urban sprawl and waste disposal in waterways, exacerbate flood vulnerability across many neighbourhoods, particularly informal settlements as stated by BMPO-12, "Address flood risks, informal settlement needs". This observation reflected the lived reality of recurrent flooding areas like Uselu, Ogebson, Upper Sakponba, and Siluko Road, where floodwaters disrupt mobility, damage homes, and displace residents during heavy rainfall. Planners must therefore prioritise climate-sensitive approaches by integrating flood-mapping tools, improving stormwater drains, and promoting land-use controls that restrict settlement in flood-prone zones. A relevant case is Dar es Salaam and Tanzania, where community-driven flood risk mapping through PGIS helped identify vulnerable areas, guide low-cost drainage improvements and relocation programs [25]. Applying such participatory mapping in Benin could empower residents of informal settlements to co-create flood mitigation solutions, while improving government accountability in disaster preparedness.

On the other hand, ethnic diversity in Warri City is defined by the co-existence of the Itsekiri, Urhobo, and Ijaw groups, which directly shapes urban planning strategies and community engagement processes. Historical ethnic tensions and disputes over land ownership have created contestations in urban development projects, as highlighted by WCPO-1 ("Address flood risks, informal settlement needs") and WCPO-14 ("Incorporate cultural preservation, accessibility, and ethnic diversity"). For example, disagreements among ethnic communities often slow down housing or infrastructure projects, with local chiefs sometimes resisting development that threatens traditional land rights. Planning in Warri thus requires context-sensitive engagement that recognises the authority of traditional institutions, while building trust across groups. Co-design workshops and multi-ethnic planning councils can foster inclusive dialogue, ensuring that no group feels excluded from decisions affecting their communities. A successful example comes from Jos Plateau's inter-ethnic peace committees Dialogue Process, which were integrated into development planning to mediate disputes and build trust among divided communities [54]. Replicating similar mechanisms in Warri could help planners mediate land disputes and incorporate cultural preservation into infrastructure projects.

Socio-economic factors, such as poverty and low digital literacy, are also important, with BMPO-2 noting,

"Account for low digital literacy, high poverty, and community distrust", and WCPO-2 agreeing, "Account for low digital literacy, land disputes, and community mistrust". Successful local projects, like BMPO-7's youth centre and WCPO -7's flood barrier, showed that community-driven designs enhanced relevance. International examples, such as Dar es Salaam's BRT (BMPO-1, WCPO-1) and Medellín's inclusive spaces (BMPO-4, WCPO-4), offer transferable lessons for context-sensitive planning [8].

Urban planners from both Benin Metropolis and Warri City emphasized the imperative to consider various contextual factors in urban facility planning: "Incorporate market traders' needs, accessibility for disabled residents, and flood-prone areas" (BMPO-3); "Account for housing affordability, land costs, and resident participation" (BMPO-10); "Consider traffic issues, commuter needs, and limited internet access" (WCPO-5); and "Account for housing costs, land disputes, and residents' input" (WCPO-10).

3.7 Opportunities for Inclusive and Ethical Digital Integration

Despite challenges, planners view potential for digital technologies like GIS and citizen engagement platforms to enhance inclusivity, provided ethical considerations like data privacy and equitable access are prioritised.

Planners recognise opportunities for digital tools to support human-centric planning. BMPO-9 asserted, "I use GIS daily; expanding it for inclusivity is possible with investment", and WCPO-9 echoed, "I use GIS for port planning; expanding it for inclusivity needs investment". Citizen engagement platforms are also promising, with BMPO-7 suggesting, "Engagement platforms could boost participation, but we need to train communities first", and WCPO -7 noting, "Engagement platforms could work with community leaders, but digital skills are low". Ethical considerations are critical, with BMPO-1 emphasising, "Data privacy is key; residents' information must be protected", and WCPO-1 agreeing, "Data privacy is crucial; residents must trust how their information is used". Inclusivity in digital adoption is a concern, as BMPO-2 warned, "Ensure digital tools do not exclude non-tech-savvy residents," and WCPO-2 added, "Digital tools must include non-tech users". Practical strategies, like BMPO-12's "Digital flood mapping is viable, but community platforms need more outreach" and WCPO-12's "Digital pollution mapping is viable", highlighted the need for accessible and ethical digital integration to support inclusive planning in non-smart cities [3].

In contexts of low digital literacy and heightened vulnerability, ethical digital engagement requires more than the deployment of tools; it necessitates safeguards that protect communities from exploitation and exclusion. This involves ensuring informed consent when collecting residents' data, communicating clearly how information will be used, and guaranteeing that participation is voluntary and without coercion. Safeguards such as anonymization, opt-in models, and transparent feedback loops are vital to building community trust in digital initiatives [55]. Additionally, planners must account for the risk of digital marginalisation, where only the digitally literate or affluent can meaningfully contribute, thus leaving behind those peri-urban residents with low income and informal settlements. To address this, hybrid engagement strategies that blend digital tools with face-to-face forums, radio campaigns, and community kiosks could ensure more equitable participation [56].

Furthermore, ethical engagement should prioritise data justice, ensuring that digital technologies empower rather than harm vulnerable populations. In African cities, where histories of marginalisation intersect with weak institutional accountability, safeguarding community rights over digital data becomes critical. Embedding community-led data governance, where local leaders or committees oversee the management and use of collected data, can reduce mistrust and enhance legitimacy [57]. Finally, ethical frameworks should include capacity-building initiatives, equipping residents with digital literacy skills and planners with training in rights-based digital practices, thereby creating inclusive digital ecosystems that reinforce human-centric planning.

The thematic analysis revealed that urban planning in Benin Metropolis and Warri City faced significant challenges in embedding human-centric principles due to a combination of financial limitations, institutional weaknesses, digital divides, governance inefficiencies, and social barriers that constrain inclusive development. While planners recognised the potential for inclusive and ethical digital integration, the lack of context-sensitive frameworks, coupled with systemic issues like corruption and centralised governance, limits progress. Community engagement and localised solutions are critical to overcoming these barriers, as evidenced by successful projects like market upgrades and slum improvements. These findings underscored the research gap: while smart city models exist, few embed human-centric principles tailored to the socio-cultural and infrastructural realities of African cities [8, 13].

4 Policy Implications of the Study

Edo and Delta State governments should revise urban development policies, e.g., Edo State Urban Development Policy and Delta State Urban Renewal Policy to mandate human-centric principles, such as accessibility for people with disabilities (BMPO-3, WCPO-3), safety for pedestrians (BMPO-15, WCPO-15), and inclusivity for the 60% of residents in informal settlements [13]. These revisions should include the creation of urban accessibility taskforces within ministries to monitor compliance. Besides, the establishment of pilot projects about accessibility and pedestrian safety in high-density informal settlements (e.g., Ugbowo in Benin and Jakpa in Warri) could demonstrate how human-centric upgrades like pedestrian bride, ramps, safe crossings, and inclusive markets can be rolled out gradually.

Policies should require participatory planning processes, setting measurable targets for equitable service access, and ensuring facilities reflect community-identified needs.

Policymakers should allocate dedicated budgets for inclusive infrastructure, such as ramps, communal water taps, and pedestrian paths, as suggested by BMPO-4 and WCPO-4. To ensure accountability, budgetary allocations should be tied to performance-based disbursement models, where funds are released only upon evidence of inclusive facility delivery. Partnerships with international organisations like the African Development Bank [4] and private sector incentives could address funding gaps, but state governments should also create public-private-community partnerships (PPCPs) to integrate local leaders into project delivery. In collaboration with local universities like the University of Benin and Delta State University, institutional reforms should include mandatory capacity-building programs for urban planners on human-centric planning and GIS. Anti-corruption measures such as digital procurement portals should be introduced to track contracts transparently, in order to ensure resources are directed to inclusive projects.

Policies should invest in affordable digital infrastructure, such as community internet hubs in informal settlements, to support engagement platforms, as suggested by BMPO-7 and WCPO-7. In Benin, hubs could be piloted around Ring Road and Oba Market, while in Warri, Effurun roundabout could serve as test sites. Subsidised GIS tools and digital literacy training for residents and planners (BMPO-2, WCPO-2) should be rolled out through community ICT centres managed by local councils. Ethical guidelines mandating data privacy, transparency, and inclusivity for non-tech-savvy groups (BMPO-1, WCPO-1) should be backed by local data protection units embedded in planning ministries to ensure residents' trust.

Governance reforms should decentralise planning authority to local government areas (e.g., Oredo, Uvwie, etc.), thus enabling community-driven processes like town halls (BMPO-1) and forums (WCPO-1). To institutionalise participation, state governments should mandate quarterly participatory budgeting meetings at local government headquarters. Policies require transparent decision-making via digital feedback platforms (BMPO-12, WCPO-12) while combining this with offline kiosks in markets and transport hubs for inclusivity. Updating the Benin and Warri master plans with participatory governance frameworks, as suggested by BMPO-3 and WCPO-3, should begin with pilot participatory mapping exercises in flood-prone areas, such as Uselu in Benin and Jeddo in Warri, to ensure spatial justice is built into new plans [15].

Policies should mandate community engagement through co-design workshops, town halls, and partnerships with local leaders, as recommended by BMPO-7 and WCPO-7. These workshops should be institutionalised as annual planning festivals, integrating cultural norms to enhance participation. Non-digital channels, such as radio campaigns and feedback kiosks (BMPO-4, WCPO-4), should be expanded using local-language programming on Edo Broadcasting Service (EBS) and Delta Broadcasting Service (DBS). In Warri, policies should ensure ethnic inclusivity by mandating multi-ethnic advisory councils that include Itsekiri, Urhobo, and Ijaw leaders (WCPO-14), hence reducing conflict and enhancing buy-in [26].

Policymakers should develop urban planning frameworks tailored to local realities, via integrating Benin's flooding and heritage needs (BMPO-12, BMPO-14) and Warri's oil-related and ethnic challenges (WCPO-12, WCPO-14). For example, in Benin, flood-mitigation pilot projects should pair digital flood mapping with community-built drainage clearing groups, while in Warri, oil spill-impacted areas could be integrated into urban renewal projects. Frameworks should also prioritise affordable infrastructure (BMPO-10, WCPO-10) through incremental housing upgrade schemes supported by micro-credit, and community-led heritage planning (BMPO-14, WCPO-14) through collaboration with the Oba's palace in Benin and ethnic cultural councils in Warri. Adopting participatory models from successful cases like Curitiba's planning (BMPO-7, WCPO-7) should involve exchange programs for Edo and Delta planners to learn from cities with strong participatory frameworks [8].

Policies should establish ethical guidelines for digital planning, to ensure data protection and transparency (BMPO-1, WCPO-1). Training programs for residents and planners in digital tools (BMPO-2, WCPO-2) should be expanded to certificate programs in partnership with NGOs and tech hubs in both states. Investments in GIS for slum mapping (BMPO-9, WCPO-9) should begin with pilot mapping of informal settlements in Upper Sakponba (Benin) and Enerhen (Warri), hence generating actionable baseline data for policy interventions. To align with the objectives in this study, digital initiatives should focus on underserved areas, embedding ethical and inclusive digital approaches that enhance participation and accessibility in non-smart cities [3].

This study assessed and enhanced the integration of human-centric principles to overcome identified barriers, leverage digital and ethical opportunities, and propose a context-sensitive framework for Benin Metropolis and Warri City. See Table 3 for the policy roadmap on embedding these principles. Policymakers could transition these non-smart cities toward inclusive and smarter urban infrastructures by mandating human-centric policies, increasing funding, bridging the digital divide, reforming governance, institutionalising engagement, piloting test projects, and prioritizing local needs. These measures bridge the research gap by adopting human-centric principles tailored to the socio-cultural and infrastructural realities of African cities, in order to ensure planning meets the diverse needs of residents in Benin and Warri.

Table 3. Policy roadmap for embedding human-centric principles in Benin Metropolis and Warri City

Domain	Specific Actions	Pilot Location(s)	Expected Outcomes
Policy & legal reforms	Revise Edo & Delta urban development policies to mandate accessibility, pedestrian safety, and informal settlement inclusion. Create urban accessibility taskforces.	Ugbowe (Benin), Jakpa (Warri)	Inclusive legal frameworks to ensure services meet the needs of vulnerable residents.
Infrastructure & funding	Allocate budgets for ramps, communal water taps, and safe pedestrian paths. Introduce performance-based disbursement models.	Central markets & transport hubs in both cities	Tangible inclusive infrastructure delivery with accountability in resource utilization.
Capacity building	Establish training programs for planners in human-centric design and GIS, in collaboration with universities. Launch exchange programs with participatory cities.	University of Benin; Delta State University	Skilled planners able to implement context-sensitive and participatory planning.
Digital inclusion	Deploy community internet hubs, solar-powered kiosks, and subsidised GIS tools. Provide digital literacy programs in local languages.	Ring Road (Benin), Effurun Roundabout (Warri)	Expanded internet access, improved digital engagement, and stronger planning capacity.
Governance reform	Decentralise planning authority to local government associations; institutionalise quarterly participatory budgeting meetings. Introduce digital procurement portals for transparency.	Qredo (Benin), Urwie (Warri)	Reduced corruption, improved accountability, and stronger local participation.
Community engagement	Institutionalise annual co-design ”planning festivals”; expand outreach through local radio, kiosks, and advisory councils inclusive of ethnic leaders.	Edo Broadcasting Service; Delta Broadcasting Service; Itsekiri/Urhobo/Ijaw councils in Warri	Stronger trust and inclusion of marginalised voices in planning processes.
Context-specific planning	Develop frameworks to address Benin’s flooding/heritage and Warri’s oil-related/ethnic challenges. Pilot participatory mapping of flood-prone and spill-affected areas.	Uselu (Benin), Jedde (Warri)	Locally grounded frameworks reducing risks and protecting cultural/environmental assets.
Ethical digital planning	Establish data protection units; invest in GIS-based slum mapping; partner with NGOs/tech hubs for certification programs in digital tools.	Upper Sakgonba (Benin), Enerhen (Warri)	Ethical and inclusive use of digital tools, improved data-driven decision-making.

5 Recommendations

To promote inclusive and smarter urban development in non-smart African cities like Benin Metropolis and Warri City, this study recommended the establishment of precise human-centric planning guidelines, increased funding and institutional capacity, affordable digital access, and participatory and transparent governance reforms. Other proposed changes included strengthened community engagement through diverse channels, development of context-sensitive planning frameworks, implementation of ethical digital policies, and fostering of local and international partnerships for knowledge exchange.

There is a pressing need to expand affordable digital infrastructure that directly serves marginalised communities. Governments in Edo and Delta States, in partnership with private telecom providers, should establish community internet hubs and subsidised broadband access in informal and peri-urban settlements. Solar-powered Wi-Fi kiosks can also be deployed in areas with unreliable electricity, to provide residents with stable internet access without

dependence on the national grid. These measures will not only extend connectivity but also ensure affordability, which remains a major barrier to digital participation.

Equally important is the promotion of inclusive digital literacy. Training initiatives should go beyond conventional workshops to incorporate mobile-based literacy modules, designed to work on simple feature phones as well as smartphones in local languages. Schools, vocational centres, and community associations should integrate digital skills training into their programmes, targeting groups often excluded from digital spaces, such as women and older residents. Youth volunteers could also be trained as "digital ambassadors" to support peers and elders in navigating digital tools, creating a peer-to-peer model of learning that is culturally grounded and sustainable.

Upgrading planning tools and data systems is another crucial step. Many urban planning institutions rely on outdated GIS tools and fragmented datasets with limited ability to implement inclusive and data-driven strategies. Shifting towards open-source GIS software will reduce costs, while improving interoperability across agencies. Additionally, creating shared data repositories accessible to multiple stakeholders could prevent duplication and promote evidence-based decision-making. Crowdsourced mapping platforms, such as OpenStreetMap, should be adopted to capture real-time data on informal settlements, flooding, and infrastructure gaps, in order to ensure that the needs of marginalised populations are represented in planning processes.

Addressing the financial barriers to digital access will also be essential. Policymakers should establish digital inclusion funds supported by state budgets, donor agencies, and private sector corporate social responsibility initiatives to subsidise data for internet connectivity and devices for low-income households. Micro-finance schemes and device-leasing programmes render smartphones and tablets affordable to vulnerable groups. International partners, such as the African Development Bank and Smart Africa Alliance, should be engaged to co-finance innovation pilots that could be scaled up across Benin and Warri.

Finally, ethical and inclusive governance must underpin all digital initiatives. Clear guidelines should be established to protect residents' data privacy, ensure transparency, and guarantee inclusivity, especially for non-tech-savvy populations. The institutionalization of multi-channel participation systems involves combining online platforms with automated short message service (SMS) surveys and voice-assisted tools to reach those excluded by the internet and literacy barriers. Training for urban planners should equip them with the skills to design low-bandwidth and equitable engagement platforms, which reflect the socio-economic realities of the communities they serve. Together, these interventions will bridge access gaps, improve digital equity, and embed inclusive participation into the foundation of smart urban planning in Benin and Warri.

6 Conclusions

The findings of the present study provided valuable insights for the benefits of a broad spectrum of stakeholders. Urban planners and policymakers in non-smart cities, like Benin Metropolis and Warri City, could draw from the recommended human-centric and context-sensitive planning approaches to guide more inclusive and sustainable infrastructure development. Local governments and municipal authorities would find the study instrumental in reforming outdated planning frameworks, addressing infrastructural inequalities, and prioritizing citizen engagement. Marginalised urban residents, particularly those in informal settlements, the disabled, and digitally excluded groups, are positioned to benefit directly from more equitable and participatory planning practices. The study also offered practical guidance for donor agencies, development partners, and academic institutions working to support the transition of Africa toward smarter and socially inclusive urban governance models rooted in ethical, localised, and forward-looking planning principles.

Looking ahead, future research should explore longitudinal studies to track the long-term outcomes of embedding human-centric principles in African urban planning, particularly in relation to facility, service and delivery, community empowerment, and resilience to climate and socio-political shocks. Pilot interventions in specific sectors, such as community-driven flood management in Benin and inclusive housing schemes in Warri, would provide empirical evidence of how context-sensitive planning models could be scaled. Comparative cross-city studies across West Africa could deepen understanding of how cultural, political, and infrastructural differences shape the success of inclusive planning frameworks. Additionally, integrating digital ethics research into urban governance studies would help address emerging issues of data privacy, algorithmic bias, and equitable digital participation. Such forward-looking inquiries will not only strengthen the practical applicability of human-centric planning but also bridge the existing gap found in the interconnections of theory, policy, and lived realities in the rapidly urbanising context of Africa.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability

The data used to support the research findings are available from the corresponding author upon request.

Conflicts of Interest

The author declares no conflicts of interest.

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