HUMAN-CENTERED AND TECHNO-CENTRIC PATHWAYS TO SMART URBAN PERFORMANCE IN AFRICA: A CONTEXTUAL FRAMEWORK FOR URBAN DEVELOPMENT, GOVERNANCE, AND KPI-BASED ASSESSMENT

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Rapid urbanization, uneven infrastructure provision, and widening demands for efficient public services have intensified the relevance of smart-city strategies across African urban regions. Yet the transfer of generic smart-city models to African contexts remains analytically insufficient when local governance capacity, socio-economic inequality, informality, and infrastructural deficits are not treated as constitutive planning conditions. This article presents a consolidated scholarly manuscript on smart urban development in Africa by organizing the literature into a coherent urban-development framework centered on planning, governance, and performance assessment. The paper synthesizes the findings of a comprehensive literature review that examined more than 95 publications and consolidated 30 distinct smart-city definitions. It shows that the literature converges around three major dimensions—technology and data, economy/society, and governance—while also separating into two principal interpretive approaches: a techno-centric approach emphasizing ICT-enabled efficiency and infrastructural intelligence, and a human- and social-centric approach emphasizing participation, social capital, collaboration, and quality of life. Building on these conceptual foundations, the article systematizes seven key features of smart-city development, delineates the nine operative elements of an African smart-city approach, and translates these into a practical key-performance-indicator (KPI) architecture for urban administrators and policymakers. The discussion further integrates concrete African initiatives, including projects in Kenya, Rwanda, Nigeria, Ethiopia, Ghana, Morocco, and South Africa, to demonstrate how context, institutional capacity, and implementation feasibility shape smart urban trajectories on the continent. Framed for the scope of urban development and smart cities scholarship, the manuscript offers a policy-relevant synthesis that links conceptual clarity to urban planning practice and performance evaluation.

Index Terms — smart cities; Africa; urban development; urban governance; ICT; public services; KPI assessment; smart urban performance

INTRODUCTION

Smart-city discourse has become an influential part of contemporary urban development scholarship because it promises to align digital infrastructures, administrative capacity, and urban service delivery with broader goals of sustainability and quality of life. Foundational literature has consistently shown that smart cities are not reducible to a single technological template; rather, they are multi-dimensional arrangements that combine data systems, governance institutions, economic priorities, and citizen-oriented outcomes [2, 3, 4, 5]. For journals concerned with urban development and smart cities, this makes the concept especially relevant because it sits at the intersection of infrastructure planning, urban management, public policy, and socio-technical transformation.

The African context introduces a sharper planning challenge. Urbanization is accelerating, but many cities continue to confront infrastructural deficits, service-access inequalities, institutional constraints, and uneven technological readiness. In such circumstances, smart-city planning cannot be treated as a simple matter of digital adoption. It must instead be understood as a contextual urban-development problem in which technology, governance, and social inclusion must be calibrated together [1, 12, 6].

This manuscript develops that proposition into a structured academic synthesis. It is organized around four questions central to the scope of the *Journal of urban development and smart cities*: (i) what conceptual dimensions organize the smart-city literature; (ii) how do techno-centric and human-centered interpretations differ; (iii) what specific features characterize smart-city development in African urban settings; and (iv) how can these elements be translated into a coherent KPI-based urban-performance framework?

The article proceeds by presenting the review design that underpins the analysis, consolidating the conceptual dimensions of smart cities, clarifying the two dominant interpretive approaches, examining the African urban context and its illustrative cases, and translating these findings into an operational assessment architecture suitable for planning and policy.

REVIEW DESIGN AND ANALYTICAL BASIS

The analytical basis of this manuscript is a comprehensive descriptive review of the smart-city literature, centered on the study by Moumen et al. [1]. The review searched three major scholarly repositories—Web of Science, Scopus, and Google Scholar—and examined more than 95 publications in order to identify the most relevant definitions and conceptualizations of the smart city. From that broader corpus, 30 distinct definitions were retained and used to analyze the rhetoric, dimensions, and interpretive tendencies of the concept [1].

The key methodological feature of the review is its qualitative content analysis of definitions. The selected definitions were not treated as interchangeable descriptions; they were examined for keywords, conceptual emphases, and recurring dimensions. This allowed the literature to be organized into two major approaches and into broader thematic dimensions that are directly relevant to urban planning, public management, and performance evaluation.

Table 1: Review design and analytical foundation of the manuscript.

Component	Content
Review type	Comprehensive and descriptive literature review of smart-city scholarship
Primary databases	Web of Science, Scopus, and Google Scholar
Scale of literature examined	More than 95 publications reviewed
Definitions consolidated	30 distinct smart-city definitions retained for close conceptual analysis
Analytical method	Qualitative content analysis focused on keywords, conceptual emphases, and dimensions
Principal analytical outputs	Two major smart-city approaches, three consensus dimensions, an African contextual framework, and a KPI-based assessment logic
Urban planning relevance	Connects conceptual smart-city debates with governance, public services, infrastructure planning, and comparative urban assessment

This review design is particularly appropriate for urban-development scholarship because it moves beyond isolated case claims and instead clarifies the conceptual architecture that should guide planning decisions. Rather than assuming a universal smart-city model, it establishes a framework that can be interpreted in relation to local context, institutional readiness, and sectoral priorities.

CONCEPTUAL FOUNDATIONS OF SMART CITIES

The smart-city concept emerges from the convergence of three major developments: the growing centrality of sustainability in urban policy, accelerating urbanization, and rapid advances in information and communication technologies (ICTs) [1]. In the literature, these drivers collectively frame the smart city as a strategic attempt to improve urban functionality, service efficiency, resource management, and citizen well-being through the coordinated use of digital tools and institutional innovation.

A major contribution of the review literature is its clarification that smart cities are multi-dimensional. The conceptual field is often crowded with overlapping terms, but recurring patterns can still be identified. The consolidated literature points to three consensus dimensions: technology and data, economy/society, and governance. These dimensions provide a useful foundation for urban development analysis because they correspond directly to infrastructure systems, socio-economic outcomes, and public-institutional capacity.

Table 2: Consensus dimensions of smart cities and their planning significance.

Dimension	Sub-concepts	Shared planning significance
Technology and Data	Data generation, data sources, analytics, digital infrastructure	Smart cities depend on connected environments, diverse data streams, analytics, and robust digital infrastructure to support communication, coordination, and evidence-based urban decisions.
Economy/Society	Economic goals, social involvement, private-sector collaboration, competitiveness	The smart-city agenda seeks to improve quality of life and optimize resource use while also encouraging innovation, economic growth, and new forms of collaboration between citizens, firms, and public institutions.
Governance	Technological aids, data-driven decision-making, active government support	Governance is increasingly mediated by digital tools, real-time information, and institutional support for innovation, making administrative capacity a central condition of smart urban performance.

The literature also shows that these dimensions are not purely technical categories. Their planning value lies in the fact that they jointly determine whether technology contributes to urban development or merely intensifies administrative complexity. In other words, a city may possess advanced digital devices and still underperform if governance systems are weak, social access is narrow, or public service outcomes are poorly aligned with citizen needs [7, 9].

KEY FEATURES OF SMART-CITY DEVELOPMENT

Beyond broad dimensions, the literature identifies a set of recurring development features that define the operational profile of a smart city. These features are especially relevant to urban-development research because they translate abstract conceptual debates into recognizable planning domains.

Table 3: Key features associated with smart-city development.

Feature	Development content
Smart people	Citizens possess ICT literacy, educational capacity, and the social and human capital required to participate effectively in urban transformation.
Smart infrastructure	Urban systems are supported by intelligent infrastructure, IoT applications, and advanced technological networks.
Smart living	Quality of life is enhanced through stronger public and private services, with attention to health, culture, housing, security, and participatory use of amenities.
Smart economy	Economic development is linked to ICT-enabled enterprise, innovation, and the integration of digital systems into production and business models.
Smart mobility	Contemporary transport technologies, logistics, and intelligent transport systems improve accessibility, movement, and urban efficiency.
Smart management	Administrative systems incorporate intelligent management, citizen communication, e-governance, and participatory decision mechanisms.
Smart environment	Environmental quality is protected through long-term, green, and risk-aware urban planning supported by modern technologies.

These features illustrate why smart-city planning cannot be reduced to a single sector. They involve human capital formation, physical infrastructure, public-service design, mobility systems, environmental stewardship, and institutional capability. For urban development scholarship, this reinforces the need to analyze smart-city interventions as integrated planning systems rather than isolated technological projects.

TWO APPROACHES TO SMART URBANISM

A major finding of the reviewed literature is the distinction between two interpretive approaches to the smart city: the techno-centric approach and the human- and social-centric approach [1]. This distinction is not merely rhetorical. It determines how problems are framed, how investments are prioritized, and how success is measured.

Table 4: The two dominant approaches to smart-city conceptualization.

Approach	Core logic	Representative emphases in urban development
Techno-centric	Urban intelligence is driven primarily by ICT, sensor systems, data networks, automation, and infrastructural efficiency.	Connected devices, real-time data, digital control of infrastructure, service optimization, cost and energy reduction, and technologically mediated resource management.
Human- and social-centric	Urban intelligence is achieved through the interaction of technology with social capital, collaboration, governance quality, and citizen well-being.	Participation, stakeholder coordination, social inclusion, quality of life, human capital, community engagement, multi-actor governance, and balanced development across sectors.

The techno-centric approach views the smart city as an urban space where advanced technologies permeate city systems in order to optimize service delivery, infrastructure performance, and resource use. It privileges digital infrastructure, sensor networks, real-time data collection, and the intelligent management of city functions. Within this perspective, technologies such as IoT, big data, and integrated digital platforms become central drivers of urban efficiency.

The human- and social-centric approach, by contrast, understands the smart city as a multi-actor, socially embedded development process. Technology remains important, but it is treated as a means rather than an end. This perspective emphasizes social capital, collaborative governance, community participation, institutional trust, and the alignment of technological change with lived urban needs. From the standpoint of urban development and smart cities research, this second approach is critical because it restores governance and citizenship to the center of smart-city planning [6, 12].

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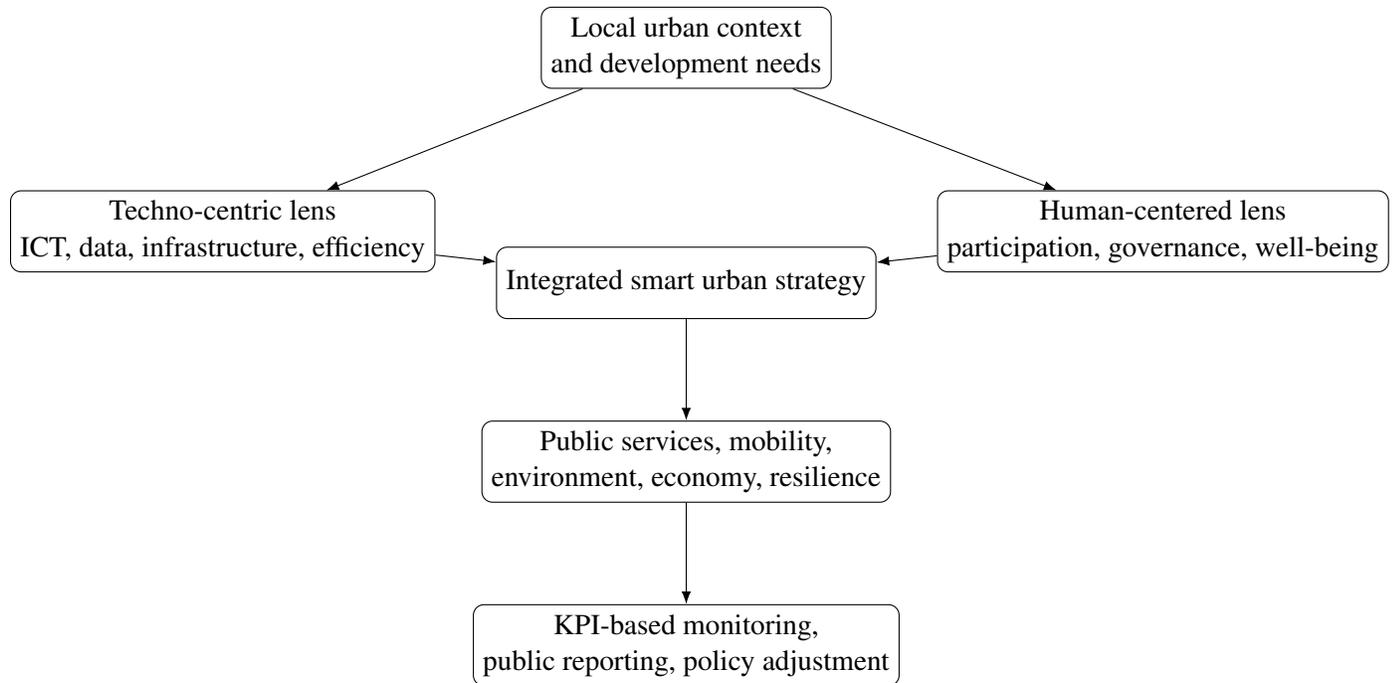
Figure 1: Integrated smart urban development logic for African cities.

For urban planning practice, the key implication is not that one approach should replace the other. Rather, smart urban performance depends on how effectively technological capability is integrated with governance quality, social inclusion, and strategic planning.

SMART-CITY DEVELOPMENT IN THE AFRICAN CONTEXT

The African urban context gives this conceptual distinction practical urgency. The reviewed literature emphasizes that African cities are experiencing fast population growth, rapid urbanization, and increasing pressure on housing, transport, services, and infrastructure [1]. It further notes that the world's fastest-growing urban areas over the 2016–2025 period are concentrated in Africa, underscoring the scale of transformation facing the continent.

At the same time, African cities are not uniformly equipped with high-tech systems comparable to those found in many European, North American, or East Asian settings. Infrastructural deficits, service inequalities, healthcare and education gaps, and sometimes unstable political contexts shape the feasibility of smart-city implementation. This is why a direct importation of generic smart-city models is analytically weak and practically risky.

The review also makes two important contextual observations. First, African cities may face fewer legacy constraints than older metropolitan systems elsewhere, which can create opportunities for technological leapfrogging in fields such as mobile services, fiber connectivity, and smart grids. Second, there is no single African smart-city model because geography, history, institutional capacity, and urban form differ substantially across cities.

Table 5: Illustrative African smart-city initiatives cited in the literature.

Location / Project	Country	Urban-development significance
Konza Technopolis	Kenya	Example of an early large-scale smart-city initiative designed to link technology, infrastructure, and future-oriented urban growth.
Cité du Fleuve	Democratic Republic of Congo	Illustrates the ambition to create new urban forms through planned smart-city development under complex infrastructural conditions.
Eko Atlantic City	Nigeria	Represents a high-visibility smart urban project associated with new-city development and investment-led urban restructuring.
Lanseria Smart City	South Africa	Demonstrates policy interest in planned smart-city expansion in a major metropolitan context.
Irembo and Vision City, Kigali	Rwanda	Show how digital public services, solar-powered streetscape technologies, and neighborhood-scale interventions can be linked to service modernization.
Nigerian Smart City Initiative	Nigeria	Highlights the effort to connect ICT innovation with physical infrastructure in support of improved service delivery.
Smart parking intervention, Addis Ababa	Ethiopia	Demonstrates targeted problem-solving through technology deployment in response to transport and parking constraints.
IBM Smarter Cities Challenge, Accra	Ghana	Illustrates external partnership models aimed at applying technology to economic and social development.
Casablanca Smart City and Rabat ranking	Morocco	Reflect how digital economy, telemedicine, mobility, and ecological-transition initiatives can support urban competitiveness and international visibility.

These examples are important for urban-development scholarship because they show that smart-city practice in Africa is neither absent nor uniform. It is unevenly distributed, sectorally differentiated, and strongly conditioned by local governance, financing, and implementation capacity. The literature further notes that concrete smart-city applications are concentrated in roughly ten of the continent's fifty-four countries, reinforcing the fact that smart-city development remains spatially selective and institutionally uneven [1].

AN AFRO-SMART URBAN DEVELOPMENT FRAMEWORK

To respond to this context, the literature formulates an African smart-city approach as a planning framework that links technology and data to broader goals of quality of life, efficiency, sustainability, and economic development. This Afro-Smart framing is especially suitable for urban development research because it translates abstract smart-city rhetoric into domain-specific planning concerns.

Table 6: Core elements of an African smart-city approach.

Element	Operational meaning for urban development
Connectivity	Building and maintaining high-speed internet and wireless networks to connect residents, businesses, and government services.
Data and analytics	Collecting and analyzing data to inform decisions and improve city services.
Sustainability	Using technology and data to reduce environmental impacts and improve energy efficiency.
Mobility	Improving transportation options and reducing congestion through smart transportation systems.
Livability	Improving access to healthcare, education, and other public services through technology-enabled planning and delivery.
Economic development	Attracting and retaining businesses, creating jobs, and promoting innovation through digitally enabled urban economies.
Governance	Improving city leadership, decision-making, and citizen participation through data-driven and technology-supported administration.
Safety and security	Enhancing security for residents and visitors through monitoring, coordinated response, and protective urban systems.
Resilience	Preparing for, withstanding, and recovering from disasters, emergencies, and other disruptions.

The review further stresses that these elements must be pursued through a holistic planning logic. An African smart-city strategy requires collaboration between city government, private firms, and citizens; a clear long-term vision; and the integration of environmental, social, economic, technological, and governance concerns within one planning framework [1]. This is a crucial point for the *Journal of urban development and smart cities*: the value of the smart-city concept lies not in the isolated deployment of technology, but in its ability to support integrated urban development.

The literature also outlines practical principles for implementation: engage stakeholders early, focus on improving public-service delivery, promote local economic development, foster innovation suited to local problems, and ensure long-term sustainability. These principles are directly aligned with urban-development priorities such as service equity, institution building, and adaptable planning.

KPI-BASED ASSESSMENT FOR SMART URBAN PERFORMANCE

A central contribution of the reviewed scholarship is the translation of the African smart-city framework into a KPI-based assessment methodology. The literature identifies KPIs as one of the most common and practical methods for evaluating smart and sustainable city performance because they allow policymakers and administrators to connect smart-city initiatives to measurable outcomes [1, 8, 11].

The proposed KPI matrix is designed specifically to assess the role of ICT in making African cities more sustainable and more effective. Its methodological foundation is drawn from multiple reference systems, including major smart-city index frameworks, smart sustainable city standards, the ICT Development Index, and institutional guidance associated with the Global City Indicators Facility, UN-Habitat, ITU, UNECE, ISO, and the European ranking of medium-sized cities. This gives the framework comparative structure while still allowing contextual adaptation for African cities [1].

Table 7: Assessment logic for an Afro-Smart KPI framework.

Assessment domain	Illustrative focus of measurement	Urban-development relevance
Energy and sustainability	Energy efficiency, resource consumption, environmental impact, air quality	Links digital interventions to environmental performance and long-term urban sustainability.
Transport and mobility	Transportation efficiency, congestion reduction, mobility access, smart transport systems	Connects infrastructure innovation to movement, accessibility, and everyday urban functionality.
Digital infrastructure	Connectivity, communication systems, data capacity, ICT readiness	Assesses the baseline technological conditions needed for modern urban management and service delivery.
Public services and quality of life	Healthcare access, education access, service reliability, quality of life outcomes	Ensures that technological modernization is judged by concrete improvements in citizen welfare.
Governance and participation	Citizen engagement, transparency, responsiveness, data-informed decision-making	Evaluates whether smart-city systems strengthen institutional legitimacy and collaborative governance.
Community-centered outcomes	Satisfaction with advanced technology services, accessibility of services, quality of service, community inclusion	Brings human-centered and social-equity concerns into smart-city performance assessment.

This KPI logic is especially valuable for urban development research because it prevents smart-city assessment from collapsing into a narrow inventory of devices or platforms. Instead, it asks whether ICT interventions generate measurable additional value in urban sectors and whether that value is legible to stakeholders and the public.

The literature also identifies a critical limitation: citizen participation in the design of KPIs remains limited in many African contexts. This can weaken the human-centered element of both evaluation and implementation. For that reason, community-driven indicators—including satisfaction with technology-enabled services, accessibility, service quality, and social inclusion—should be built directly into assessment systems. In practical terms, this means that smart urban performance must be measured not only by technical efficiency, but also by whether residents experience improved access, trust, and inclusion.

DISCUSSION

From the perspective of urban development and smart cities scholarship, three conclusions follow from this synthesis.

First, the smart city is best understood as a planning framework rather than a fixed technological model. The reviewed literature demonstrates that smart-city development operates through a combination of technological capability, socio-economic objectives, and governance arrangements. This makes the concept inherently interdisciplinary and explains why purely technical definitions are analytically incomplete.

Second, African urban contexts require explicitly contextual smart-city strategies. The literature is unequivocal that there is no generic solution for African cities. Fast urban growth, infrastructural deficits, varied governance

capacity, informal economies, and uneven financing conditions all affect what kinds of smart-city interventions are feasible, justifiable, and scalable. In this setting, context is not a secondary modifier; it is a primary planning variable.

Third, the most policy-relevant contribution of the Afro-Smart framework is its insistence on linking digital systems to urban outcomes that matter: service delivery, economic opportunity, environmental sustainability, public safety, resilience, and citizen participation. This makes the framework especially compatible with the mission of journals concerned with urban development, because it moves the discussion away from technological spectacle and toward operational urban performance.

The reviewed scholarship also highlights a productive tension between ambition and feasibility. Large-scale flagship projects may symbolize technological progress, but the literature suggests that existing towns and cities often provide the more viable arena for practical smart-city implementation. Incremental upgrades in digital public services, mobility management, utilities, and governance systems may therefore be more durable and socially meaningful than stand-alone greenfield projects.

POLICY AND PLANNING IMPLICATIONS

The manuscript yields several implications for planners, urban managers, and policymakers.

1. Prioritize context before technology. Smart-city planning should begin with local social, economic, political, and spatial conditions rather than with preselected digital tools.

2. Treat governance as infrastructure. Institutional coordination, stakeholder engagement, and data stewardship are as important as physical and digital systems.

3. Measure outcomes, not only inputs. Urban performance frameworks should capture service accessibility, quality of life, and citizen inclusion, not merely the presence of ICT systems.

4. Support incremental implementation. Existing urban systems often offer stronger opportunities for scalable, service-oriented smart interventions than highly capital-intensive showcase developments.

5. Embed public accountability. KPI findings should be reported in formats that are understandable and accessible to decision-makers, stakeholders, and the public.

These implications reinforce the central argument of this manuscript: smart urban development in Africa is most effective when technology is embedded within a broader framework of public-service improvement, governance quality, and socially inclusive planning.

CONCLUSIONS

Smart-city discourse remains one of the most influential but contested frameworks in contemporary urban development. The literature synthesized here demonstrates that the concept is structured by three recurring dimensions—technology and data, economy/society, and governance—and by two major interpretive approaches: a techno-centric approach centered on digital infrastructure and efficiency, and a human- and social-centric approach centered on participation, collaboration, and quality of life.

In African urban contexts, this distinction has direct planning consequences. Because cities across the continent are shaped by rapid urbanization, uneven infrastructure, institutional constraints, and varied development

trajectories, smart-city planning cannot rely on imported templates. It must be contextual, integrative, and evaluable.

The Afro-Smart framework provides that bridge. By organizing smart-city development around connectivity, data and analytics, sustainability, mobility, livability, economic development, governance, safety and security, and resilience, it translates conceptual smart-city debate into a practical urban-development agenda. By linking these elements to a KPI-based assessment structure, it also gives policymakers and planners a credible way to evaluate the public value of ICT-enabled interventions.

For the scope of the *Journal of urban development and smart cities*, the principal contribution of this manuscript is therefore twofold: it clarifies the conceptual foundations of smart-city thinking in Africa, and it converts those foundations into a planning-oriented framework for governance, implementation, and performance assessment. In doing so, it supports a more grounded and policy-relevant approach to smart urban transformation.

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