JAMBURA JOURNAL OF INFORMATICS
Volume 8, No. 2 | October 2026 : 92-106
ISSN 2685-4244, doi: 10.37905/jji.v8i2.41744

Smart city governance and digital transformation: A systematic literature review

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Article history:
Received September 27, 2026
Revised October 19, 2026
Accepted October 24, 2026

Keywords:
Digital transformation
Global South
Inclusive urbanization
Smart city governance
Sustainable development

ABSTRACT. Digital transformation creates opportunities for urban services while raising questions about institutional capacity, inclusion, and control over infrastructure. This systematic review examines institutional and infrastructure drivers, implementation barriers and geopolitical risks, and inclusive governance strategies, with implications for the Global South. Scopus was searched on 1 May 2026 for literature within 2016–2026. Of 320 retrieved documents, 314 remained after year filtering, 148 after document-type filtering, and 144 after English-language filtering. Bibliometric analysis describes these 144 global records, while thematic discussion draws on 26 substantive references. The two sets are distinct, and study-level selection accounting between them is incomplete. Thematic findings emphasize coordination, financing, infrastructure readiness, administrative capacity, and meaningful citizen participation. Contextual publications on industrial sustainability, political change, and security inform interpretation but do not establish municipal governance effects. A conditional framework links readiness, accountability, participation, and distributional assessment. Its policy implications are propositions for local evaluation, rather than validated causal effects. Single-database coverage, heterogeneous evidence, unspecified screening and quality-appraisal procedures, and references published after the stated search date limit reproducibility and the strength of conclusions. The contribution is an integrated account of governance conditions and evidence boundaries rather than a universally applicable model.

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INTRODUCTION

Digital transformation changes how cities coordinate public services, manage infrastructure, and engage residents. In resource-constrained urban settings, these changes depend on institutional capacity, reliable connectivity, and access to digital services. Technologies such as the Internet of Things, artificial intelligence, and data analytics therefore raise governance questions alongside technical ones. Reviews of smart-city applications and low-carbon urban development provide useful starting points, but technological capability alone does not establish equitable access or accountable decision-making (Das, Aiyetan, & Mostafa, 2026; Lim et al., 2021; Wang et al., 2019). Sustainable urban governance and spatial economic relationships also require attention to differences between municipal settings rather than assumptions of a single development pathway (Belizaire, 2026; Li et al., 2026).

Existing research addresses related problems at different analytical scales. Lim et al. (2021) examine relationships among smart-city technologies and applications, while Wang et al. (2019) review low-carbon solutions in Chinese cities and industrial parks. These contributions help explain technological and environmental priorities but do not by themselves integrate municipal capacity, transnational technology dependence, and the distribution of civic decision-making power. Empirical governance research and work on partnerships identify institutional arrangements as important implementation conditions (Kruhlov, Dvorak, Moroz, & Tereshchenko, 2024; Dameri & Benevolo, 2016). Comparative analysis of India, Singapore, and Indonesia and research in Nigeria further indicate that governance arrangements must be interpreted within their political and infrastructural settings (Liando, Ganaie, & Yuslaini, 2026; Egba et al., 2026).

Tan and Taeihagh (2020) already synthesize governance drivers and barriers in developing countries and emphasize socioeconomic, human, legal, and regulatory reform alongside technology. The need for institutional reform, inclusion, and partnerships is therefore established prior knowledge. The present contribution is narrower: it connects these conditions with transnational technological dependence and the distinction between access to participation and authority over decisions. This integration offers a way to organize implementation questions, rather than a claim to discover governance conditions for the first time. The earlier review positions the study within the literature and lies outside the 26-reference thematic endpoint.

The literature also connects urban digitalization with unequal service access, data protection, and control over technological infrastructure. Analyses of the Digital Silk Road and international standards describe strategic dependencies that may influence procurement and regulation, although these analyses do not measure municipal governance outcomes across the Global South (Hemmings, 2020; Ding, 2021). Evidence on infrastructure readiness is more directly municipal, whereas research on Brazilian military applications of artificial intelligence and ISO 14001 in Jordanian industry offers contextual comparisons with limited transferability to civic governance (de Borba Costa et al., 2026; Mndzebele, Tshovhote, & Gumbo, 2026; Altarazi & Haddaden, 2026).

A specific analytical task is to connect these bodies of work without treating their findings as interchangeable. Research on labor-market dualization and post-Soviet political change concerns wider institutional conditions rather than direct tests of smart-city participation (Rennick & Žilović, 2025; Duvanova, 2025). Similarly, a gamified survey, an e-participation platform, and citizen control over infrastructure represent different forms of engagement. Their contributions must be assessed in relation to who participates, what authority participants hold, and whether public institutions respond to their input (Rijshouwer & van Zoonen, 2023; Mutiarin & Lawelai, 2023; Cardullo & Kitchin, 2019). The review consequently examines relationships among governance capacity, technological dependencies, and participation rather than claiming that these topics have not been studied previously.

This study examines institutional and infrastructure drivers, implementation barriers and geopolitical risks, and inclusive governance strategies. The Global South provides an interpretive focus on resource constraints, uneven service access, and institutional asymmetries; it is not a geographic restriction on the Scopus search. The contribution is a conditional governance framework linking these three dimensions while distinguishing direct municipal evidence from contextual interpretation. Practical recommendations are treated as propositions requiring local assessment, rather than established effects of a universally applicable governance model (Gerli, Mora, Zhang, & Sancino, 2024; Zisengwe, 2024; Ma & Wu, 2023; Ncamphalala & Vyas-Doorgapersad, 2022).

The article presents the search and screening totals, distinguishes the bibliometric corpus from the thematic reference set, and examines the three research questions. A cross-question synthesis then develops governance propositions, identifies limitations, and specifies priorities for empirical research.

METHODS

Research Questions

The review addresses three questions concerning institutional and infrastructure drivers, implementation barriers and geopolitical risks, and inclusive governance. These questions organize the thematic discussion. They do not constitute evidence that every reference directly investigates each question or that the search covers all Global South contexts.

Literature Search Strategy

Scopus was searched on 1 May 2026 in the Article Title, Abstract, Keywords fields. The search retrieved 320 documents. The Boolean expression in Scopus advanced-search syntax is: TITLE-ABS-KEY(("ICT integration" OR "information and communication technology" OR "digital technology" OR "smart technology" OR "emerging technologies" OR "digital infrastructure" OR "interoperability" OR "digital transformation") AND ("governance framework" OR "governance model" OR "regulatory framework" OR "institutional framework" OR "policy framework" OR "management framework" OR "strategic framework" OR "IT governance" OR "digital governance") AND ("smart city" OR "smart cities" OR "intelligent city" OR "digital city" OR "ubiquitous city" OR "urban computing" OR "smart urbanism")). The publication-year, document-type, and language filters are reported separately in Table 1. Neither Global South nor country-specific terms formed part of the search expression. The 2026 coverage is necessarily partial at the stated search date.

Table 1. Screening criteria and document allocation

Criteria	Inclusion documents	Exclusion documents
Document year	Published in 2016-2026 (314 documents)	Published below 2016 (6 documents)
Document type	Article (148 documents)	Conference paper (79 documents), Book chapter (57 documents), Review (19 documents), Book (5 documents), Conference review (4 documents), Editorial (1 document), Data paper (1 document). The number of documents after screening by document type: 148 documents.
Document language	English (144 documents)	Chinese (3 documents), Russian (1 document)

Research Questions and Synthesis Strategy

The three research questions guide the organization of the synthesis and the interpretation of its evidence boundaries.

RQ1: What are the primary institutional and infrastructure drivers of digital transformation in Global South smart cities?

RQ2: What challenges and geopolitical risks constrain the equitable implementation of smart city frameworks in emerging economies?

RQ3: How can inclusive governance strategies and citizen participation models foster sustainable and equitable urban digital ecosystems?

Table 2 maps the research questions to thematic criteria and associated references. Its three rows contain 24 distinct references; Djatmiko et al. (2025) and Cardullo and Kitchin (2019) bring the substantive reference set to 26 and inform the participation discussion. The set includes contextual publications and a conference proceeding, so it cannot be equated without qualification to 26 eligible journal articles selected from the 144-record corpus.

Table 2. Research questions, criteria, and synthesis strategy

Criteria by RQ	Strategy to answer	Associated references
RQ1: Focuses on administrative models, infrastructure readiness, digital technologies, and institutional capacities driving smart city development in emerging markets.	Thematic organization of policy enablers, infrastructure assessments, and governance mechanisms.	Kruhlov, Dvorak, Moroz, & Tereshchenko (2024); Liando, Ganaie, & Yuslaini (2026); Egba et al. (2026); Das, Aiyetan, & Mostafa (2026); Lim et al. (2021); Dameri & Benevolo (2016); Ma & Wu (2023); Dai, Yuanheng, & Tong (2026); Li et al. (2026).
RQ2: Centers on structural barriers, digital divides, funding deficits, policy implementation gaps, and foreign technological dependency or geopolitical vulnerabilities.	Comparison of barriers, risk interpretations, and institutional contexts.	Hemmings (2020); Ding (2021); Mndzebele, Tshovhote, & Gumbo (2026); de Borba Costa et al. (2026); Altarazi & Haddaden (2026); Duvanova (2025); Ncamphalala & Vyas-Doorgapersad (2022); Zisengwe (2024).
RQ3: Emphasizes citizen engagement, digital literacy, participatory governance platforms, circular economy integration, and policy frameworks ensuring social equity.	Discussion of inclusion, participation, and environmental governance propositions.	Wang et al. (2019); Belizaire (2026); Gerli, Mora, Zhang, & Sancino (2024); Rijshouwer & van Zoonen (2023); Rennick & Žilović (2025); Mutiarin & Lawelai (2023); Yoon et al. (2020).

Note. The table maps 24 references. Djatmiko et al. (2025) and Cardullo and Kitchin (2019) additionally inform RQ3, producing 26 substantive references overall. The labels describe thematic relevance, not verified membership in the 144-record bibliometric corpus.

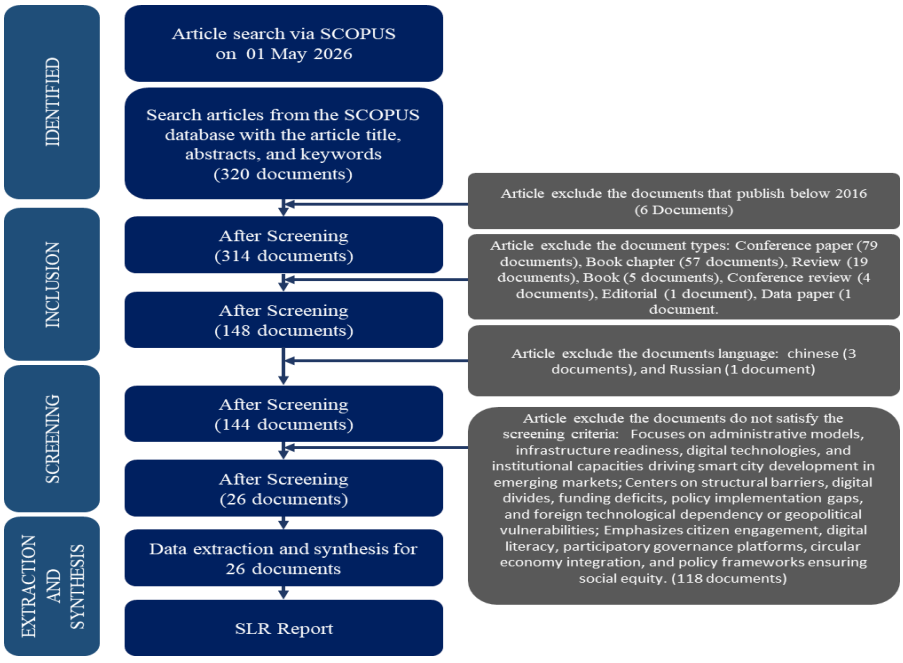


Figure 1. Study selection flow showing database filters and the 26-reference thematic endpoint

Figure 1 presents the selection totals: 320 retrieved documents, 314 after year filtering, 148 after document-type filtering, 144 after language filtering, and 26 references at the thematic endpoint. The diagram assigns the remaining 118 documents to thematic non-eligibility, but study-level decisions and distinct exclusion reasons are unspecified. The flow therefore supports aggregate accounting rather than a fully reproducible PRISMA selection history. References published after 1 May 2026 also prevent the thematic set from being attributed entirely to the stated database search.

Results and Discussion

The results separate the global bibliometric corpus of 144 records from the thematic discussion of 26 substantive references. Figures 2–5 describe the former; Tables 2–5 organize the latter. Bibliometric prominence is not used as evidence of implementation effectiveness or inclusion.

Bibliometric Distribution of the 144 Scopus Records

Figure 2 shows publication activity in the 144-record Scopus corpus between 2016 and 2026. Annual counts ranged from 2 to 7 between 2016 and 2021, reached 16 in 2023, and peaked at 53 in 2025. The 2026 count was 27 at the stated search date. Because 2026 is incomplete, its count cannot establish a decline relative to the full year 2025.

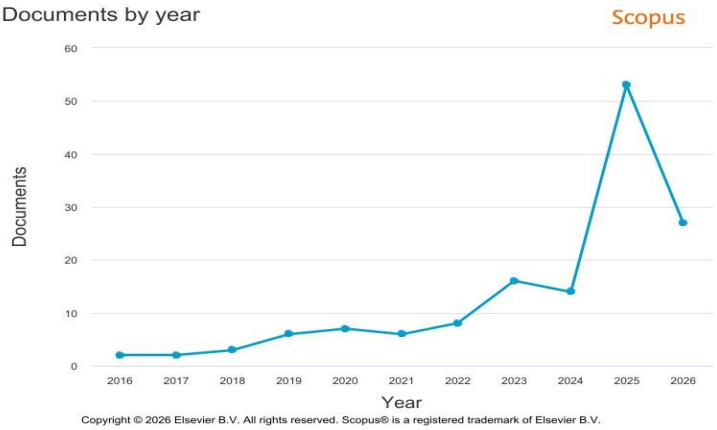


Figure 2. Number of documents by year in the 144-record Scopus corpus

Figure 3 presents the leading authors in the 144-record corpus. Chu, Z., Nurmandi, A., Shah, S.A., and Taeihagh, A., among others, each contributed two documents. The small counts indicate dispersed authorship among the displayed contributors; they do not establish the influence or quality of the studies.

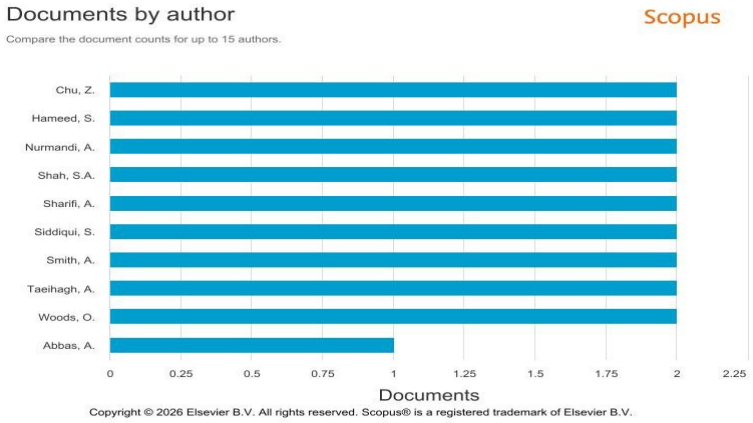


Figure 3. Number of documents by author in the 144-record Scopus corpus

Figure 4 shows that Universiti Utara Malaysia contributed five documents. The National University of Singapore, Tongji University, Norges Teknisk-Naturvitenskapelige Universitet, and Universitas Muhammadiyah Yogyakarta each contributed three. These are affiliation counts within the bibliometric corpus, rather than counts of city case studies.

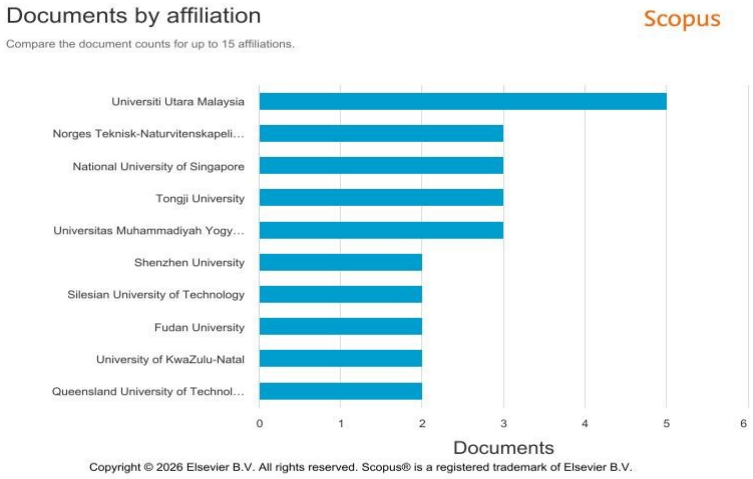


Figure 4. Number of documents by affiliation in the 144-record Scopus corpus

Figure 5 shows contributions from China (24 documents), the United Kingdom (19), Indonesia (14), India (11), the United States (11), Malaysia (10), and Australia (8). This distribution demonstrates that the search retrieved a global corpus. Institutional locations do not identify study settings, and contributions from the United Kingdom, the United States, Australia, or Singapore cannot be relabeled as Global South evidence. The thematic discussion therefore considers contextual transferability separately from bibliometric geography.

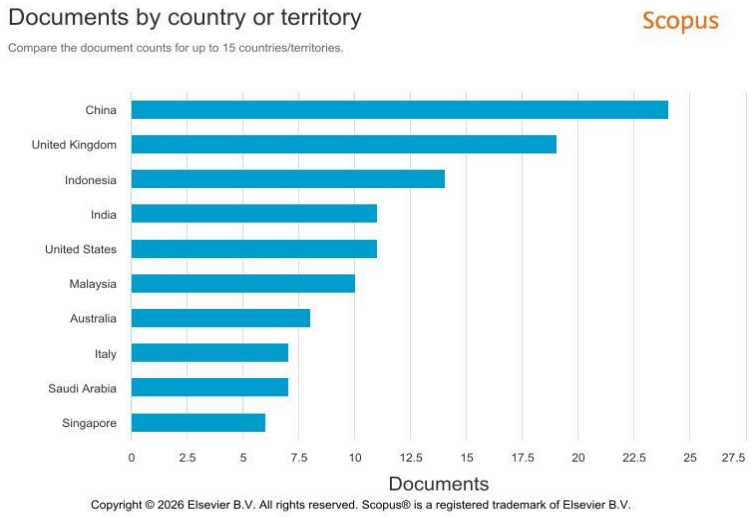


Figure 5. Number of documents by country in the 144-record Scopus corpus

Primary Institutional and Infrastructure Drivers

Institutional coordination and infrastructure readiness recur as conditions shaping implementation, although the evidence addresses different outcomes. Ma and Wu (2023) examine digitalization and carbon emissions across 353 Chinese cities; their findings concern environmental outcomes in a specific policy setting and do not establish universal gains in administrative efficiency. Dai, Yuanheng, and Tong (2026) examine subway opening and industry–academia–research

collaboration, offering an indirect connection between infrastructure and innovation rather than evidence that municipal bureaucratic silos were dismantled. Li et al. (2026) address spatial economic networks in Northeast China, which informs regional context rather than directly testing smart-city governance reform.

Public-private partnerships can provide financing and expertise, but their governance effects depend on contractual responsibilities, oversight, and local capacity. Kruhlov, Dvorak, Moroz, and Tereshchenko (2024) examine partnerships in Ukrainian urban development, while Das, Aiyetan, and Mostafa (2026) discuss opportunities and barriers in African cities. These settings cannot be treated as institutionally equivalent. Dameri and Benevolo (2016) provide an empirical governance perspective, while Liando, Ganaie, and Yuslaini (2026) compare India, Singapore, and Indonesia. Together, these publications support attention to coordination and contextual adaptation; they do not establish a common effect size or demonstrate that hybrid arrangements consistently outperform all alternatives.

Infrastructure readiness concerns whether connectivity, energy, data systems, and staff capabilities can support proposed services. Research in Nigeria identifies constraints involving energy, digital literacy, and regulatory support (Egba et al., 2026). The technology–application perspective of Lim et al. (2021) complements this account but operates at a different analytical level. The comparison suggests that technical ambition and operational capacity must be assessed together. Investments in sensors or analytics cannot be assumed to produce resilient services when power, maintenance, or institutional responsibilities remain uncertain. Table 3 summarizes the proposed mechanisms and their contextual boundaries.

Table 3. Summary of primary institutional and infrastructure drivers

Institutional Driver	Implementation Mechanism	Governance implication	Regional Context	References
Integrated Policy Frameworks	National digital strategies and proactive municipal digital governance restructuring.	Potential administrative coordination and alignment with sustainability goals; not a common measured effect.	Urban China and Southeast Asia	Ma & Wu (2023); Li et al. (2026)
Public-Private Partnerships	Collaborative financing, risk sharing, and direct transfer of technical expertise from private entities.	Financing and implementation opportunities conditional on contracts and oversight.	Eastern Europe and Sub-Saharan Africa	Kruhlov, Dvorak, Moroz, & Tereshchenko (2024); Das, Aiyetan, & Mostafa (2026)
Infrastructure Readiness	Expansion of broadband networks, modernization of power grids, and extensive IoT sensor deployment.	Operational capacity for data processing; resilience benefits require evaluation.	Global South Municipalities	Egba et al. (2026); Lim et al. (2021)
Hybrid Governance Models	Blending centralized policy coordination with decentralized, market-driven innovation protocols.	Context-dependent adoption and coordination; no pooled comparative effect.	India, Singapore, and Indonesia	Liando, Ganaie, & Yuslaini (2026); Dameri & Benevolo (2016)

Note. Mechanisms and outcomes are analytical summaries with different levels of direct support. Li et al. (2026) examine spatial economic networks, and Dai et al. (2026), discussed in the text, examine transport-linked innovation. Regional labels are broad contexts rather than a standardized country classification.

Challenges and Geopolitical Risks Constraining Implementation

Implementation barriers connect access to technology with the ability of institutions to respond. Zisengwe (2024) examines civic technology in Nigeria and South Africa and identifies differences in relationships between civic actors and government. Ncamphalala and Vyas-Doorgapersad (2022) examine ICT and service delivery in Ekurhuleni, emphasizing leadership, budgets, infrastructure, and training. These findings suggest that service digitalization requires administrative capacity alongside connectivity. They do not show that every municipality experiences the same barriers, nor do they quantify the effects of digitalization on inequality across the Global South.

Geopolitical dependence introduces a different scale of concern. Hemmings (2020) analyzes risks associated with the Digital Silk Road, while Ding (2021) examines international digital standards-setting. These accounts identify mechanisms through which external suppliers and standards may influence technological choices. Their relevance to municipal procurement is interpretive: they do not establish that foreign investment necessarily reduces sovereignty or produces surveillance in every recipient city. Research on artificial intelligence in Brazilian military security addresses another institutional setting and cannot directly substantiate claims about routine municipal use of civic data (de Borba Costa et al., 2026).

Political and regulatory context can shape the use of digital infrastructure, but the supporting evidence must remain sector-specific. Duvanova (2025) examines post-Soviet regime change rather than a causal relationship between imported smart-city systems and authoritarianism. Mndzebele, Tshovhote, and Gumbo (2026) concern municipal infrastructure readiness, whereas Altarazi and Haddaden (2026) investigate environmental management in Jordanian industry. The latter does not provide evidence for cyber statecraft or data-sovereignty claims. Accordingly, procurement transparency, interoperability, independent oversight, and safeguards for civic data are proposed governance responses rather than effects established by these contextual publications. Table 4 distinguishes municipal implementation barriers from wider political and security interpretations.

Table 4. Summary of implementation challenges and geopolitical risks

Challenge Category	Specific Barrier or Risk	Governance concern	Affected Region	Ref.
Structural Digital Divides	Inadequate broadband connectivity, skill shortages, and massive informal settlements.	Potential exclusion and uneven access; magnitude varies by setting.	Sub-Saharan Africa and Latin America	Mndzebele, Tshovhote, & Gumbo (2026)
Institutional Inertia	Chronic lack of data privacy frameworks and the digitizing of existing dysfunction	Capacity and accountability constraints; civic trust effects are not quantified.	South African Municipalities	Zisengwe (2024); Ncamphalala & Vyas-Doorgapersad (2022)
Geopolitical Vulnerabilities	technological dependency and transnational infrastructure investments.	Potential dependence and data-sovereignty concerns; not inevitable outcomes.	Global South participating in BRI	Hemmings (2020); Ding (2021)
Authoritarian Tech Export	The uncritical adoption of foreign surveillance and population control architectures.	Political-context concern; the cited regime study does not test smart-city technology export.	Post-Soviet Regimes and Transitioning Democracies	Duvanova (2025)

Challenge Category	Specific Barrier or Risk	Governance concern	Affected Region	Ref.
Cyber Statecraft Risks	Exploitation of sensitive civic data by external tech conglomerates without audit capabilities.	Security-context interpretation; the cited industrial study does not establish civic-data exploitation.	Amazonian Basin and Southeast Asia	de Borba Costa et al. (2026); Altarazi & Haddaden (2026)

Note. The categories combine municipal evidence with contextual political and security interpretation. Altarazi and Haddaden (2026) concern industrial environmental management; de Borba Costa et al. (2026) concern military security; Duvanova (2025) concerns regime change. These publications do not demonstrate municipal surveillance effects.

Inclusive Governance Strategies and Citizen Participation Models

Participation must be assessed by the authority available to residents as well as by the availability of digital channels. Wang et al. (2019) provide environmental and technological context, while Rijshouwer and van Zoonen (2023) discuss the methodological implications of gamified surveys. Neither source establishes that participation platforms invariably change municipal decisions. The comparison of Jakarta and Kuala Lumpur by Mutiarin and Lawelai (2023) is more directly relevant to ICT and citizen participation, although it is a conference publication rather than an article satisfying the stated document-type filter. Cardullo and Kitchin (2019), examining Dublin, offer a critical perspective on levels of citizen participation that can inform interpretation beyond their original setting.

Digital inclusion also depends on skills, affordability, accessibility, and the availability of support. Djatmiko et al. (2025) examine barriers to e-government adoption among marginalized communities and are relevant to this relationship. Yoon et al. (2020) address older adults' use of online health information and provide contextual evidence on digital inequality rather than a direct evaluation of municipal literacy programs. Rennick and Žilović (2025) concern labor-market dualization and democratic transition; their findings cannot substantiate claims that community participation reduces vandalism or increases ownership of smart infrastructure. Such outcomes require direct evaluation within municipal programs.

Belizaire (2026) connects sustainable governance, smart infrastructure, and urban resilience, supporting discussion of integrated planning. Gerli, Mora, Zhang, and Sancino (2024) examine relationships between grassroots digital initiatives and incumbent institutions across European settings. Their findings draw attention to power relationships and changing forms of cooperation rather than establishing urban mining as a universal participation mechanism. Together with the civic-technology evidence, these studies suggest that meaningful inclusion depends on institutional responsiveness and the distribution of decision-making authority. Public-private-people partnerships, community representation, and independent scrutiny of data practices are therefore governance propositions whose effects require local testing. Table 5 summarizes these strategies without treating projected benefits as guaranteed outcomes.

Table 5. Summary of Inclusive Governance Strategies

Strategy Theme	Participation Model	Proposed governance benefit	Technological Enabler	Ref.
Participatory Governance	Urban living labs and accessible public e-participation portals.	Closer alignment with community needs when institutions respond to participation.	Cloud-based civic forums and digital feedback loops.	Wang et al. (2019); Mutiarin & Lawelai (2023)

Strategy Theme	Participation Model	Proposed governance benefit	Technological Enabler	Ref.
Digital Capacity Building	targeted digital education and universal municipal accessibility programs.	Improved access and skills as objectives; program effects require direct evaluation.	E-learning platforms and public Wi-Fi infrastructure.	Yoon et al. (2020)
Sustainable Integration	circular economy policies and engaging gamified civic applications.	Resource efficiency and civic engagement as objectives; survey evidence does not establish environmental effects.	Real-time environmental monitoring tools.	Rijshouwer & van Zoonen (2023)
Collaborative Stewardship	Public-private-people partnerships featuring formal civil society representation.	Community scrutiny and rights protection as proposals, rather than guaranteed effects.	Open-source data repositories and transparent algorithmic registries.	Belizaire (2026)
Localized Resource Sharing	Community-driven urban mining and decentralized resource-sharing networks.	Connecting environmental objectives with civic practices as a proposition; the cited study concerns grassroots innovation.	Localized digital peer-to-peer exchange platforms.	Gerli, Mora, Zhang, & Sancino (2024)

Note. Benefits are proposed implementation objectives. Yoon et al. (2020) concern online health-information inequality; Rijshouwer and van Zoonen (2023) concern research participation; Gerli et al. (2024) concern grassroots digital innovation. These studies do not directly validate every technological enabler listed here.

Characteristics and Relevance of the Thematic Reference Set

Table 6 identifies the setting and evidence role of all 26 substantive references. Descriptions are limited to identifiable publication characteristics. Unspecified details are left unclassified, and none of the entries constitutes a formal quality rating. Publications outside municipal governance provide contextual interpretation rather than direct confirmation of the proposed framework.

Table 6. Publication characteristics and relevance of the 26 substantive references

Reference	Setting	Design or publication focus	Evidence role and boundary
Altarazi & Haddaden (2026)	Jordanian industry	Questionnaire and exploratory factor analysis	Industrial sustainability; indirect context, not cyber governance.
Belizaire (2026)	Urban resilience across settings	Governance and infrastructure analysis	Links planning and resilience; not a common causal effect.
Cardullo & Kitchin (2019)	Dublin, Ireland	Critical study of participation	Distinguishes participation roles; outside focal geography.
Dai et al. (2026)	Listed enterprises in China	Panel difference-in-differences analysis	Subway opening and collaborative innovation; indirect municipal relevance.
Dameri & Benevolo (2016)	Smart-city governance	Empirical analysis	Governance arrangements; cross-context transfer needs care.

Reference	Setting	Design or publication focus	Evidence role and boundary
Das et al. (2026)	African cities	Systematic review and case analyses	Infrastructure, finance, capacity and inclusion; postdates search.
de Borba Costa et al. (2026)	Brazilian Air Force and Amazonia	AI and security analysis	Military security; contextual relevance only.
Ding (2021)	China and international standards	Policy essay	Digital standards and strategic influence; not municipal outcome testing.
Djatmiko et al. (2025)	Marginalized users of public services	Qualitative e-government analysis	Access and adoption barriers; complements RQ3 mapping.
Duvanova (2025)	Post-Soviet political regimes	Political analysis	Regime dynamics; not a test of technology export.
Egba et al. (2026)	Nigeria	Mixed methods	Energy, regulation and skills shape public-service digitalization.
Gerli et al. (2024)	Twelve European countries	Interviews with grassroots actors and experts	Changing relations with incumbent institutions; contextual transfer.
Hemmings (2020)	China and Digital Silk Road recipients	Geopolitical essay	Strategic infrastructure dependence; contextual risk analysis.
Kruhlov et al. (2024)	Ukrainian cities	Analysis of public-private partnerships	Financing and institutional arrangements; transfer is conditional.
Li et al. (2026)	Northeast China	Spatial-network and threshold analysis	Regional economic linkages; indirect governance relevance.
Liando et al. (2026)	India, Singapore and Indonesia	Comparative governance analysis	Context-dependent coordination and inclusion.
Lim et al. (2021)	Smart-city technologies and applications	Text-mining analysis	Technology–application relationships; not a regional inclusion evaluation.
Ma & Wu (2023)	353 Chinese cities	Panel empirical analysis	Digitalization and carbon emissions; outcome-specific evidence.
Mndzebele et al. (2026)	Benoni, Ekurhuleni, South Africa	Qualitative municipal case study	Infrastructure readiness; postdates search.
Mutiarin & Lawelai (2023)	Jakarta and Kuala Lumpur	Comparative governance conference paper	ICT and participation; conflicts with article-only filter.
Ncamphalala & Vyas-Doorgapersad (2022)	Ekurhuleni, South Africa	Qualitative study using documents and interviews	Leadership, budgets, training and ICT readiness.
Rennick & Žilović (2025)	Serbia and Tunisia	Labor-market and political-transition analysis	Institutional context; no direct infrastructure-ownership evidence.
Rijshouwer & van Zoonen (2023)	Smart-city research participation	Methodological reflection on gamified survey	Participation in research; not proof of policy influence.
Wang et al. (2019)	Chinese cities and industrial parks	Review	Low-carbon solutions; environmental rather than participation effects.
Yoon et al. (2020)	Older adults and health information	Study of Internet-use inequalities	Digital exclusion context; not a municipal literacy intervention.
Zisengwe (2024)	Nigeria and South Africa	Civic-tech database analysis and interviews	Different patterns of civic-government collaboration.

Cross Question Governance Framework

The synthesis connects four conditional relationships. First, service ambitions must match operational readiness: reliable power, connectivity, maintenance, and administrative capability determine whether planned systems can function. Second, financing arrangements must be accompanied by accountability: procurement and partnership mechanisms should specify responsibilities for data, service continuity, and oversight. Third, participation requires influence: access to an interface does not demonstrate that residents can change priorities or challenge decisions. Fourth, distributional assessment is needed to establish who benefits, who remains excluded, and whether environmental gains coexist with accessible services. These relationships are proposed for empirical testing rather than treated as effects demonstrated across the 26 references.

Differences between contexts qualify the framework. Evidence of carbon-emission relationships in Chinese cities concerns an environmental outcome, whereas research in Ekurhuleni concerns operational and administrative readiness. Zisengwe (2024) identifies more collaborative civic-government relationships in the South African initiatives than in the Nigerian initiatives studied. Gerli et al. (2024) likewise show that relationships between grassroots initiatives and incumbent institutions can change rather than follow a uniform progression. These comparisons do not establish direct statistical contradictions because designs and outcomes differ. They instead challenge a single sequence of technological investment leading automatically to participation and sustainability.

Practical Implications and Research Priorities

Municipal authorities could apply the framework through a readiness assessment before procurement, explicit contractual provisions for interoperability and service continuity, accessible participation channels with published responses, and monitoring of service use across population groups. These actions are recommendations derived from the synthesis. Their effectiveness, costs, and feasibility have not been evaluated jointly. Local assessment should consider maintenance budgets, staff capacity, accessibility needs, and the legal authority to oversee suppliers.

Research priorities include longitudinal comparisons of municipalities with different fiscal and administrative capacities; assessment of whether participation changes budgets or service priorities; evaluation of digital access alongside environmental outcomes; and investigation of supplier dependence and public oversight. Future reviews should publish complete search exports, study-level eligibility decisions, extraction fields, appraisal results, and a transparent account of how thematic categories are generated. These measures would allow the proposed relationships to be examined against a reproducible evidence base.

Limitations

Scopus-only coverage, the English-language restriction, and the stated article filter limit breadth and may omit relevant local scholarship. The global search did not operationalize a country-level Global South eligibility rule; the regional focus is therefore interpretive. The 144 records and 26 substantive references represent different analytical units, and the 118-record transition lacks study-level exclusion accounting. Table 2 maps 24 references, with two additional participation references completing the thematic set. The inclusion of a conference paper and literature reviews also prevents the thematic set from being described as an article-only sample.

Temporal coverage is inconsistent. The Scopus search is dated 1 May 2026, but Dai et al. (2026), Mndzebele et al. (2026), and Das et al. (2026) were published later. The date and process of any additional retrieval are unspecified; their inclusion cannot be represented as a verified result of that

search. The initial search and the thematic reference set therefore have different temporal boundaries; completeness through the end of 2026 is not established.

Unspecified screening independence, extraction procedures, protocol status, and study-level quality appraisal constrain reproducibility and confidence. Reference authenticity does not establish Scopus indexing at the search date or the relevance of each citation to a particular claim. The inclusion of industrial, political, health-information, and military publications broadens interpretation but weakens direct municipal inference. Heterogeneous designs, settings, and outcomes do not support pooled effectiveness estimates, a validated implementation ranking, or universal claims about equity and sustainability.

Conclusion

For RQ1, institutional coordination, financing arrangements, operational infrastructure, and staff capacity emerge as interconnected conditions for digital transformation. For RQ2, unequal access, institutional constraints, and dependence on external technologies identify potential barriers whose importance varies by context. For RQ3, participation mechanisms are more plausibly inclusive when residents can influence decisions and obtain accessible services, rather than merely use digital interfaces. The review contributes a conditional framework linking readiness, accountability, participation, and distributional assessment. This framework organizes implementation questions; it does not establish comparative effectiveness. The global search scope, incomplete study-level selection accounting, heterogeneous reference set, and unresolved search-date inconsistency limit the strength and geographic reach of the conclusions. Future research should test the framework through comparative municipal studies, longitudinal assessment of service access and civic influence, and transparent reporting of selection and evidence quality.

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