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Decision-making for Sustainable Future Cities: Factors, Stakeholders, Phases, and Mechanisms

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ABSTRACT

Achieving sustainable urban development remains a pressing global challenge, as decision-making processes are often shaped—and constrained—by complex economic, political, institutional, and technological factors. This study explores urban decision-making frameworks within the context of future city theories, including Smart, Resilient, Sustainable, Compact, Intelligent, Digital, and Livable cities. Using a mixed-method approach that combines a narrative literature review with semi-structured interviews, the research integrates conceptual models with practical insights from 17 international experts in urban planning, architecture, and sustainability. Findings reveal that while structured frameworks offer valuable guidance, urban decision-making in practice is dynamic, iterative, and highly context-dependent. Experts emphasized the need for adaptive strategies, cross-sector collaboration, and early-stage stakeholder participation to navigate conflicting urban priorities and ensure equitable outcomes. The study identifies critical factors influencing decisions, including regulatory fragmentation, funding limitations, stakeholder power imbalances, and the uneven adoption of emerging technologies. A five-phase model of the urban-planning decision-making process is presented—encompassing data collection, analysis, alternative generation, policy enforcement, and monitoring—while highlighting key implementation gaps that undermine long-term sustainability. The study underscores the importance of bridging the gap between theory and practice through integrated governance systems, participatory planning mechanisms, and data-driven tools. It recommends calling for future research into the long-term effectiveness of decision-making frameworks and the development of context-sensitive, inclusive, and resilient planning approaches suited to complex urban realities.

Keywords: Decision-making mechanisms, Future city theories, Sustainable urban development, Stakeholders' involvement, Urban planning.

INTRODUCTION

Sustainability has become a central focus in academic and professional discourses, with its usage and related publications growing exponentially (Cano & Londoño-Pineda, 2020). The 2030 Agenda for Sustainable Development and its 17 SDGs emphasize global sustainability efforts, yet only 12%-15% of targets are on track (Clara Fong & Diana Roy, 2023; Johanna Braun, 2023). Achieving sustainable urban development requires integrating economic, social, and environmental dimensions (United Nations News, 2022). Future-city theories offer pathways to sustainability by fostering well-being, equity, resource efficiency, and intergenerational responsibility (Balogun et al., 2020; Clement et al., 2023; Kahachi et

al., 2024b; Kahachi et al., 2024a). However, adopting inclusive, dynamic decision-making remains a challenge (Berta et al., 2018; Bottero et al., 2021). Urban planning must address development, rejuvenation, and sustainability, shaped by stakeholder and environmental factors. (Kahachi, 2020a; Franziska Schreiber, 2021; Utilities One, 2023). Additionally, planning has shifted from traditional methods to adaptive frameworks that manage urban uncertainties and align with sustainable development principles balancing growth, equity, and environmental protection (Van Stigt et al., 2015; Kahachi, 2020b). Flexible, data-driven approaches support resource allocation, risk management, and sustainable policies, leveraging tools, like GIS, AI, and big data analytics (Kahachi, 2022; Olaniyi et al., 2023; Sabine Ameer, 2023). Despite these advances, stakeholder integration in decision-making remains limited (Becker et al., 2023; Ganeshu et al., 2023). Hence, this article addresses these gaps by reviewing decision-making frameworks in future cities' theories, such as Smart City, Resilient City, and Sustainable City. This study contributes to the literature by integrating multi-regional expert insights and synthesizing a five-phase framework for understanding urban decision-making mechanisms in sustainable future cities. It examines processes, stakeholder roles, and tools, like governance models, policy frameworks, technology, and community engagement while discussing challenges and implications for sustainable urban development.

RESEARCH METHODOLOGY

This study employed a qualitative, two-step methodology combining a narrative literature review and semi-structured expert interviews to examine decision-making frameworks in sustainable urban development. This approach integrated theoretical insights from existing literature with practical perspectives from urban planning professionals. The narrative literature review explored decision-making mechanisms within future city theories (Smart, Resilient, Sustainable, Compact, Intelligent, Digital, and Livable Cities), offering flexibility in synthesizing diverse perspectives without the rigid criteria of systematic reviews (Alan Bryman, 2014). It identified key factors, stakeholder roles, and governance mechanisms, forming the conceptual foundation for the study. To complement this, semi-structured interviews captured real-world challenges in urban decision-making. 17 experts from academia, government agencies, and private consultancy firms were selected based on pre-defined eligibility criteria, including a minimum of five years of experience, involvement in urban planning or sustainability initiatives, and geographic diversity. The sampling approach was purposive rather than random, aligning with qualitative research standards (Alan Bryman, 2014). To clarify the diversity and relevance of expert participation, Table 1 provides an overview of each participant's country of origin, academic background, professional role, and involvement in urban planning or sustainability initiatives. This table reflects the intentional inclusion of varied geographic, institutional, and disciplinary perspectives across regions and sectors. Thematic analysis identified three key challenges: (1) regulatory and policy barriers, (2) conflicting stakeholder interests, and (3) the increasing role of data-driven technologies in planning.

Table 1. Summary of expert participants (country, education, occupation, sustainability involvement)

#	Country	Educational Level	Occupation	Sustainability/Urban Planning Involvement
1	Germany	PhD in Urban Policy	Urban Planning Consultant	Smart mobility, EU policy
2	Canada	PhD in Geography	Academic/Researcher	Resilience, green infrastructure
3	Iraq	MSc in Urban Planning	Government Planner	Urban renewal, climate adaptation
4	Netherlands	PhD in Architecture	Urban Design Professor	Smart cities, spatial planning
5	United States	PhD in Sustainability Science	City Data Officer	Data-driven planning
6	Brazil	MSc in Civil Engineering	Environmental Planner	Community planning
7	UK	MSc in Urban Design	Local Government Advisor	Carbon-neutral development
8	Kenya	MSc in Environmental Studies	NGO Program Director	Inclusive development
9	UAE	PhD in Public Policy	Regional Policy Analyst	Smart regulation

10	India	MSc in Urban Infrastructure	Consultant	Urban resilience (WB)
11	Australia	PhD in Environmental Planning	Academic	Biodiversity, resilience
12	France	PhD in Political Science	Sustainability Strategist	Governance, stakeholder mediation
13	China	MSc in Transport Planning	Mobility Planner	Public transport modernization
14	Spain	PhD in Urban Governance	Urban Studies Researcher	EU Smart Cities
15	South Africa	MSc in Development Studies	Municipal Advisor	Housing, budgeting
16	Malaysia	MSc in Sustainable Architecture	Lecturer	Green infrastructure
17	Egypt	MSc in Environmental Management	Urban Analyst	Heritage, energy audits

Methodological limitations include reliance on a small, time-bound sample, affecting generalizability. Additionally, potential biases in expert responses and the subjectivity of thematic analysis may influence interpretation. However, diverse sector representation helped mitigate these limitations. While the narrative review provided flexibility, it may not capture all frameworks, an issue addressed by incorporating inter-disciplinary sources. By integrating literature and expert insights, this study bridges gaps between theory and practice, offering a comprehensive understanding of decision-making in future cities and strengthening its contribution to sustainable urban development.

RESULTS AND DISCUSSION

This section discusses the results of the literature review and qualitative insights gathered from 17 international experts representing diverse sectors and geographies. These include academics, consultants, public officials, and NGO practitioners from both the Global North and South. Their contributions enrich the understanding of decision-making mechanisms that shape urban development trajectories in future cities. The next sub-section explores key theoretical approaches, such as institutional frameworks, governance factors, and actor-actor networks and their influence on structuring urban decisions. Therefore, the five-phase process of decision-making, covering data collection, analysis, planning, enforcement, and monitoring is explained. This combined analysis provides a grounded, yet globally-informed, foundation for advancing sustainable urban development discourse.

Urban Development Decision-making Framework

The results showed that the decision-making process in urban planning is widely recognized by the 17 experts as a cyclical, multi-layered, and iterative process rather than a linear sequence of steps. Experts broadly agreed with the UN-habitat, 2007 Sustainable Urban Planning Guide (UN-Habitat, 2007), emphasizing that planning activities are often conducted in parallel and require continuous adjustment. To clarify, the process is typically divided into phases and steps using urban planning and management frameworks, which commonly consist of identifying, measuring, and analyzing issues, generating alternative solutions, assessing and comparing options, followed by implementation and monitoring. Researchers stated that frameworks aim to guide urban planning, facilitate stakeholder involvement, and reduce the complexities and uncertainties tied to urban development (Stuart 1969; Beck & Storopoli, 2021). However, expert perspectives varied regarding the effectiveness of these frameworks in achieving sustainability goals. Some argued that while theoretical models provide valuable guidance, their real-world implementation is hindered by political inertia and institutional constraints. Others stressed the importance of flexibility, noting that rigid decision-making structures often fail to accommodate evolving urban challenges. The broader sample of 17 experts from diverse national and institutional backgrounds enabled the identification of both shared concerns and context-specific challenges. Notably, experts from high-income countries (e.g. Germany, Canada, and the Netherlands) emphasized institutional flexibility and advanced digital infrastructure, while those from middle- and low-income contexts (e.g. Kenya, Brazil, Iraq) highlighted bureaucratic rigidity, inconsistent funding, and limited technological access. This contrast underscores that contextual realities shape the feasibility and effectiveness of iterative planning models.

Frameworks/Approaches of Urban Planning Decision-making

Urban planning decision-making incorporates

various frameworks, each with strengths and limitations. Traditional rational planning, often criticized for its rigid and top-down nature, was described by some experts as outdated, yet necessary for projects requiring strong central coordination (Stuart, 1969; Batty, 1976) Incremental planning, which allows for gradual policy adjustments (ESHNER et al. 1992; Bin 2013), was considered by most experts to be more adaptable, but often slow and reactive. Scenario planning, frequently associated with Smart Cities and Resilient Cities, was viewed favorably for its flexibility and stakeholder engagement (Wright, 2000a; Wright, 2000b; Conway, 2004). However, with the diverse sample experts' geographic and institutional backgrounds, variations in the adoption and perceived effectiveness of these frameworks became more evident. Experts working in high-capacity governance environments highlighted successful uses of scenario planning integrated with digital tools, while experts from lower-capacity settings emphasized the challenges in applying such approaches due to limited technical expertise or institutional resistance. One expert working in government urban policy stated: "We often create scenarios, but political cycles and budget constraints dictate which one actually moves forward". Another expert from a private consultancy institution added that technology-driven scenario models are underutilized in practice, as many municipalities lack the resources to fully implement them. These insights suggest that while theoretical planning frameworks remain useful, their real-world impact varies significantly depending on the local planning context and institutional maturity.

Key Factors Influencing Urban Planning Decision-making

Urban planning decisions are shaped by multiple inter-dependent factors. Environmental considerations, such as climate resilience, air quality, and biodiversity, remain central, but are often deprioritized in favor of short-term economic gains (Kahachi, 2017a; Kustysheva, 2017). Experts with environmental backgrounds stressed the need for stronger integration of ecological data in planning tools, while others warned that environmental concerns are frequently sidelined due to economic and political pressures. Economic constraints and social factors were identified as particularly influential and divisive in shaping decisions (Liu & Zhu, 2011; Lu et al., 2013; Kahachi, 2017b). Urban planners from the public sector in low- and middle-income countries emphasized challenges related to fluctuating budgets, fragmented authority, and community distrust—often exacerbated by rapid urban growth. In contrast, experts from European and North American settings highlighted concerns with rigid administrative structures and siloed departments that limit innovation and coordination. These variations point to the need for governance models that are both adaptive and context-sensitive.

Cultural identity and cohesion were also highlighted by multiple experts as shaping planning priorities, especially in historic or religiously significant cities, where modern interventions must align with deeply rooted traditions. Perspectives from East Asia and the Middle East emphasized the tensions between centralized authority and the need for inclusive stakeholder engagement. One expert working in a Gulf country observed, *"Cultural values are non-negotiable, so planners have to work around them—not through them"*. Several experts emphasised that while centralized systems enable swift policy action, they can also limit meaningful community participation, one senior planner remarked: *"We know what needs to be done for sustainable urban development, but funding mechanisms don't support long-term investments or community engagement"*. Conversely, private-sector experts noted that public-private partnerships (PPPs) can advance innovation and financial sustainability, provided that community voices are included and regulatory processes streamlined.

Political and administrative dynamics also emerged as recurring themes in literature (Greer & Minar, 1964; Kahachi et al., 2022) Government-affiliated experts noted that policy continuity is a major barrier, as political turnover often leads to policy reversals. One interviewee from a planning agency stated, "*A well-developed urban strategy can be abandoned overnight with a change in administration*". However, other experts argued that strong legal frameworks can mitigate political risks by enforcing long-term sustainability commitments.

Lastly, technological advancements, including GIS, IoT, and AI, were widely acknowledged as transformative tools for urban decision-making (Brotchie, 1984; Shiode, 2000). Experts in technology and smart city planning noted that while these tools improve efficiency, the digital divide remains a major

challenge, particularly in developing cities. A smart city specialist pointed out that *"while AI-driven models can enhance planning, many city governments lack the technical expertise to utilize them effectively"*.

Actors/Stakeholders of Urban Planning Decision-making

Urban decision-making involves multiple actors, each with varying levels of influence and interest (Thompson et al., 2016). Government authorities and professional planners continue to play a central role in shaping policy agendas and overseeing implementation. However, expert perspectives revealed growing tensions between governance structures and the principles of inclusive planning. While state-led systems were often credited for institutional continuity, several interviewees criticized their tendency to exclude local communities from the early phases of planning. As one community engagement specialist put it, *"Planners talk about participatory decision-making, but in reality, many communities only get consulted after major decisions are already made."*

Private developers and businesses play a decisive role in shaping urban growth, particularly through large-scale real estate and infrastructure investments. Although many experts acknowledged the value of private-sector involvement in bringing innovation and capital to the table, concerns were raised about its disproportionate influence on urban agendas. A stakeholder dynamics researcher noted, *"There's a fine line between public-private cooperation and corporate-driven urbanization that prioritizes profit over social equity"*.

Utilities and service providers are essential in enabling the physical and operational foundations of cities, including energy, water, sanitation, and transportation. While these actors often operate behind the scenes, their alignment with long-term planning goals was described as crucial, particularly in fast-growing or resource-constrained urban regions. Academic and scientific institutions contribute research and technical knowledge, especially in the fields of sustainability, climate adaptation, and environmental impact assessment. Their influence, however, was described as variable—shaped by their proximity to policy institutions and the openness of decision-making channels.

Environmental and social organizations were consistently described as advocates for inclusivity, equity, and sustainability (Heurkens et al., 2015; Thompson et al., 2016), yet many experts noted the limited influence of these groups, largely due to their lack of enforcement power. As one NGO practitioner working in the environmental sector observed, "*We provide data and recommendations, but unless there's a political will, implementation remains a challenge*".

The degree of stakeholder inclusion and impact varied significantly by region and governance context. NGO leaders and academics from Kenya, Brazil, and South Africa highlighted how systemic exclusion persists—especially for residents in informal settlements—often resulting in weak trust and community resistance. Meanwhile, experts from France and the UAE acknowledged growing institutional interest in public participation, but questioned the depth of such engagement. One urban advisor remarked that, *"consultation has become a checkbox rather than a genuine dialogue."*

Despite these variations, most experts emphasized that effective stakeholder engagement is indispensable for achieving inclusive and sustainable outcomes. The challenge lies in balancing influence and accountability across diverse institutional and social landscapes. The discussion that follows explores how these actors interact across the structured phases of urban decision-making.

The Phases of Decision-making in Urban Development

Sustainable urban development requires the integration of social, economic, and environmental priorities into regional planning strategies that are adaptive, inclusive, and forward-looking. Drawing from a range of theoretical models and expert insights, future cities are envisioned as dynamic systems where decision-making is cyclical, iterative, and evidence-driven. Experts emphasized that sustainability goals can only be achieved when planning frameworks are grounded in local realities and informed by reliable data.

International bodies, such as the United Nations Development Programme (UNDP), stress that data-informed decision-making enhances transparency, accountability, and policy innovation by helping diagnose urban challenges, assess intervention outcomes, and enable adaptive responses to complex urban problems (UNDP, 2023). Most experts described

the planning cycle as involving several inter-linked stages: identifying and analyzing key urban issues; generating and evaluating alternative strategies; and ultimately implementing, monitoring, and adjusting actions over time. However, as many interviewees noted, incorporating sustainability into these stages is far from straightforward. It is mediated by multiple factors—economic and political constraints, stakeholder dynamics, and institutional capacity—as well as by the decision-making tools available at each phase. For example, while some experts described successful use of GIS and performance indicators in early planning stages, others pointed to the lack of technical infrastructure or limited cross-sector coordination as recurring barriers.

The following sub-sections explore the specific tools and mechanisms applied across each stage of the urban decision-making process. While theoretical frameworks often present these phases as distinct, expert feedback reveals that in practice, cities tend to draw from overlapping tools and strategies to adapt to evolving conditions. Understanding how these instruments function at different decision points offers critical insights into the effectiveness, limitations, and potential of planning systems in both developed and developing urban contexts.

Phase 1: Data Collection

Urban planning fundamentally depends on the availability of comprehensive and high-quality data to guide informed decision-making. Contemporary planning frameworks increasingly emphasize the need for structured and integrated data systems. These include urban information models, planning data models, and multi-layered 3D urban representations that help planners understand spatial dynamics and future growth scenarios (Hopkins et al., 2005; Jim and John, 2011; Ferreira et al., 2015). Traditional data collection methods such as surveys, focus groups, census data, and satellite imagery remain foundational (Gösta et al., 2020). However, these are now complemented by a growing array of modern techniques. Experts discussed the expanding use of IoT sensors, real-time crowdsourcing platforms, AI-driven predictive analytics, and mobile-generated data, which offer richer and more dynamic insights into evolving urban conditions (Klosterman, 2015; Rathore et al., 2016; Ma et al., 2020; Ilchenko, 2021).

Despite these advancements, expert perspectives varied regarding the reliability and practical usability of urban data. Planners working in digitally advanced contexts described how digital transformation has significantly enhanced forecasting capabilities, scenario modeling, and performance tracking. At the same time, several practitioners, especially those operating in under-resourced municipal contexts, raised critical concerns around data fragmentation, lack of interoperability across agencies, and inadequate data governance structures. As one expert working in local government noted, *"We have access to more data than ever, but poor integration across agencies leads to inefficiencies and data redundancy."* Similarly, a private-sector expert emphasized that while open data portals have expanded, much of the information is outdated, incomplete, or not standardized—limiting its utility in real-time decision-making.

Overall, the data collection phase reflects both the promise and the limitations of current urban technology systems. While digital tools are transforming planning processes, their effectiveness remains uneven, shaped by broader institutional capacities and data management practices.

Phase 2: Data Analysis

Analyzing urban data allows planners to extract meaningful insights for sustainable development. Traditional statistical analysis, GIS mapping, and demographic modeling have been foundational in urban planning. More recently, big data analytics, machine learning, and AI-driven simulations have revolutionized the process, enhancing predictive capabilities and scenario modeling (Andrade et al., 2019; Shah et al., 2019; Kaluarachchi, 2022). Comprehensive frameworks, like those in Smart Cities, integrate multi-method approaches, ensuring strategic data management. Together, these tools are essential for interpreting data and guiding sustainable urban planning.

However, experts highlighted significant disparities in the adoption and effectiveness of advanced analytical tools across contexts. Government-affiliated planners operating in resource-constrained municipalities pointed to limited technical expertise, budgetary restrictions, and institutional inertia as key barriers to implementation. In contrast, private-sector professionals and consultants observed a growing gap between technological capability and institutional readiness. One

expert remarked, *"We have the technology to predict urban growth trends with high accuracy, but city officials often rely on conventional planning methods due to regulatory inertia"*. Additionally, concerns were raised about overreliance on quantitative data alone. Several experts advocated for integrating qualitative approaches—such as ethnographic studies, stakeholder interviews, and participatory mapping—to capture the socio-cultural and political dimensions of urban complexity. This call for mixed-method analysis reflects a broader recognition that data must not only be technically accurate, but also contextually grounded and socially inclusive.

Overall, while the tools available in this phase offer unprecedented analytical power, their impact depends heavily on institutional willingness, trust in data systems, and the ability to synthesize diverse sources of knowledge into coherent planning strategies.

Phase 3: Generating and Evaluating Alternatives

The development of urban planning alternatives requires a structured approach to assess competing options in terms of sustainability, resilience, and livability. Theoretical models in urban planning emphasize rational, iterative, and scenario-based methodologies that allow planners to consider diverse future trajectories under varying conditions (Loconte et al., 2013; Perveen et al., 2017; Deloly et al., 2021) These frameworks are increasingly supported by computational tools, such as CityEngine and Multi-Criteria Decision Analysis (MCDA), which enhance the evaluation of alternatives across multiple performance indicators.

Equally important are participatory methods—such as community workshops, public forums, and co-design sessions—which aim to incorporate local knowledge and ensure that proposed alternatives reflect stakeholder priorities. While these methods are widely promoted in theory, experts pointed to significant gaps in their practical application. Several interviewees noted that although scenario-based planning allows for informed and flexible decision-making, urban development decisions are frequently shaped by political and economic constraints. One expert remarked, *"We can design multiple future scenarios, but in the end, decisions are driven by funding availability and political will rather than by long-term sustainability goals"*. Concerns were also raised about the tokenistic nature of public participation in many planning contexts. Experts involved in community engagement emphasized that stakeholder consultations are often conducted after key decisions have already been made, undermining the legitimacy and influence of public input. As one expert explained, *"Cities conduct stakeholder meetings, but these are often held too late in the process, when key decisions have already been made."*

To address these issues, experts recommended the integration of participatory approaches at the earliest stages of alternative development, along with the adoption of transparent and measurable evaluation criteria. Doing so not only enhances the legitimacy of selected alternatives, but also builds broader support for implementation and monitoring.

Phase 4: Enabling and Enforcing Urban Change

Following the selection of an urban development strategy, implementation depends on a combination of legal, regulatory, and financial mechanisms that support and enforce planned change. Traditional tools—such as zoning laws, building codes, land-use plans, and tax incentives—remain essential components of regulatory systems aimed at guiding sustainable urban transformation (Nel et al., 2018; Radu, 2020; Gade, 2021). These instruments offer a legal basis for decision enforcement, spatial control, and accountability across public and private sectors. Recent years have also witnessed the emergence of innovative tools that enhance enforcement and monitoring capacities. These include Voluntary Local Reviews (VLRs) that align local plans with global sustainability indicators, blockchain-based land registries to reduce corruption and increase transparency, and performance-based urban contracts that tie implementation to measurable outcomes. Experts noted that such innovations hold considerable promise, particularly in contexts where traditional mechanisms have proven to be insufficient or easily circumvented.

However, perspectives diverged regarding the effectiveness of enforcement tools in practice. Several planners and public officials raised concerns about institutional limitations, noting that enforcement often suffers from inconsistent application, limited inter-agency coordination, and political interference. As one policymaker stated, *"Many well-intentioned sustainability regulations are bypassed due to political pressure from developers and private interests"*.

Conversely, some experts expressed optimism about the growing role of real-time monitoring systems. Tools powered by IoT and AI were cited as effective in identifying zoning violations, tracking emissions, and improving compliance with urban sustainability standards. One expert explained, *"Real-time monitoring through IoT and AI can detect zoning violations, track emissions, and improve compliance with urban sustainability regulations"*.

Despite these benefits, several experts warned of emerging risks related to privacy, data security, and algorithmic bias. The use of automated surveillance and enforcement technologies raises ethical questions about how data is collected, interpreted, and used in decision-making. These concerns suggest that while digital tools can strengthen enforcement, they must be accompanied by clear governance frameworks and safeguards to ensure transparency and public trust.

Phase 5: Monitoring and Control

Monitoring and control mechanisms are essential for ensuring that urban planning decisions remain aligned with long-term sustainability objectives. These systems allow planners and policymakers to track progress, identify deviations, and adapt strategies in response to changing urban conditions. Scholars emphasize that a range of tools support this process, including statistical datasets, satellite-based remote sensing, IoT-enabled environmental monitoring systems, and citizen reporting platforms (Manninen, 2008; Marconcini et al., 2015; Choi & Lim, 2023). Standardized frameworks, such as urban sustainability indicators and Environmental Impact Assessments (EIAs), serve as key instruments for evaluating outcomes. These tools support the measurement of environmental factors—such as air quality, noise pollution, habitat conservation, flood vulnerability, and coastal erosion—as well as economic metrics, including employment rates, income levels, industrial growth, and economic resilience. Together, these provide an integrated view of a city's performance and adaptability.

While experts generally agreed on the importance of continuous monitoring, they also identified key implementation challenges. Several government officials noted that existing monitoring frameworks are often oriented toward periodic reporting rather than long-term outcome evaluation. As one planning expert observed, *"Cities publish sustainability reports, but these often lack follow-up mechanisms to ensure accountability"*. Social indicators were also highlighted as an under-developed area within current monitoring systems. Experts emphasized that metrics related to demographics, equity, public health, education, and safety are frequently overlooked, limiting the capacity to assess inclusive urban well-being. Moreover, a number of interviewees pointed to the under-utilization of community participation in the monitoring process. A civic technology advocate remarked, *"Crowdsourced urban data and participatory sensing can greatly enhance real-time monitoring, but most cities still rely on centralized reporting structures"*. To address these limitations, experts proposed stronger adoption of open data platforms, participatory auditing mechanisms, and community-led monitoring initiatives. Such approaches, they argued, can increase transparency, foster civic trust, and enable more responsive urban governance.

CONCLUSIONS

While modern technologies, such as artificial intelligence, machine learning, and GIS, are transforming urban planning into a more data-driven and predictive field, their adoption remains uneven. Institutional resistance, regulatory fragmentation, and the digital divide continue to hinder widespread integration—particularly in lower-capacity urban systems. Stakeholders play a central role in the planning process, yet true public engagement often remains limited or symbolic, occurring too late to meaningfully influence outcomes. Strengthening early-stage participation, transparency, and governance is therefore essential to enable more inclusive and equitable urban decision-making. Table 2 synthesizes the key mechanisms identified across the five phases of the urban planning decision-making process. It highlights persistent challenges raised by experts, including fragmented data systems, political inertia, weak stakeholder engagement, regulatory inconsistencies, and under-developed monitoring frameworks. These barriers underscore the need for more integrated, adaptive, and participatory approaches that can bridge the gap between theoretical models and on-the-ground planning realities.

Table 2. Sustainable development mechanisms in urban planning decision-making and expert-identified constraints

Phase	Sustainable Development Mechanisms	Potential Limitations & Constraints (Expert Insights)
Phase 1: Data Collection	• Surveys • Interviews and Focus Groups • Ethnographic Observations • Sensors and Remote Sensing • Participatory Data Collection • Social Media and Crowdsourcing • Official Statistics	• **Data accuracy and bias** – Surveys and participatory data are often influenced by respondent bias and under-representation of marginalized communities. • **Resource constraints** – High costs and technical expertise required for sensor deployment and real-time monitoring. • **Data fragmentation** – Lack of standardization and integration across different data sources leads to inconsistent urban insights.
Phase 2: Data Analysis	• Experts and Planners • Big Data Analytics • GIS • Machine Learning • Data-driven & Statistical Analysis • Data Management & Analysis Frameworks	• **Uneven adoption of technology** – Many cities lack the infrastructure or expertise to implement advanced AI and machine learning models. • **Political resistance to data-driven decisions** – Policy choices often prioritize political agendas over empirical evidence. • **Data privacy concerns** – Expanding the use of smart technologies and big data raises ethical and regulatory challenges.
Phase 3: Generating & Evaluating Alternatives	• Brainstorming • Design and Evaluation • Analytical Methods & Artificial Intelligence • Stakeholder Engagement • Policy Decision-support Tools • Collaborative Approach	• **Limited stakeholder influence** – Public participation is often symbolic rather than genuinely shaping outcomes. • **Trade-offs between efficiency and inclusivity** – Time constraints may lead to prioritizing speed over comprehensive stakeholder engagement. • **Resistance to AI-driven decision-making** – Experts noted reluctance in governments to rely on automated models for high-stake planning.
Phase 4: Enforcing/ Enabling Urban Change	• Legal and Regulatory Frameworks • Tax Reformation and Policies • Development Initiatives • Federal Initiatives • City Governance • Disruptive Technologies	• **Regulatory inconsistencies** – Policy implementation varies across jurisdictions, leading to inefficiencies. • **Resistance from interest groups** – Developers and businesses may push back against stringent sustainability policies. • **Lack of enforcement mechanisms** – Smart regulations require strong institutional backing to be effective.
Phase 5: Monitoring & Control	• Urban Statistics • Remote Sensing and IoT • Public Participation • Sensory Networks • Industrial and Economic Flows • Demographic Change & Ethnographic Analysis • Services Utilization Analysis	• **Short-term focus** – Many monitoring frameworks emphasize short-term compliance rather than long-term urban resilience. • **Data accessibility issues** – Public access to monitoring data is often restricted, reducing transparency and accountability. • **Limited integration of citizen-driven monitoring**- Crowdsourced data and participatory monitoring remain underutilized.

Despite the previously mentioned limitations, this study demonstrates that urban decision-making has evolved beyond the traditional rational models toward more dynamic, data-informed, and participatory approaches. Future city theories, such as Smart, Resilient, and Sustainable Cities, promote holistic planning processes rooted in evidence, inclusivity, and adaptability. However, expert insights revealed persistent disconnects between vision and practice, often shaped by economic constraints, governance instability, and institutional path dependencies.

The findings confirm that decision-making is influenced by a complex interplay of environmental, social, economic, cultural, political, and technological factors. This complexity requires planners and policymakers to balance competing priorities while remaining responsive to evolving urban conditions. Future research should prioritize the integration of emerging technologies into planning systems, particularly in developing cities where digital infrastructure remains under-developed. Longitudinal studies are also needed to assess the long-term effectiveness of planning frameworks and to identify strategies for reconciling short-term political agendas with long-term sustainability goals.

Addressing urban complexity in the 21st century will require cross-sector collaboration, advanced scenario modeling, and participatory monitoring mechanisms to enhance resilience and governance responsiveness. Bridging theory and practice demands flexible, context-sensitive, and multidisciplinary decision-making frameworks capable of navigating uncertainty and accelerating progress toward sustainable urban development.

In summary, this study contributes to the urban planning literature by synthesizing globally diverse expert insights into a unified five-phase decision-making model. The participation of 17 experts from countries across the Global North and South enabled comparative perspectives on regulatory, technological, and cultural

dimensions of urban governance. This international scope enhances the external validity of the findings and supports their relevance to both academic researchers and policy-makers operating in varied urban contexts.

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