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INTEGRATING SMART TRANSPORTATION SYSTEMS AND URBAN GOVERNANCE FOR SUSTAINABLE MOBILITY: A SYSTEMATIC REVIEW AND CONCEPTUAL FRAMEWORK

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A B S T R A C T

This study examines how cities may develop sustainable and inclusive transportation networks in response to rising urbanization, climate change, and digital disruption. Grounded in the Smart City Framework and Resource-Based View (RBV) philosophy, a PRISMA-guided review of 71 peer-reviewed works (2018–2025) investigates the incorporation of AI, IoT, and platform-based mobility within urban transportation. The research evaluates governance frameworks, emphasizing the 15-minute city and spatial equality, and indicates that technical efficacy is contingent upon institutional capacity, coordination, infrastructure, and inclusive policies. It underscores governance disparities across cities in the Global North and South, emphasizing the necessity for specific frameworks that tackle informal transportation and foster community engagement. A suggested conceptual framework connects governance, digital competencies, and proximity-oriented planning to facilitate sustainable mobility. This research theoretically integrates the Resource-Based View and smart city principles, providing practical recommendations for policymakers and planners to promote equitable, technology-driven urban mobility systems.

1. INTRODUCTION

Urban mobility is a crucial element of sustainable urban development and governance, functioning as a catalyst for economic progress and a facilitator of enhanced quality of life (Beyazit & Canitez, 2023). Efficient public transportation systems substantially advance sustainable development by improving economic efficiency and fostering social well-being (Saddal et al., 2023). Sustainable urban governance includes the mitigation of traffic-related pollution, the advancement of social fairness in mobility access, and the promotion of multi-modal transportation systems facilitated by digital technologies (Melkonyan et al., 2022). Thus, efficient urban mobility governance necessitates cooperation across different administrative tiers to guarantee socio-spatial justice, connectedness, and integrated governance. This alignment is essential for maintaining urban areas and meeting international sustainability obligations (Ribeiro & Fachinelli, 2024).

Notwithstanding the recognized significance of urban mobility, numerous cities, especially in the Global South, persist in experiencing inadequate governance structures, disjointed institutions, and insufficient intersectoral coordination. These governance deficiencies lead to mismatched transportation policy, insufficiently funded infrastructure, and unequal access to mobility services. The situation is exacerbated by the lack of integrated digital platforms for real-time planning, monitoring, and decision-making. Although several cities have trialed mobility changes, their enduring influence is constrained

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by difficulties related to institutional capacity, political will, and data governance.

Digital transformation presents a viable solution for tackling these structural difficulties. Emerging technologies, including artificial intelligence (AI), the Internet of Things (IoT), and big data analytics, empower cities to develop responsive, adaptive, and human-centric transportation systems (Melkonyan et al., 2022; Helbing et al., 2024). These instruments enable the implementation of intelligent transportation systems (ITS), dynamic route optimization, predictive maintenance, and multimodal integration. An essential component of sustainable urban mobility is the incorporation of Active Mobility (AM) into Intelligent Transportation Systems (ITS) and the application of data-driven services in smart cities. These solutions improve accessibility, connectedness, and social inclusion, therefore fostering the advancement of intelligent, sustainable urban settings (Papageorgiou et al., 2024a, 2024b). Furthermore, urban planners are utilizing technological innovations to enhance energy efficiency, waste management, and public safety (Phalak, 2024). The implementation of smart city projects, including edge AI and Blockchain, tackles urban mobility and energy issues, promoting the transformative potential for more intelligent and resilient cities (Badidi, 2022). The availability of digital technologies alone is inadequate without a clear policy and governance framework that links technological implementation with social and environmental objectives (Sha et al., 2024).

This research examines the function of intelligent transportation systems in promoting sustainable urban mobility. It specifically examines the convergence of governance innovation, digital transformation, and resource capabilities development in the formulation of inclusive and efficient mobility solutions. The article delineates enabling factors and enduring obstacles in the implementation of smart transport initiatives by using global and regional experiences. The study enhances the discourse on how cities might establish intelligent and equitable mobility systems in response to increasing urban constraints and sustainability requirements.

The '15-Minute City' is an innovative concept that prioritizes proximity and mixed land-use, aligning with global sustainability objectives by improving environmental, social, and economic outcomes (Allam et al., 2022). Notwithstanding the promising potential of these solutions, growing urbanization persists in posing issues such as traffic congestion, air pollution, and inadequate public transit networks (Flores-Albornoz et al., 2024). Confronting these difficulties necessitates a comprehensive and cooperative strategy that engages policymakers, urban planners, and communities by integrating sustainable transportation methods and new mobility solutions to promote resilient urban systems.

This study is directed by the following research objectives: (1) to examine the transformative capacity of smart transportation systems in urban mobility and governance; (2) to identify pivotal emerging technologies influencing sustainable urban mobility; (3) to present global and regional case studies that showcase successful smart transportation initiatives; (4) to address challenges and opportunities related to the implementation of smart mobility solutions; and (5) to propose actionable strategies and policy recommendations for improving urban mobility through smart systems.

This inquiry is directed by the subsequent research questions:

RQ1: *In what ways can cities strategically incorporate smart transportation technologies to improve sustainable urban mobility?*

RQ2: *What governance and resource-related factors facilitate or hinder the transition to smart urban mobility systems?*

2. LITERATURE REVIEW

2.1Theoretical Framework

This research is based on two interconnected theoretical frameworks: the Smart City Framework and the Resource-Based View (RBV) hypothesis. The Smart City Framework envisions urban development as an integration of technology, governance, and sustainability to improve urban livability and efficiency (Mupfumira, Mutingi, & Sony, 2024). The notion of smart sustainable cities encompasses the multifaceted integration of individuals and digital technology, forecasting the future evolution of urban areas (Shao & Min, 2025). It underscores the need of digital infrastructure, participatory governance, and data-driven innovation in tackling urban challenges. Smart cities utilize sophisticated technologies to enhance services, manage resources, and include inhabitants, thus promoting inclusive and responsive urban settings.

This paradigm emphasizes the use of digital technologies, including edge computing, artificial intelligence, and blockchain, to enhance transit efficiency, safety, and environmental sustainability within the smart transportation sector (Phalak, 2024; Badidi, 2022). Urban mobility is redefined as a foundation for innovation, civic participation, and intersectoral collaboration. The '15-Minute City' model illustrates this transition by emphasizing closeness, decentralization, and diverse transportation alternatives in accordance with sustainability objectives (Allam et al., 2022). Moreover, the Smart City Framework facilitates discourse on systemic reform, interagency collaboration, and equitable urban service provision.

The Resource-Based View (RBV) thesis elucidates how cities and transport agencies can attain sustainable competitive advantages by utilizing distinctive and non-replicable resources, especially technology assets and data capabilities (Osakwe et al., 2022). The Resource-Based View (RBV), first utilized in the private sector, has become pertinent in public administration by highlighting the strategic deployment of public digital infrastructure, human capital, and information technologies to improve institutional performance. This encompasses investments in IoT infrastructure, big data analytics, and AI-driven planning tools that allow cities to optimize traffic flows, minimize delays, and improve service delivery (Fatorachian et al., 2025; Mizrak, 2024). The Resource-Based View (RBV) asserts that the purposeful utilization of resources improves both organizational and systemic performance. Empirical research substantiates the RBV hypothesis by illustrating that competencies in big data analytics and IoT substantially influence sustained competitive advantage. High-tech manufacturing companies possessing robust big data analytics capabilities have demonstrated the ability to maintain competitive advantages, underscoring the significance of these technological assets (Vafaei-Zadeh et al., 2024). Likewise, the incorporation of technical advancements into transportation systems improves efficiency, diminishes emissions, and fosters equitable mobility (Alharb & Alabdulatif, 2024). This paradigm emphasizes the significance of developing resource capacities to facilitate intelligent urban transportation systems and promote sustainable urban development. Public agencies that hold valuable, uncommon, and inimitable resources are better equipped to maintain operational excellence and provide intelligent transportation solutions that correspond with urban sustainability objectives.

The Smart City Framework and RBV theory collectively offer a comprehensive analytical perspective to comprehend the intersection of digital transformation, governance innovation, and resource optimization in defining the future of urban mobility. These frameworks collectively direct the investigation into how intelligent transport systems might be implemented not solely as technological artifacts, but as socially integrated solutions that promote equity, resilience, and urban well-being.

3. METHODOLOGY

This study utilized a Systematic Literature Review (SLR) methodology to examine peer-reviewed full-text articles pertaining to smart mobility, sustainable urban transportation, and the execution of the 15-minute city concept. The aim was to discover, synthesize, and analyze theme trends concerning governance models, digital innovation, urban proximity planning, and equity in global urban transportation systems.

3.1 Review Protocol and Search Methodology

The search approach employed a comprehensive Boolean search string tailored for Scopus, encompassing all four theme domains: smart governance, digital innovation, urban proximity planning (15-minute city), and spatial equity. The subsequent Scopus-compatible search query was utilized within the TITLE-ABS-KEY field:

The integrated search query encompassed versions of the following concepts: 15-minute city, urban planning, walkability, community accessibility, innovation, obstacles to smart mobility, governance models, institutional dynamics, and stakeholder involvement. The Boolean logic was employed and applied to the TITLE-ABS-KEY field in Scopus to guarantee a thorough yet targeted retrieval of pertinent studies. The comprehensive Scopus-compatible search query is outlined below:

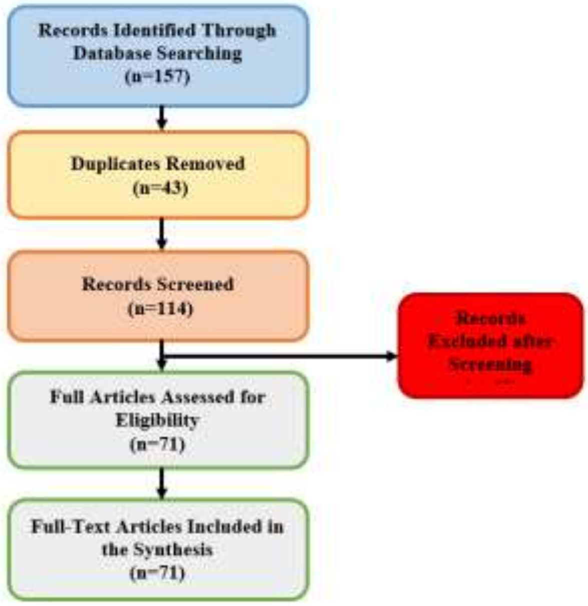

Figure 1. PRISMA Flow Diagram of the systematic review process.

TITLE-ABS-KEY((("15-minute city" OR "15 minute city" OR "compact city" OR "walkable city" OR "proximity city") AND ("urban planning" OR "city design" OR "town planning" OR "spatial planning" OR "sustainable development" OR "smart city") AND ("accessibility" OR "mobility" OR "transportation" OR "connectivity" OR "infrastructure") AND ("community" OR "neighborhood" OR "local" OR "services" OR "public space" OR "green space" OR "livability")) OR (("urban planning" OR "city planning" OR "town planning" OR "spatial planning") AND ("innovation" OR "development" OR "advancement" OR "improvement") AND ("15-minute city" OR "compact city" OR "proximity city" OR "walkable city") AND ("sustainability" OR "environment" OR "green" OR "eco-friendly") AND ("transportation" OR "mobility" OR "accessibility" OR "infrastructure") AND ("community" OR "neighborhood" OR "local" OR "public space")) OR (("smart mobility" OR "urban mobility" OR "sustainable transport" OR "intelligent transport") AND ("barrier" OR "challenge" OR "obstacle" OR "hindrance") AND ("developed region" OR "developed country" OR "high-income" OR "advanced economy") AND ("infrastructure" OR "technology" OR "policy" OR "regulation") AND ("public transport" OR "mobility services" OR "transportation" OR "accessibility")) OR (("governance" OR "management" OR "administration" OR "oversight") AND ("institutional" OR "organizational" OR "structural" OR "systemic") AND ("dynamics" OR "processes" OR "interactions" OR "changes") AND ("smart mobility" OR "intelligent transport" OR "sustainable transport" OR "mobility initiatives") AND ("policy" OR "regulation" OR "framework" OR "strategy") AND ("stakeholder" OR "participant" OR "actor" OR "engagement") AND ("innovation" OR "technology" OR "advancement" OR "development")))

Filters for publication year (2018–2025), language (English), and document type (peer-reviewed journal articles) were employed to guarantee relevance and quality. The systematic review adhered to a defined approach derived on PRISMA principles (Figure 1).

This visual illustrates the number of records identified, screened, excluded, and included during the study selection process based on PRISMA 2020 guidelines.

A thorough search was performed across many academic databases, including Scopus, Web of Science, and Google Scholar, focusing on literature published from 2018 to 2025. The search query integrated terms and Boolean operators pertaining to smart mobility, urban governance, 15-minute cities, sustainable transportation, and digital innovation. Only complete, peer-reviewed journal papers published in English were included.

3.2 Eligibility Criteria

Articles were included if they addressed smart urban mobility, sustainable transportation, or the execution of the 15-minute city concept. Eligible works were required to explicitly address at least one of the four designated themes: smart governance, digital innovation, proximity planning, or spatial equity. Only empirical or conceptual works published in peer-reviewed journals from 2018 to 2025, written in English, and accessible in full text were deemed eligible for inclusion.

Studies were eliminated if they were exclusively on technical design without urban application, lacked a mobility or urban planning element, or were non-peer-reviewed materials such as conference abstracts, editorials, or opinion pieces. The preliminary database search produced a total of 157 items. Following the elimination of 43 duplicates, 114.

4. RESULTS AND DISCUSSIONS

4.1. Synopsis of Themes

Using a thematic synthesis approach, the obtained data were examined. Inductively, coding was done to find trends within each theme area; deductively, it was guided by the Resource- Based View (RBV) theoretical framework and the Smart City paradigm. Iteratively improved themes were tested against the study's conceptual framework. This methodical methodology guaranteed theme consistency by allowing a thorough and repeatable synthesis of world literature, therefore addressing contextual heterogeneity across nations and governance systems.

4.2 Analysis of Theme Content

4.2.1 Digital invention and smart mobility technologies

Urban transportation systems' digital revolution has hastened the development of mobility services, so changing city infrastructure, user demand, and environmental goals management. Real-time data analytics, platform-based mobility, artificial intelligence (AI), and mobile apps together allow cities to move from stationary to dynamic mobility planning. But this change brings complicated governance issues, infrastructure dependencies, and socio-spatial consequences requiring integrated, context-sensitive frameworks (Tsakalineis et al., 2020; Acheampong, 2022).

Digitalization is positioned as a fundamental pillar of transport decarbonization policies within the European Union. By means of technology taxonomies and project mapping, Tsakalidis et al. (2020) and Gkoumas et al. (2021) show how EU research and innovation (R&I) investments have guided digital infrastructure development, especially in promoting modal integration, artificial intelligence deployment, and platform synchronizing. Their results highlight the policy-technical interface: digital technologies run the danger of fragmentation and redundancy without standardized regulatory systems and performance monitoring. Salerno (2020) supports this point of view by underlining how unevenly adapted automation projects in EU transportation remain legally disconnected, across road, rail, and multimodal corridors.

Urban-level diagnostics expose the variation of smart mobility adoption depending on institutional maturity and socio-technical capacity, in contrast to policy-centric approaches by means of longitudinal research of Italian cities, Pinna et al. (2017) show how smart public transport policies change in response to financial incentives and stakeholder readiness. By comparing smart mobility implementations across German-speaking cities and Sarajevo, Situm et al. (2024) extend this study exposing discrepancies not in technological availability but in policy coordination, civic involvement, and interoperability. Their results imply that without adaptive governance systems, technical solutions by themselves are inadequate.

Studies from the Middle East and Asia outside Europe add even more to the conversation. Analyzing digital mobility networks in Riyadh, Alanazi (2023) and Moussa (2025) show how well integrated ICT solutions improve traffic flow and urban administration. These systems, which are generally top-down, could so ignore inclusive access planning. Liu et al. (2024) and Moreno et al. (2025) find in Hong Kong and Seoul spatial diagnostics by Liu et al. (2024) and Moreno et al. (2025) show that older districts gain more from digital mobility networks due of established infrastructure, while younger, expansive developments confront accessibility problems despite digital innovations. These observations highlight the paradox of digital innovation: if not ingrained in fair urban structures, it might aggravate already existing geographical inequities.

Platform mobility the spread of app-based ride-hailing, micromobility, and shared car services focusses more and more of the literature. Acheampong (2022) notes this change as especially noticeable in metropolitan Africa, where platform-based services are replacing inefficiencies left by insufficient public transportation. On labor informality, data privacy, and algorithmic control, these services do, however, create fresh governance conundrums. User polls in Ghana show conflicting opinions: while platforms increase convenience, safety, regulatory uncertainty, and affordability remain issues of concern even if platforms help (Acheampong, 2022). Using bibliometric analysis in ASEAN, Pambudi and Hwang (2025) reveal an exponential increase in platform mobility literature however draw attention to the poor integration of user behavior, institutional design, and sustainability in current systems.

Concurrent with platform-based mobility, a strong debate is developing on digital governance and smart city preparedness. Examining Poland's Gigabit Society agenda, Kuś et al. (2025) find digital skills gaps, poor 5G coverage, and uneven municipal digital initiatives as roadblocks to fully achieving smart mobility's possibilities. Guzikova and Somga (2021, 2023) tie digital economy developments including mobile money, FinTech, and blockchain logistics to urban economic growth and young employment in Africa. Still, these technologies are not widely dispersed; infrastructure asymmetries limit digital mobility scale-up. Hadzic (2024) emphasizes that top-down smart city projects in South Africa fall short unless supported by civic tech integration and bottom-up infrastructure advancements.

The literature also notes how predictive analytics and artificial intelligence (AI) are increasingly helping to maximize mobility systems. Showing how machine learning algorithms might assist fair service distribution, Abouhassan et al. (2024) present an AI-based system to improve 15-Minute City coordination. Though ethical and political systems lag behind technical capabilities, similar computational developments are found in Southeast Asia and the Middle East. As Alam et al. (2024) contend, artificial intelligence needs to be ingrained in inclusive and sustainable policy frameworks else it runs the danger of giving efficiency first priority over fairness.

Though many digital mobility studies show technical optimism, criticisms of digital barriers, exclusive designs, and sustainability blind spots exist. African cities are under twin pressures, according to Jieutsa et al. (2023) and Chakabwata (2024), catching up with digital infrastructure while avoiding technology path dependencies that reproduce Western urban bias. Their work highlights how vital inclusive access, indigenous innovation, and participatory government must be in smart urbanism if it is to be relevant in poor environments. As Table 1 shows, a wide spectrum of research emphasizes how digital innovations such artificial intelligence, IoT, and blockchain are progressively included into urban transport systems to increase operational efficiency and sustainability outcomes.

4.2.2 Institutional Dynamics and Government

The management of smart transportation systems has become a major issue in the development of technologically enabled urban surroundings. Governance systems are being rebuilt to allow a variety of stakeholders, technology, and institutional levels as cities move toward more connected and data-driven transportation systems. Though different strategies remain regarding what constitutes “smart” governance and how it should be operationalized, the literature shows a growing agreement that effective governance is a prerequisite for the successful implementation of smart mobility solutions (Brownrigg-Gleeson et al., 2025; Tomor et al., 2021).

According to a basic strand of the literature, smart governance is a technocratic effort mostly dependent on digital infrastructure and automated data flows, therefore positioned as a technocritical attempt. Research in European and North American settings, for example, underline the instrumental part of digital dashboards, real-time monitoring, and algorithmic decision-making (Mondschein et al., 2021; Georgouli et al., 2023). Critics contend that, particularly in places where digital inclusion remains uneven, such tools run the danger of reinforcing institutional silos and marginalizing public action, even while they increase efficiency and responsiveness (Soe, 2021; Jieutsa et al., 2023).

Conversely, participatory and hybrid forms of government have been popular especially in the Mediterranean area and the Global South. Governance changes have increasingly aimed to include stakeholder involvement mechanisms into mobility planning in Brazil, India, and some of Africa (Verma et al., 2023; Praharaj et al., 2018). These models underline how important co-creation, community mapping, and localized planning are for forming responsive transportation networks. For example, Verma et al. (2023) show how, despite institutional inertia and capacity constraints, India's Smart Cities Mission has driven municipal authorities to embrace innovative methods for inclusive decision-making.

Determining governance results depends much on institutional environment. Tomor et al. (2021) show that institutional histories and political cultures cause cities like Utrecht and Curitiba to vary greatly in their governance systems even if they use similar smart mobility technologies. Likewise, Wibisono (2024) notes that administrative fragmentation and lack of institutional preparation sometimes stifle stakeholder involvement within Smart Specialisation Strategies in European Union regions. These results highlight how context-sensitive and institutionally rooted governance approaches must be rather implemented, not generally applicable.

Many studies highlight the gap between urban governance capacity and national policy aspirations. Analyzing Brussels's MaaS deployment, Tánczos (2025) emphasizes that although EU policy promotes integration and sustainability, city-level implementation suffers with fragmented data standards and unbalanced incentives between public and private actors. Surakka et al. (2018) bolster this point of view even further by pointing out that legal uncertainty and inadequate regulatory consistency often impede systematic MaaS advancements.

The analysis also notes a significant epistemic change in governance philosophy from top-down managerialism toward networked, dynamic, and adaptable models. By means of longitudinal case studies in Latin America, Przeybilovicz and Cunha (2024) chart this evolution and contend that digital-era administration progressively requires navigating intricate sociotechnical assemblages. This fits the theoretical view of government as a "assemblage" (Mondschein et al., 2021), in which infrastructure, knowledge, and power interact across levels.

Still, empirical, and methodological limitations exist notwithstanding these theoretical advances. With little use of comparative or longitudinal measures, most research on government depend on qualitative case designs that is, interviews, document analysis. This limits the generalizability of results and impedes the construction of strong performance measures for governance. Moreover, whereas African, Southeast Asian, and small-city settings remain underrepresented, research from Western Europe and industrialized economies show overrepresentation (Brownrigg-Gleeson et al., 2025; Hadzic, 2024). Table 2 offers some data on how policy coherence, multilevel coordination, and institutional architecture affect the viability of smart mobility governance approaches.

4.3. Urban Planning transitions and the 15-Minute City

Emerging as a transforming urban design paradigm aiming at reshining the spatial and temporal dynamics of cities by guaranteeing that basic amenities are accessible within a 15-minute walk or cycle from inhabitants' residences, is the 15-Minute City (15MC). Particularly as cities negotiate climatic imperatives, health justice, and urban livability, the 15MC has spurred strong scientific, policy, and practical attention since its conceptual popularization by Carlos Moreno. Five main threads define the body of literature on 15MCs: conceptual frameworks, diagnostic assessments, implementation strategies, spatial justice criticism, and government innovation.

Conceptually, a range of research has aimed to define and hone the theoretical foundations of the 15MC. Rooted in chrono-urbanism, Moreno (2024) offers a narrative evolution of the idea stressing its development from modernist planning concepts to modernist discourses on livability and proximity. Particularly in post-socialist and polycentric urban environments, Szymańska et al. (2024) offer a spatial and structural framework recognizing both possibilities and implementation obstacles. In a similar vein, Khavarian-Garmsir et al. (2023) follow the lineage of the 15MC back to the Garden City and New Urbanism movements, noting ten fundamental traits that bind proximity-based models together and warning against deterministic interpretations that ignore local context.

To operationalize the idea, empirical evaluations of 15MC implementation have included spatial diagnostics, geographic modeling, and indicator-based assessments. Using panel data from 200 Swedish cities, Elldér (2024) discovers via built environment elements including population density and mixed land use that the realization of 15MC concepts over time favorably correlates with these elements. Using a two-stage floating catchment area (2SFCA) model in Hong Kong, Liu et al. (2024) create a 15MC score that exposes notable differences between aging center districts and more car-dependent new towns. Akrami et al. (2024), who employ GIS and stakeholder interviews to show how Oslo's inner neighborhoods satisfy proximity goals, but outer zones suffer with spatial isolation, mirror these results.

Case studies highlight even more the disparate distribution of 15MC application. Using configurational research, Murgante et al. (2024) examine Terni and Matera in Southern Europe and find, while certain urban centers show optimal 15MC patterns, others reveal spatial injustice, especially in access to green space and public amenities. By means of geomarketing techniques, Villanueva-Durbán et al. (2025) offer a fine-grained accessibility profile of Valencia, therefore matching 15MC concepts with Sustainable Development Goals (SDGs). In Hamilton, New Zealand, Wang et al. (2024) similarly use mobility and GIS data to separate districts by degree of access and mode reliance. Translating the 15MC's normative vision into practical policy metrics calls for such instruments.

Notwithstanding its popularity, critical voices have expressed worries on the epistemological, sociopolitical, and spatial consequences of the 15MC paradigm. In a theory-driven critique, Mouratidis (2024) notes seven main shortcomings of the 15MC paradigm, including its possible to aggravate social exclusion in underprivileged communities, overreliance on Western urban structures, and underestimating of mobility as a kind of social capital. Using a GIS-based composite score, Moreno et al. (2025) evaluate cultural site access in Seoul to demonstrate how well-meaning 15MC projects could unintentionally widen spatial inequality in access to cultural facilities. Through empirical studies in Egypt's New Administrative Capital, Aboulnaga et al. (2025) discover that although the city achieves proximity in form, it neglects underlying environmental and transportation inefficiencies, therefore exposing a gap between design and lived experience.

Apart from spatial and equitable criticisms, academics have questioned the methodological and technological preparedness of cities to apply and track 15MC ideas. While Abouhassan et al. (2024) propose that AI-based optimization algorithms could improve service distribution and geographical coordination, Papadopoulos et al. (2023) contend that present assessments need strong methodological frameworks to evaluate conformity with 15MC objectives. Likewise, by means of a bibliometric analysis of "X-minute city" literature, Sepehri and Sharifi (2025) spot scattered clusters of study lacking integration across fields like mobility, health, and land-use planning.

Still a major enabler or limitation in 15MC implementation is governance. Analyzing urban planning records from North America and Australia, Lu and Diab (2023) find notable differences in how municipalities understand and apply 15MC ideas; some adopt them as aspirational aims while others embed them in legislative frameworks. Shoina et al. 2024 link the 15MC model to the Smart and Green Transition in Thessaloniki, Greece, and contend that strategic alignment between smart city planning and 15MC aims improves institutional coherence and delivery. up unstable environments like Palestine, Enab et al. (2024) underline the requirement of adaptive governance techniques by stressing the use of prefabricated, adaptable infrastructure to fill up acute service delivery shortages.

Finally, during the 15MC debate, health and well-being have become cross-cutting issues. Rojas-Rueda et al. (2024) provide a thorough set of measures connecting 15MC design to health equality results, therefore framing proximity not only as a spatial problem but also as a predictor of physical mobility, mental well-being, and environmental exposure. This shows a more general shift toward intersectoral governance in which public health, urban planning, and climate resilience cross. Urban planning ideas like the 15-Minute City have been extensively debated in the literature for their ability to reconfigure accessibility, mobility, and land-use inside compact city models, as Table 3 summarizes.

4.4. Obstacles toward Global South Smart Urban Mobility

Although the global smart mobility debate mostly honors technological development, automation, and urban innovation, cities in the Global South deal with structural and systematic obstacles that hamper the acceptance and deployment of smart transport solutions. These obstacles have institutional, sociopolitical, economical, technological, and infrastructure aspects in addition to being technical. Growing amounts of research reflect this complexity and show how different global policy narratives are from the grounded reality of urban transportation networks in developing nations.

Underdevelopment of infrastructure is a frequent limit that shows itself as inadequate digital foundations, scattered public transportation systems, and insufficient road networks. For example, Guzikova and Somga (2021) discover that in many African settings the promise of digital mobility is hampered by basic infrastructure shortcomings unstable energy, low mobile adoption, and limited broadband connectivity. Their results imply that smart mobility solutions like ride-hailing platforms or real-time tracking systems are probably to underperform or remain exclusive without matching investments in physical and digital infrastructure.

Policy inconsistency and institutional fragility add much more complexity to smart mobility transitions. Research like Hadzic (2024) and Jieutsa et al. (2023) contend that poor regulatory environments, over-centralized decision-making, and lack of coordination across metropolitan authorities hamper the operationalizing of smart transportation plans. Hadzic (2024) emphasizes in South Africa how top-down policy methods may overlook grassroots innovation and civil society engagement, therefore generating misaligned priorities between policy goals and public demands. Echoing this in their analysis of African cities, Jieutsa et al. (2023) advocate more inclusive and dispersed government structures that allow the reality of informality and spatial inequality.

Another important obstacle is socioeconomic exclusion; many smart mobility innovations especially those based on digital platforms are intended for middle-class, technologically educated consumers. Studying ride-hailing users in Ghana, Acheampong (2022) finds that while digital platforms provide convenience and flexibility for certain urban dwellers, they also widen affordability gaps and expose users to safety and data privacy concerns. Similar worries are expressed by Chakabwata (2024), who criticizes the structural obstacle to effective involvement in smart urban economies the unequal access to digital skills and education in African higher institutions. This digital divide inhibits not just user participation but also local mobility solution innovation.

Furthermore, restricting technology transfer and innovation spread are cultural, spatial, and behavioral mismatches. Studies by Alanazi (2023) and Amoah (2024) in nations like Saudi Arabia and Kenya indicate that despite major investment in ICT infrastructure and digital services, user adoption remains uneven due of cultural preferences for private vehicle ownership, poor public trust in government systems, and opposition to behavior modification. These results suggest that socio-cultural context shapes technological acceptance just as much as technical viability.

Weak private sector synergies create another obstacle. According to Tánczos (2025) and Surakka et al. (2018), mobility innovations including Mobility-as---a- Service (MaaS) platforms find difficulty in cities lacking defined policy frameworks or data-sharing systems. In African and South Asian settings, where informal transportation providers rule the scene and are usually left out of digital transformation agendas, this is especially pertinent. The lack of stakeholder alignment results in parallel systems one technologically sophisticated, the other informally ingrained declining efficiency and thereby sustaining fragmentation.

Environmental vulnerability and climate fragility are still another less spoken about but developing obstacle. Reliability of smart mobility infrastructure is degraded in areas experiencing frequent floods, heat waves, or energy crises. For example, Enab et al. (2024) in their research on Nablus, Palestine, suggest prefabricated and flexible infrastructure solutions exactly since traditional smart city models are sometimes ill-suited for conflict-affected and climate-sensitive areas. These results demand context-responsive solutions able to resist environmental shocks and fit to limited resources.

Notwithstanding these obstacles, the literature presents numerous approaches to get above them. Suggested by Koji and Bae (2018), localized innovation ecosystems can close gaps by using mobile technologies and community involvement. Likewise, Alam et al. (2024) support an ecosystemic approach to smart mobility one that incorporates digital tools and artificial intelligence inside inclusive, climate-resilient, participatory governance systems. Crucially, these ideas offer context-anchored paths for digital mobility transformation rather than only repeating Global North models. With an eye on infrastructure, institutional capacity, and digital fairness, Table 4 synthesizes important issues confronting developing countries in their adoption of smart mobility technology.

4.5. Synopsis and Research implications

Table 5 below offers a comparative matrix capturing shared innovations and regional variations in smart transportation implementation to augment the synthesis thematic findings. The research shows a clear pattern: whereas digital innovation is a worldwide trend, institutional, infrastructure, and governance settings greatly influence its acceptance and efficacy.

Several cross-cutting consequences show up across all the themes. First, smart mobility success depends on multilevel governance and institutional coordination especially in controlling cross-sectoral digital change. Second, digital inclusion is still a neglected obstacle particularly in fast urbanizing regions where informal transportation rules. Third, although the 15-minute city concept has promise, outside high-income areas execution depends on context and is constrained. These realizations underline the need of place-based planning, participatory urban government, and infrastructure spending.

The Resource- Based View (RBV) hypothesis provides a helpful prism through which one may grasp why some cities outperform others in implementing smart mobility those who deliberately use technology capabilities and governance assets achieve greater alignment between innovation and public value generation. The Smart City Framework stresses, meantime, citizen-centric planning, data integration, and platform compatibility.

The research thus emphasizes the requirement of integrated models combining institutional agility with technical preparedness. This lays the groundwork for the conceptual framework that will be discussed in the future section and helps cities to systematize clever transportation options inside their urban sustainability agendas.

The literature shows, all things considered, convergence as well as divergence in smart mobility strategies in various metropolitan settings. Although technology presents transforming possibilities, their effect is limited by planning paradigms, government systems, and socioeconomic reality. These trends underline the need of matching urban equitable goals with institutional preparation and technology capacity. This overview guides the later study of worldwide case evidence and offers a vital basis for comprehending the facilitators and restrictions of smart transportation systems. must know how resource optimization, governance innovation, and digital change interact to define urban mobility going forward. These models together direct the research on how smart transportation systems may be operationalized not only as technical artifacts but also as socially integrated solutions improving fairness, resilience, and urban well-being.

5. DISCUSSION

The results of the thematic content analysis expose a sophisticated but perceptive web of linked ideas that mold the conversation on sustainable urban mobility and smart transportation. Though they overlap in several ways, these themes smart governance, digital innovation, and proximity-based planning the 15-minute city model also highlight important geographical inequalities, conceptual tensions, and implementation gaps.

The idea of smart government shows different modalities in different countries. Emphasizing real-time monitoring, algorithmic decision-making, and automation (Mondschein et al., 2021; Georgouli et al., 2023), smart government sometimes assumes a technocratic and technologically intense shape in Western settings such the EU and North America. Although effective, this approach runs the danger of marginalizing citizen involvement and widening digital gap. Conversely, hybrid or participatory governance models have arisen in the Global South including cities in India, Brazil, and portions of Africa, stressing stakeholder participation, community mapping, and co-creation (Verma et al., 2023; Praharaj et al., 2018). Though they seek to balance power inequalities, these approaches can lack institutional competence and limited resources.

This disparity has direct bearing on the Smart City Framework, which supports technologically inclusive and citizen-centric governance. Still, implementation is inconsistent. For example, whilst smart city programs in Europe gain from strong infrastructure and institutional support, similar projects in Sub-Saharan Africa and South Asia struggle with fragmented regulatory frameworks and infrastructure shortages (Hadzic, 2024; Jieutsa et al., 2023). This emphasizes the need of matching local institutional capability with governing approaches.

Concurrent with this fast global movement toward smart urbanization revealed by the subject of digital innovation especially through AI, IoT, and platform mobility. Still, digital literacy and governance maturity are significant enablers or obstacles. While in cities like Accra and Nairobi, innovations like app-based mobility services exist but remain limited by poor data governance and affordability concerns, data-driven planning has improved accessibility and transport coordination in places including Riyadh, Oslo, and Valencia (Akrami et al., 2024; Villanueva-Durbán et al., 2025).

From the perspective of the Resource- Based View (RBV) hypothesis, differences in cities' access to valuable, scarce, and inimitable resources such digital infrastructure, data assets, and trained human capital help to explain this diversity. While cities in the Global South often suffer with technological and organizational shortcomings, therefore restricting their capacity to derive competitive or adaptive advantages in smart mobility, cities in the Global North have progressively institutionalized these assets (Vafaei-Zadeh et al., 2024). The development of the 15-minute city (15MC) as a planning concept extends this relative comparison. While European cities such Paris, Milan, and Oslo have started operationalizing 15MC ideas through integrated spatial and transportation planning (Elldér, 2024; Murgante et al., 2024), cities in Asia, the Middle East, and Africa struggle with implementation challenges. Among these are low urban density, peripheral informality, and inadequate walkable infrastructure (Moreno et al., 2025; Enab et al., 2024). Even in technologically advanced cities like Hong Kong, there still are differences between freshly built suburbs and historic areas.

Most importantly, these observations highlight ongoing flaws in both global and local governments. These gaps show up in mismatched policy systems, inadequate MaaS and data sharing regulation, and the exclusion of unofficial mobility players from the digital revolution. Governance gaps also mirror more general regional asymmetries: although Europe leads in research and policy integration, Africa, Latin America, and portions of Asia remain underrepresented in empirical evaluations and framework building.

Overall, even although smart mobility technologies and urban proximity models show great potential, their effective implementation depends on flexible, inclusive, technologically ready governing frameworks. Together, the Smart City Framework and RBV theory support that digital innovations have to be ingrained in context-responsive government plans where institutional capacities and public involvement take front stage. Strategic investments in capacity building, regulatory harmonization, and infrastructure equality across regions will help to close the innovation-implementing divide.

5.1 Conceptual Structure or Model

A conceptual framework is provided (see Figure 2) to show how governance, innovation, and spatial planning interact to facilitate sustainable urban mobility in the framework of smart cities, so synthesizing the themes derived from the investigation.

To show the dynamic interactions among the found variables, the framework combines the theoretical lenses of the Resource-Based View (RBV) and the Smart City Framework.

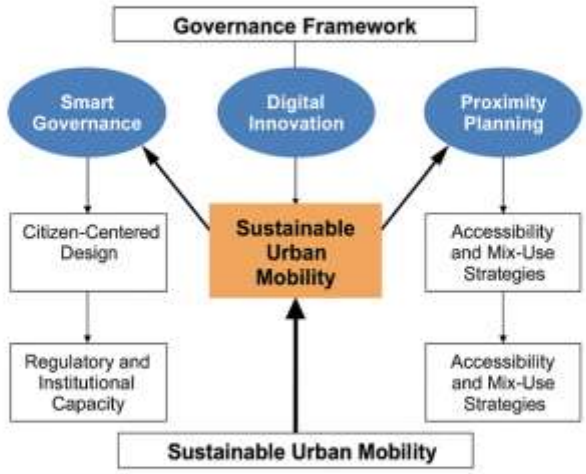

Figure 2. Conceptual framework illustrating the interaction between smart governance, digital innovation, resource-based capacity, urban planning, and sustainable urban mobility.

5.2 Definition of the conceptual model:

One institutional enabler is smart government. It offers the participatory platforms, public responsibility systems, and regulatory framework needed for smart mobility deployment. Whereas in lower-capacity environments it serves as a policy scaffold to promote experimentation and stakeholder cooperation, in well-resourced cities it facilitates centralized data oversight and agile decision-making.

The technology driver is digital innovation that is, artificial intelligence, IoT, platform mobility. It lets real-time analytics, demand-responsive mobility, and flawless data sharing. In advanced digital environments, innovation enables user-centric planning and multimodal integration. When digital capacity is limited, innovation is more incremental and usually directed on low-cost mobile platforms.

• The fundamental assets are found in resource-based capacity, informed by RBV. These comprise organizational procedures, human knowledge, physical infrastructure roads, ICT networks and human experience. Their availability and strategic fit with innovation define whether cities can translate clever ideas into operational benefits.

• Urban planning innovations guarantee spatial coherence and equity by means of the 15-minute City model and others. Essential services clustered within walking or cycling distance help to lower dependency on motorized transportation and hence minimize spatial inequality. Such innovations' success relies on urban density, land-use diversity, and community co-design participation.

•Sustainable Urban Mobility comes of result. This is an integrated aim reached when planning systems, digital ecosystems, and governance structures line up to offer fair, effective, low-carbon transportation choices.

5.3 Utility for frameworks:

• Operational Alignment: Describes how cities could deliberately match resource capacities, digital technology, and governance structures to support the acceptance and deployment of smart transportation solutions. To activate latent infrastructure and use integrated systems, for example, successful cities use institutional transformation and cross-sector cooperation.

• Provides a visual policy tool for spotting implementation roadblocks. The approach can enable politicians to identify gaps between institutional preparedness and governance intention or between innovation capacity and planning strategies.

• Academic Flexibility: Particularly by means of case comparisons, scenario-based simulations, or mixed-method assessments, the framework is flexible for application in empirical testing. It also helps create hypotheses for research on digital governance models and urban sustainability transitions.

6. CONCLUSION

By means of a thematic synthesis of contemporary scholarly and policy-oriented literature, this review set out to investigate the changing terrain of smart transportation systems and their contribution to sustainable urban mobility. anchored in the Smart City Framework and Resource-Based View (RBV) theory, the study revealed that while digital innovations such AI, IoT, and platform mobility offer unprecedented chances for urban transformation, their success depends on governance capacity, contextual adaptability, and strategic alignment of urban planning models like the 15-minute city.

Three interconnecting pillars smart government, digital innovation, and urban proximity planning then surfaced thematically. These ideas cross to highlight the institutional obstacles and enabling variables influencing smart mobility changes. Smart government helps agile decision-making and stakeholder collaboration in highly capacity cities. On the other hand, many Global South situations nevertheless show a continuous institutional split since many governance systems remain fractured. Similarly, whilst cities like Oslo, Valencia, and Hong Kong gain from integrated digital ecosystems, others such Nairobi, Accra, and Kinshasa struggle with infrastructure and affordability restrictions, so limiting the effective use of smart mobility services. Though generally supported, the 15-minute city idea finds it challenging to be operationalized because of spatial disparity and unequal policy integration.

These results confirm that the transforming power of smart mobility depends not only on technology availability but also on the governance ready and resource setups particular to every urban environment. The RBV theory rightly clarifies how cities with unusual and inimitable digital and institutional assets get continuous benefits in the evolution of smart mobility. Emphasizing the importance of democratic, inclusive, and data-driven governing systems, the Smart City Framework enhances this point of view.

6.1 Policy and Planning recommendations

From a policy and planning standpoint, this analysis provides a number of practical revelations:

• Integrated land-use and transportation planning that advances spatial fairness and service accessibility be top priority for urban designers. This includes incorporating transit-oriented development ideas, building small, mixed-use districts supporting walkability and active transport, and improving last-mile connectivity.

• Policymakers must designate targeted investments in digital infrastructure, including broadband access, sensor networks, and open data platforms. In areas where spatial inequality is clear-cut these interventions are vital to assure the viability of the 15-minute city model. Furthermore, required in smart mobility applications are solid data governance systems to handle privacy, interoperability, and responsibility. Policies should also support public-private cooperation utilizing technology to protect public interests.

• Platform-based mobility technologies like MaaS with equality at the center should be developed by smart city builders. Designing interfaces should thus take low-income and digitally excluded people into account, include alternatives for informal transportation, offer subsidies for vulnerable users, and guarantee multi-language and accessible platforms that fit users with disabilities.

• Reformers of governance have to solve policy fragmentation by enhancing institutional capacity and intersectoral cooperation. Establishing unified urban mobility authority, improving local government autonomy in mobility decision-making, and allowing adaptable regulatory frameworks that can react to developing technology and user needs all help to support this. Institutionalizing these changes depends on capacity.

6.2 Limitations

This study has restrictions even with its broad reach. The study is based just on abstracts, therefore limiting the depth of methodological, empirical, and contextual insights that might be gained via full-text readings. Often of great importance in systematic review procedures, meta-analysis or quality assessment of the examined research is also precluded by this restriction. Moreover, although the study covers a large geographic area, empirical research from Sub-Saharan Africa, Southeast Asia, and Latin America is still underrepresented, therefore restricting generalizability to these newly developing areas.

6.3 Future Research Directions

Future studies should fill in important factual, contextual, and conceptual voids based on the results of this review. Through addressing these aspects, next studies can offer grounded, practical insights that not only improve theoretical models but also guide responsive policy design and scalable urban mobility solutions.

• Expanding full-text inclusion and meta-synthesis by including whole papers instead of depending just on abstracts will enable a more solid synthesis of theoretical applications, analytical tools, and procedures. It would also provide understanding of how clever mobility strategies differ between empirical environments and allow critical assessment of study quality.

Test the conceptual framework practically: Empirical research should confirm the suggested paradigm connecting proximity-based planning, digital innovation, and governance. Case studies, longitudinal surveys, or simulation models could evaluate how these elements interact in real-world cities, therefore exposing causal paths, trade-offs, and adaptive techniques across many governing regimes.

• Contextualize results across underrepresented geographies: Future research has to especially target secondary and peripheral urban regions in the Global South, especially in Latin America, South Asia, and Sub-Saharan Africa. These areas sometimes have unique mobility issues including poor digital infrastructure, informal transportation reliance, and government restrictions needing context-specific smart mobility solutions.

• Look at social equity effects and lived experiences; human-centered research examining how smart mobility systems influence various user groups is much sought for. Examining inclusion across gender, socioeconomic class, age, and disability will help researchers make sure smart transportation plans promote fair access and user empowerment rather than reinforce current disparities

Table 1. Summary of Smart Mobility Technologies and Digital Innovation

Author and Year	Country	Research Context	Methodology	Key Findings	Thematic Focus
Tsakalidis et al. (2020)	European Union	EU-funded transport R&I	Two-tier policy and tech maturity analysis	Digital technologies support decarbonisation via EU R&I	Transport decarbonisation, digital transformation
Gkoumas et al. (2021)	European Union	Smart mobility policy in EU	Technology taxonomy and project analysis	Link between R&I and EU Sustainable Smart Mobility Strategy	Smart mobility policy, innovation monitoring
Salerno (2020)	European Union	Automation in transport	Review of tech and legal challenges	Need for harmonized EU regulations	Automation, regulatory frameworks
Pinna et al. (2017)	Italy	Urban smart mobility in Italian cities	Longitudinal indicators-based analysis	Progress linked to financial support	Smart city policy, public transport evolution
Situm et al. (2024)	Germany, Austria, Switzerland, Bosnia	Smart mobility comparison	25 expert interviews	Tech disparity & insights for policy	Comparative smart mobility, urban policy
Kuś et al. (2025)	Poland	Gigabit Society progress	Policy analysis using DESI	Barriers: low digital skills, 5G adoption	Digital transformation, smart city readiness
Alanazi (2023)	Saudi Arabia	Benchmarking smart mobility	Comparative analysis with Asia-Pacific	KSA must adopt inclusive, standardized strategies	Smart mobility infrastructure, policy planning
Pambudi & Hwang (2025)	ASEAN	Urban transportation trends	Bibliometric analysis of 1249 papers	Rise in tech-based mobility solutions	Urban mobility, smart transport innovation
Chakabwata (2024)	Africa	Tech in higher education	Theoretical models (TAM, DOI)	Need for tech investment in education	Digital education, economic growth
Acheampong (2022)	Africa	ICT and transport decarbonisation	Review chapter	Tech innovation transforming urban mobility	Platform mobility, ICT in cities
Amoah (2024)	Ghana, Kenya, Rwanda, Senegal	Africa's digital transformation	Critical analysis of infrastructure	AI, quantum tech expanding digital reach	Socio-economic transformation, infrastructure
Acheampong (2022)	Ghana	App-based mobility services	Survey in Accra & Kumasi	User behavior, safety, ride-hailing impact	Digital platforms, urban mobility
Jieutsa et al. (2023)	Africa	Digital urban governance	Workshop synthesis	Need for inclusive tech governance	Digital inclusion, policy frameworks
Koji & Bae (2018)	Africa	Mobile phones in BOP	Issue analysis	Digital access reduces info gaps	Digital access, BOP markets
Hadzic (2024)	South Africa	ICT readiness	Policy analysis	Bottom-up initiatives for smart city tech	Smart cities, infrastructure policy
Alam et al. (2024)	Global South	Smart mobility ecosystems	Conceptual framework	Integrated tech reduces emissions	Smart cities, mobility ecosystem
Moussa (2025)	Saudi Arabia	ICT in Riyadh mobility	Questionnaire-based analysis	ICT improves traffic systems	Urban mobility, ICT integration

Table 2: Summary of Governance and Institutional Dynamics in Smart Mobility

Author and Year	Country	Research Context	Methodology	Key Findings	Thematic Focus
Brownrigg-Gleeson et al. (2025)	Spain, Belgium, Finland	Smart mobility governance in Madrid, Antwerp, Turku	Focus groups and thematic analysis	Governance challenges mostly in smart governance, smart mobility, and smart living	Smart city dimensions, governance
Surakka et al. (2018)	Finland, Switzerland	Systemic MaaS innovations	Online stakeholder questionnaire	Barriers and drivers for Mobility-as-a-Service implementation	Mobility-as-a-Service, governance
Tánczos (2025)	Belgium	EU mobility policy and MaaS in Brussels	Policy analysis	Highlights need for data governance and public-private coordination	MaaS, sustainable mobility policy
Wibisono (2024)	EU regions	Smart specialization governance	Systematic literature review	Challenges in stakeholder engagement and institutional readiness	Regional governance, smart specialization
Alawadhi & Scholl (2016)	USA, Germany, Italy	Smart city initiatives and governance models	Cross-case study	Stakeholder involvement and governance diversity crucial	Smart governance models
Mondschein et al. (2021)	North America	Smart city tech deployment	Case interviews, STS theory	Organizational barriers outweigh technological ones	Smart cities, organizational governance
Tomor et al. (2021)	Brazil, UK, Netherlands	Institutional context and smart governance	Comparative case study	Institutional settings shape governance forms	Institutional theory, smart governance
Praharaj et al. (2018)	India	Urban governance in Indian smart cities	Theoretical & case study	Need for governance reform and contextual models	Governance frameworks, India
Verma et al. (2023)	India	Smart Cities Mission impact on transport	Workshops and stakeholder mapping	Urban mobility governance reshaped by reforms	Sustainable transport, governance
Marsden & Reardon (2018)	Global	Smart mobility scenarios	International scenario workshops	State involvement needed for integrated mobility	Policy, scenario planning
Georgouli et al. (2023)	Global	Urban mobility innovation	Interviews with 40 cities (UMii)	Innovative cities align long-term vision with regulation and tech	Urban innovation, mobility
Soe (2021)	Estonia	Tallinn SUMP governance	Interviews with stakeholders	Top-down SUMP models lack local ownership	Mobility planning, participation
Brouwers et al. (2025)	Belgium	Stakeholder value prioritization in mobility	Interviews + AHP (Analytic Hierarchy Process)	Short-term vs long-term value trade-offs	Stakeholder engagement, public values
Przeybilovicz & Cunha (2024)	Brazil	Digital age smart governance	Longitudinal case studies	Emergence of dynamic governance modes	Sociotechnical governance, ICT
Dribi et al. (2024)	Mediterranean	Mobility-Governance-Environment interplay	Comprehensive literature review	Synergies between governance, mobility, and environment	Integrated smart city systems
Anthony Jnr (2025)	General	Sustainable mobility governance model	Desk research, model development	Proposes KPI-driven framework for inclusive mobility	Policy development, data-driven governance

Table 3: Summary of Urban Planning Innovations and the 15-Minute City

Author and Year	Country	Research Context	Methodology	Key Findings	Thematic Focus
Allam et al. (2024)	Global	Mapping implementation practices of the 15-minute city	Mixed method (literature, policy, media analysis)	Identified global principles and gaps in 15-minute city implementation	Urban planning, proximity, policy
Pozoukidou & Angelidou (2022)	Europe	Urban planning in 15-minute cities under sustainable and smart city trends	Review of European cases	Recommendations for inclusive, proximity-based, and participatory planning	Smart planning, governance

Khavarian-Garmsir et al. (2023)	Global	Historical roots of 15-minute city	Review	Identified core principles and criticisms from past planning models	Sustainable urbanism, design theory
Murgante et al. (2024)	Italy	15-minute city indicators in Terni and Matera	Configurational analysis	Revealed urban disparities in access and imageability	Density, diversity, spatial justice
Elldér (2024)	Sweden	Longitudinal 25-year study on 15-minute city development	Fixed effects, multivariate modeling	Small cities can align with 15MC goals; density/mixed-use vital	Built environment, urban evolution
Akrami et al. (2024)	Norway	Exploring 15-minute city in Oslo	GIS, plans review, interviews	Central Oslo aligns with 15MC, suburbs lag	Accessibility, planning strategy
Villanueva-Durbán et al. (2025)	Spain	Urban accessibility in Valencia using geomarketing	GIS with high-resolution buffers	Block-level access metrics for services and green spaces	Accessibility, SDG 11, GIS
Liu et al. (2024)	Hong Kong	Assessment of 15MC status	2SFCA index method	Historic centers score higher; new towns lag	Urban compactness, transit access
Moreno et al. (2025)	South Korea	Cultural accessibility in Seoul	GIS, accessibility index	Identified equity gaps, proposed decentralization of culture	Cultural planning, equity
Enab et al. (2024)	Palestine	Architecture for 15MC in Nablus	Local feedback, architectural modeling	Proposed prefabricated modular services model	Urban services, architecture
Aboulnaga et al. (2025)	Egypt	Indicators for 15MC in New Administrative Capital	Theoretical, site visits	NAC meets many criteria; some service gaps	Livability, green urbanism
Papadopoulos et al. (2023)	Global	Assessing compliance with 15MC	Literature synthesis	Methodological gaps identified in measurement	Evaluation, urban indicators
Mouratidis (2024)	Global	Critique of 15MC model	Theoretical review	Seven pitfalls in equity and implementation	Limitations, critical urban theory
Sepehri & Sharifi (2025)	Global	Review of X-minute city models	Bibliometric analysis	Outlined research gaps and future themes	Resilience, AI, public preferences
Abouhassan et al. (2024)	Global	Integrating AI into 15-minute city	Computational modeling	AI can enhance planning, transit, walkability	AI, optimization, smart mobility
Moreno (2024)	Global	15-minute city popularization	Conceptual book	Narrative of implementation and benefits	Human-centric planning, policy
Szymańska et al. (2024)	Global	Evolution and limits of 15MC	Conceptual review	Highlights difficulties in implementation	Conceptualization, barriers
Shoina et al. (2024)	Greece	Case study in Thessaloniki	Smart-Green framework, engagement	Recommendations for policy and citizen alignment	Green transition, participation
Abdelfattah et al. (2022)	Italy	Modeling 15MC in Milan	Mapping and spatial analysis	Micro-level mapping for accessibility and resilience	Soft mobility, chrono-urbanism
Rojas-Rueda et al. (2024)	Global	Health equity in 15-minute cities	Framework development	Benefits and risks for health equity; planning strategies	Health planning, chrono-urbanism
Lu & Diab (2023)	USA, Australia	Policy determinants in x-minute cities	Planning document review	Variation in goals and implementation strategies	Policy diffusion, local living
Wang et al. (2024)	New Zealand	Applicability in Hamilton	GIS and mobile data	Partial alignment; highlights local variation	Accessibility metrics, mobility behavior

Table 4: Barriers to Smart Urban Mobility in the Global South

Author and Year	Country	Research Context	Methodology	Key Findings	Thematic Focus
Lim et al. (2024)	BRICS (Brazil, Russia, India, China, South Africa)	Barriers to EVs and smart transport infrastructure	Qualitative interviews	Infrastructure gaps, financial constraints, low public awareness	Barriers to smart urban mobility, policy
Kayisu et al. (2024)	DR Congo	Smart mobility feasibility in Kinshasa	Comparative feasibility analysis	Infrastructural, economic, and regulatory barriers	Smart mobility solutions, feasibility challenges
Behrens (2014)	Global South	Urban transport access and public transit constraints	Book chapter – qualitative synthesis	Insufficient infrastructure, reliance on informal mobility	Transport infrastructure, public transit limitations

Figueroa (2016)	Global South	Mobility, democracy, and accessibility	Theoretical perspective	High social cost of inaccessibility in dense cities	Equity, access, mobility rights
Oviedo et al. (2021)	Sierra Leone	Walking in informal settlements	Pilot study with mapping and survey	Topographic and infrastructural deficits impact walkability	Walking barriers, informal mobility
Loor & Evans (2021)	Ecuador	Informal footpath infrastructure in Quito	Case study, participatory observations	Informal paths as vulnerable but essential mobility solutions	Informal infrastructure, urban access
Wolniak & Turoń (2025)	Poland	Barriers to scooter-sharing systems	Statistical (factor analysis, regression)	Path conditions, app complexity, fleet issues	Micromobility barriers, infrastructure, tech literacy
Almatar (2024)	Global	ITS and smart city planning barriers	Literature review	Managerial, technical, and interoperability challenges	Intelligent transport systems, implementation gaps
Tomaszewska (2021)	Poland	ITS implementation barriers from LGs' view	In-depth interviews	Legal, economic, technological, and social barriers	ITS, stakeholder barriers
Razmjoo et al. (2021)	Global	Smart city development challenges	Policy analysis	Poor PPPs, old infrastructure, IT gaps	Smart cities, policy, structural limitations
Mitieka et al. (2023)	Global	Bibliometric analysis on smart mobility research	Review of 3223 studies	Limited social/economic focus, tech-heavy research bias	Smart mobility literature gaps
Acheampong (2022)	Africa (Ghana)	Diffusion of app-based mobility	Survey and mapping	Safety, access, and digital divide challenges	Platform mobility, African cities
Oviedo & Guzman (2020)	Colombia (Bogotá)	Accessibility and inequality	Accessibility index and equity analysis	Low-income areas have higher access but lower quality	Access equity, urban transport
Shiddiqi et al. (2022)	Indonesia	Sustainable transport indicators in Jakarta	Expert judgment	Institutional coordination barriers, local context misfit	Indicators, policy barriers
Sadrani et al. (2024)	Global	Barriers to electric bus systems	Fuzzy MCDM analysis	Financial and technological constraints	Electrification barriers, public transport
Butler et al. (2022)	Australia	Public attitudes on smart mobility	Quantitative survey	Reluctance to ride-share, car-dependency habits	Attitudinal barriers, behavioral resistance

Table 5: Comparative Summary of Global and Regional Smart Mobility Studies

Author and Year	Country/Region	Research Context	Methodology	Key Findings	Thematic Focus
Tsakalidis et al. (2020)	European Union	EU-funded transport R&I	Two-tier policy and tech maturity	Digital technologies support decarbonisation via EU R&I	Transport decarbonisation, digital transformation
Gkoumas et al. (2021)	European Union	Smart mobility policy in EU	Technology taxonomy and project analysis	Link between R&I and EU Sustainable Mobility Strategy	Smart mobility policy, innovation monitoring
Salerno (2020)	European Union	Automation in transport	Review of tech and legal challenges	Need for harmonized EU regulations	Automation, regulatory frameworks
Pinna et al. (2017)	Italy	Urban smart mobility	Longitudinal indicators-based analysis	Progress linked to financial support	Smart city policy, public transport evolution
Situm et al. (2024)	DACH & Balkans	Smart mobility comparison	25 expert interviews	Tech disparity & insights for policy	Comparative smart mobility, urban policy
Kuś et al. (2025)	Poland	Gigabit Society progress	Policy analysis using DESI	Barriers: low digital skills, 5G adoption	Digital transformation, smart city readiness
Alanazi (2023)	Saudi Arabia	Benchmarking smart mobility	Comparative analysis with Asia-Pacific	Inclusive, standardized strategies needed	Smart mobility infrastructure, policy planning
Pambudi & Hwang (2025)	ASEAN	Urban transportation trends	Bibliometric analysis of 1249 papers	Rise in tech-based mobility solutions	Urban mobility, smart transport innovation

Chakabwata (2024)	Africa	Tech in higher education	Theoretical models (TAM, DOI)	Need for tech investment in education	Digital education, economic growth
Acheampong (2022)	Africa	ICT and transport decarbonisation	Review chapter	Tech innovation transforming urban mobility	Platform mobility, ICT in cities
Amoah (2024)	Ghana, Kenya, Rwanda, Senegal	Africa's digital transformation	Critical analysis of infrastructure	AI, quantum tech expanding digital reach	Socio-economic transformation, infrastructure
Acheampong (2022)	Ghana	App-based mobility services	Survey in Accra & Kumasi	User behavior, safety, ride-hailing impact	Digital platforms, urban mobility
Jieutsa et al. (2023)	Africa	Digital urban governance	Workshop synthesis	Need for inclusive tech governance	Digital inclusion, policy frameworks
Koji & Bae (2018)	Africa	Mobile phones in BOP	Issue analysis	Digital access reduces info gaps	Digital access, BOP markets
Hadzic (2024)	South Africa	ICT readiness	Policy analysis	Bottom-up initiatives for smart city tech	Smart cities, infrastructure policy
Alam et al. (2024)	Global South	Smart mobility ecosystems	Conceptual framework	Integrated tech reduces emissions	Smart cities, mobility ecosystem
Moussa (2025)	Saudi Arabia	ICT in Riyadh mobility	Questionnaire-based analysis	ICT improves traffic systems	Urban mobility, ICT integration

Definitions and Footnotes for Tables 1–5 are presented in Appendix A.

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Appendix A: Definitions and Footnotes for Tables 1–5

Table	Term	Definition
Table 1	AI	Artificial Intelligence; simulates human reasoning and decision-making by machines.
	IoT	Internet of Things; interconnected devices exchanging real-time data.
	Blockchain	A decentralized ledger for secure, transparent transactions.
	MaaS	Mobility as a Service; digital integration of multiple transport services into a single platform.
Table 2	Multi-level governance	Decision-making shared across local, regional, and national governments.
	Policy coherence	Alignment of policies across sectors and governance layers.
	Institutional fragmentation	Lack of coordination and overlapping responsibilities among urban agencies.
	15-minute city	Urban model enabling access to essential services within a 15-minute walk or ride.
Table 3	Mixed land-use	Integration of residential, commercial, and civic functions in one area.
	Proximity-based planning	Urban planning focused on reducing distance between people and services.
Table 4	Informal transport systems	Unregulated and often privately run transport (e.g., boda-bodas, matatus).
	Digital equity	Equal access to digital tools, infrastructure, and services for all populations.
	Urbanization pressures	Strain on infrastructure and services due to rapid population growth in cities.
Table 5	TAM	Technology Acceptance Model: explains how users adopt and use new technology.
	DOI	Diffusion of Innovation; describes how innovations spread across populations.
	DESI	Digital Economy and Society Index; EU metric for assessing digital performance.
	Gigabit Society	EU initiative to ensure universal access to high-speed internet.
	Platform mobility	App-based transport services like Uber, Bolt, or Little Cab.