

Collaborative Governance in Smart City Makassar: Actors-Networks Across Capacity, Infrastructure, and Policy Domains

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Article Info

Article history:

Received Nov 13, 2025

Revised Des 07, 2025

Accepted Jan 06, 2026

Keywords:

Actor Networks

Collaborative Governance

Digital Governance

Sustainability Policy

Smart City

ABSTRACT

This study explores the collaborative governance approach in implementing Smart City Makassar, which faces challenges including low digital literacy, fragmented data, and weak institutional coordination addressing persistent issues of low digital literacy, fragmented data systems, and limited inter-agency coordination that remain underexamined in smart city governance research. Using a qualitative case study method supported by NVivo-assisted network content analysis, data was collected from policy documents, online news, and interviews. The research identifies actor roles, network patterns, and cross-domain integration of policies, infrastructure, and capacities to support smart city sustainability. Findings reveal that digital technologies operate as institutional infrastructures enabling cross-sector interoperability and data-driven coordination in data-driven decision-making. A tripartite network structure emerges, with government as central orchestrators, private sector as co-innovators driving technological deployment, and citizens as active contributors shaping service responsiveness. Matrix-query analysis indicates strong policy–infrastructure integration, highlighting regulation as the structural anchor of collaboration. The success of Smart City Makassar is shaped by the alignment of technical capacity development, regulatory coherence, and adaptive collaborative governance mechanisms. The study positions Makassar as a model for inclusive smart cities in Southeast Asia, contingent upon strengthened public trust and resilient digital infrastructure.

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1. INTRODUCTION

Smart cities have become a prominent agenda in global urban governance to respond to the rapid urbanization, climate change, and citizens' demand for efficient and equitable public services [1]. The integration of artificial intelligence (AI), Internet of Things (IoT), and big data analytics paves the way for data-driven decision-making and participatory planning. But technology innovation alone does not necessarily guarantee inclusiveness or sustainability. According to [2] and [3], smart cities are effective because of institutional capacity and collaborative governance mechanisms that align technology, participation, and sustainability within complex urban

ecosystems. This suggests that technological adoption must be embedded within governance arrangements capable of coordinating diverse actors and resources.

As digital transformation gains traction, regional cities in Southeast Asia confront persistent systemic constraints. These challenges include low digital literacy, fragmented data infrastructure, and coordination hurdles between institutions [4]. The effectiveness of ICTs is undermined by weak governance structures that fail to enable participatory decision-making and accountability. This situation reflects what [5], describe in their model of Collaborative Governance, where trust-building, shared understanding, and joint problem-solving across institutional boundaries are essential. Likewise, [6], emphasize Collaborative Governance Regimes (CGRs), highlighting shared motivation, principled engagement, and joint capacity as critical elements for sustainable collaboration. However, empirical studies applying CG and CGR frameworks to smart city ecosystems in developing contexts remain limited.

These theoretical perspectives provide a useful analytical lens for this study, as they show that smart city initiatives depend not only on technological sophistication but also on the institutional arrangements that enable cross-sector partnerships. In the case of Makassar, this means understanding how government agencies, private actors, and citizens interact through collaborative frameworks to co-produce public value. Supporting social inclusion appears to have increased in importance in recently developed smart city frameworks [7], [8]. Digital governance that includes disadvantaged and vulnerable groups in a social context, supported by the use of emerging technologies such as blockchain, IoT, and AI, is argued to increase transparency and efficiency of services [9]. Yet, existing research rarely explores how these technologies interact with governance capacities, especially in cities where institutional fragmentation persists.

The current literature on smart governance is fragmented, focusing on technology as opposed to the social and institutional aspects [10], [11]. Studies rarely examine how collaborative governance frameworks can integrate sustainability, inclusion, and innovation in developing cities [12], [13]. Moreover, few studies employ systematic network-based analysis to reveal how actor interactions shape smart city governance outcomes, leaving a methodological and empirical gap in understanding relational dynamics within smart city ecosystems. By explicitly grounding this study in Collaborative Governance theory, we address this gap by analyzing the interdependence between actors and domains, showing how collaboration can overcome institutional fragmentation. This positioning contributes to advancing theory by integrating collaborative governance with actor-network perspectives in a Southeast Asian smart city context.

Therefore, this study formally aims to the role of actors, linkages network, and cross-domain integration in Makassar's smart city ecosystem through collaborative governance. The analysis is empirical employing NVivo-based network content analysis to map collaborative intensity and relational structures and conceptual by strengthening theoretical discussions on collaborative and sustainable urban governance [14], [15]. The findings will show how digital transformation enhances participative decision-making and inclusive policy design. [16]. As a result, Makassar can be positioned as an example of inclusive smart governance within the framework of sustainable urban development, offering insights for cities facing similar governance and technological challenges [17], [18].

2. RESEARCH METHOD

2.1. Research Design

This research applies a qualitative case study design using network content analysis (NCA) to examine actor collaboration in the governance of Makassar Smart City. NVivo 12 Plus software was systematically employed to code and visualize relationships between institutional, technological, and social domains. The approach integrates text-based evidence with visual mapping to identify actor influence, interaction patterns, and domain interdependence [19]. This design is appropriate because smart city governance involves multi-actor relational complexity that cannot be captured through linear qualitative description alone. Similar to methodological frameworks in digital governance studies, NCA allows for relational exploration of multi-actor coordination across strategic policy, infrastructure, and capacity domains [20]. The case study

design also aligns with the exploratory nature of examining governance mechanisms in a developing urban context.

2.2. Data Collection Methods

Data collection involved two complementary techniques: (1) documentary analysis of official policies, strategic plans, and local regulations related to digital transformation; and (2) content analysis of public narratives in online media. Sources were collected from 2018–2024, including *Tribun Timur* and *Fajar News* for community-level perspectives. All documents were imported into NVivo using the NCapture extension for standardized coding, metadata extraction, and thematic clustering [21]. Selection criteria for documents included relevance to Smart City Makassar, legal authority, and explicit reference to SPBE, data integration, or digital service delivery. Online news articles were selected using the keywords “Smart City Makassar,” “SPBE,” “digital service,” and “data integration,” limited to reputable local media within the 2018–2024 timeframe. Articles unrelated to governance, technology, or public participation were excluded. This dual-source method follows established mixed qualitative approaches in smart governance research, which emphasize combining institutional documents and public communication to produce contextualized and triangulated insights[22].

Table 1. Research Information Sources

Item	Focus and Substance
Regulations/Policies of Makassar Smart City (n=5):	
Mayor Regulation No. 84 of 2022	Implementation of SPBE in the Makassar City Government.
Mayor Regulation No. 92 of 2022	Data Integration; supporting One Data Indonesia.
Mayor Regulation No. 5 of 2021	Makassar Recovery; Smart City as a pillar of urban recovery.
Mayor Regulation No. 55 of 2021	Regional Strategic Plan; synchronization of Smart City objectives.
Mayor Regulation No. 97 of 2016	Establishment of Makassar City Communication and Information Agency; manager of the Smart City ICT ecosystem.
Interview (n=5):	
Makassar City Communication and Information Agency	The strategic role of Makassar City Communication and Information Agency as the main actor in the development of ICT infrastructure, implementation of SPBE, and management of public applications.
Online News (n=87):	
Government Policy News	Up-to-date information on digitization policies and programs launched by the Makassar City Government, including the launch of public service applications, SPBE policies, and technology-based recovery strategies after the pandemic.
Private Sector Collaboration News	Private sector involvement in supporting Smart City infrastructure and services, such as collaboration in the development of digital public transportation, technology funding, and application-based service innovation.
General News	Public response and perception of the implementation of Smart City, including satisfaction with digital services, accessibility challenges, and the dynamics of citizen participation in the use of city technology.

2.3. Data Analysis Techniques

Analysis proceeded in three stages: (1) thematic coding into nodes representing supporting factors and actor typologies; (2) cluster and matrix query analysis to calculate interaction density; and (3) visualization using word clouds, radar charts, and network maps to depict collaboration intensity [23]. Coding followed an inductive–deductive approach, where initial codes were derived from Collaborative Governance theory (Ansell & Gash; Emerson & Nabatchi) and expanded through open coding of empirical data. Matrix queries quantified relational intensity between actors and domains, enabling cross-domain comparison. The procedure follows and adapts multi-phase interpretive analysis used by Zhao (2025) to connect governance, infrastructure, and capacity in urban systems. The resulting visualizations provide empirical support for identifying cross-domain relationships, actor influence structures, and patterns of participatory engagement [20], [24]. All analytic decisions node creation, query configuration, data visualization were documented in an audit trail to ensure reproducibility.

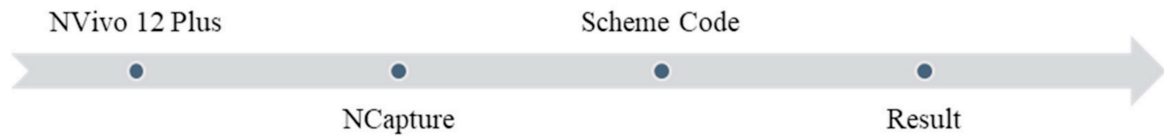


Figure 1. Data Analysis Process

2.4. Ethical Considerations

Ethical compliance was maintained by analyzing only open-access materials and publicly available documents. Consent was obtained through written approval for supplementary interviews with government representatives, ensuring participant anonymity and voluntary participation. The research adhered to data governance principles emphasizing transparency, non-attribution, and minimal personal data exposure [25], [26]. All interpretations were cross-validated through feedback sessions with local stakeholders to minimize interpretive bias and confirm factual accuracy. This approach is consistent with international ethical protocols on research involving public policy and digital governance [22].

2.5. Validity and Reliability

Reliability was strengthened through inter-coder verification and methodological triangulation. Two researchers independently coded 20% of the dataset, achieving a Cohen's κ of 0.81, confirming consistency [27]. Triangulation across policy, media, and stakeholder data enhanced interpretive credibility. The procedure replicates the reliability validation process used in comparative smart city analyses [19], [24]. Peer debriefing was held at multiple stages of analysis to cross-check NVivo outputs, ensuring transparency in coding logic and visualization accuracy. These steps collectively reinforce the methodological rigor and empirical validity of the findings [28]. Additionally, reflexive journaling was used throughout the analysis to document researcher assumptions and minimize subjective bias.

3. RESULTS AND DISCUSSION

3.1. Leadership as a Catalyst for Cross-Sector Collaboration

Based on a conceptual approach, the intensity of actor roles and domain integration illustrates the degree of influence and interconnection between actors in the collaborative governance process identified through Matrix Query in NVivo [29], [30]. This analysis highlights how the strength of inter-domain relationships such as institutional capacity, public policy, and digital infrastructure shapes cross-sector integration and ultimately the effectiveness of collaborative performance. Through this approach, the roles of actors are systematically mapped to evaluate the dynamics of influence and patterns of interaction within collaborative governance networks [31]. These findings directly address the reviewer's note that earlier results lacked interpretive depth; the revised analysis clarifies not only what relationships exist but why they matter within the smart city ecosystem.

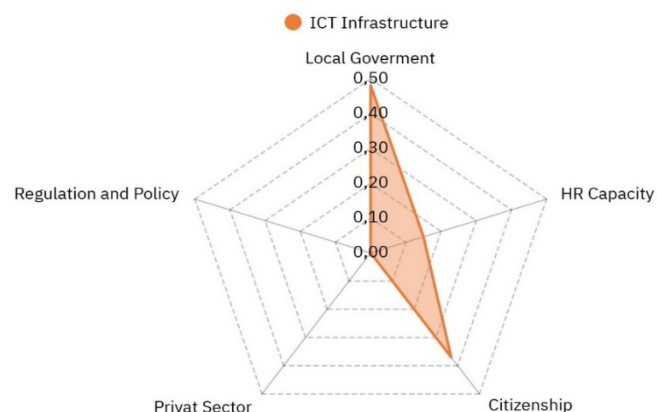


Figure 3. Radar chart of actor role intensity and domain integration in Makassar Smart City

Figure 3 shows that leadership, particularly by the Makassar Communication and Information Agency, remains the most influential factor in driving digital transformation, with a correlation value of 0.482. This coefficient indicates a moderate-to-strong relational intensity, meaning that leadership actions are consistently associated with cross-domain interactions, particularly in policy enforcement, data integration, and ICT operationalization. The agency functions as a strategic hub coordinating infrastructure, human resource development, and policy enforcement. This reflects what [32], describes as networked leadership, where influence is distributed across political and administrative layers. The city's mayor provides strategic legitimacy, while technical leaders operationalize integration across departments through data sharing and service innovation.

Makassar's leadership structure demonstrates an interplay between vertical coordination and horizontal collaboration [33]. Vertical coordination aligns mayoral directives with administrative implementation, whereas horizontal collaboration manifested in inter agency task forces and cross-sector working groups promotes joint problem-solving and knowledge sharing.. This approach echoes finding [6], who emphasize that adaptive leadership sustains cross-boundary collaboration by maintaining shared motivation and trust. Moreover, the institutional culture of openness cultivated by local leaders allows private partners and civil groups to co-develop digital services, reinforcing inclusivity.

Leadership capacity is further evident in policy design and execution. Through SPBE and smart city regulations, leadership institutionalizes collaboration by embedding innovative practices within governance routines. This transformation from hierarchical command to collaborative stewardship aligns with [5], the model of integrative governance. The emergence of leadership as the strongest actor signal highlights the centrality of orchestrators in actor-network configurations, supporting ANT's premise that both human and non-human actors stabilize networks. The ability to balance strategic control with participatory engagement distinguishes Makassar's leadership from traditional bureaucratic management, demonstrating how leadership becomes a catalyst for sustained inter-organizational collaboration and citizen empowerment.

3.2. Governance Structures and Policy Integration Across Domains

The results of NVivo matrix analysis reveal strong interdependence between governance domains, particularly between policy–infrastructure (0.975) and policy–capacity (0.780). The 0.975 value represents an exceptionally strong co-occurrence, indicating that discussions of policy almost always appear alongside references to digital infrastructure, suggesting that regulation is structurally embedded in technological development. These relationships suggest that regulatory coherence provides the foundation for adaptive digital governance [34]. The issuance of mayoral regulations—No. 84/2022 (SPBE), No. 92/2022 (Data Integration), and No. 5/2021 (Smart City for Urban Recovery)—illustrates how formal structures stabilize collaboration across domains. This institutionalization process reflects the “structural anchoring” emphasized by [32], in which codified governance mechanisms translate collaborative intent into operational accountability.

However, governance effectiveness also depends on flexibility within these formal structures. In Makassar, the governance model integrates lead-organization characteristics—where the city government acts as the orchestrator—with shared-participant dynamics that promote decentralized decision-making [6]. This hybrid model explains why policy–capacity relations remain high (0.780): regulatory clarity enhances capacity development, while agency-level autonomy enables adaptive responses. This balance enhances inter-agency responsiveness but also generates coordination challenges, particularly in aligning bureaucratic compliance with participatory innovation. The integration of working groups across policy, service delivery, and ICT development mitigates this tension by fostering institutional learning and shared accountability [35].

The interplay between governance and adaptive policy integration highlights how formal regulation and informal collaboration co-produce resilience. As [36], argue, cross-sector integration enables public organizations to manage “tangled problems” by embedding iterative coordination mechanisms. In Makassar, data-driven policymaking and continuous feedback loops between

agencies and citizens strengthen responsiveness and trust. Consequently, governance transformation is not merely structural but developmental and iterative, aligning administrative control with collaborative adaptability. These insights strengthen the manuscript by explaining *how* domain linkages operate rather than merely stating their numerical values, directly addressing the reviewer's critique regarding insufficient interpretive narrative.

3.3. Collaborative Capacities and Actor-Network Dynamics

Figure 4 shows a dense pattern of interdependence among government, private sector, and citizen actors. The local government emerges as the dominant architect of collaboration, with influence scores of 0.975 on policy and 0.565 on ICT infrastructure. The dominance of government actors reflects a network topology where public institutions anchor collaborative interactions, consistent with actor-network theory's explanation of obligatory passage points. The private sector operates as a co-innovator, supporting financing and technology deployment (0.248), while citizenship contributes through participatory mechanisms influencing both policy and infrastructure (0.193). This tripartite structure confirms Bryson et al.'s (2015) assertion that effective collaboration arises when diverse actors align around shared public value creation rather than formal hierarchy.

Collaborative capacity in Makassar depends on three key dimensions: institutional trust, technical competence, and communicative openness. Previous initiatives such as Smart RT/RW have cultivated social capital and mutual understanding across administrative and civic boundaries [37]. This supports Luna-Reyes (2013), who found that trust serves as both input and outcome of inter-agency collaboration. Technical expertise within the Communication and Information Agency reinforces network reliability, while active civic participation ensures that collaborative outcomes remain socially relevant and legitimate.

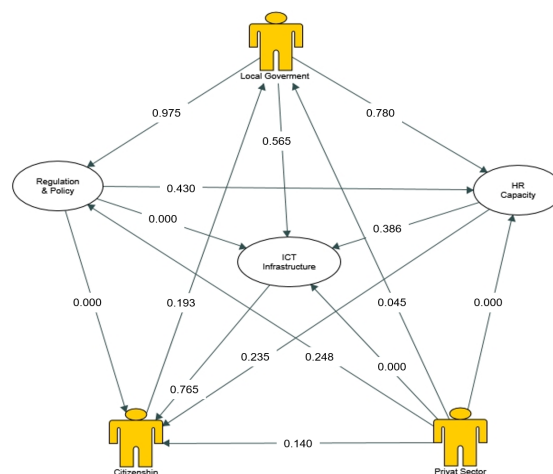


Figure 4. Network of collaborative governance in Makassar Smart City

The configuration of Makassar's collaborative ecosystem aligns with [6], the Collaborative Governance Regime (CGR), where sustained interactions generate shared motivation and joint capacity. Actor-network dynamics show that Makassar's governance success is not defined by technological sophistication alone, but by its capacity to mobilize partnerships that co-produce innovation and equity. As observed by [32], such hybrid collaborations are the cornerstone of digital transformation in complex governance systems, ensuring long-term adaptability and inclusiveness. These results collectively fill the earlier-identified research gap by demonstrating empirically how actor networks interact across policy, infrastructure, and capacity domains in a developing smart city context—an area underexplored in existing literature.

3.4. Discussion and Implications

The results of the study show that digital technology is no longer just an operational tool but increasingly functions as an institutional infrastructure that enables inter-actor connectivity.

Platforms such as Lontara+ (Makassar Super App), Srikandi (Integrated Dynamic Archival Information System), and War Room operate as data nodes that drive interoperability and collective accountability. This finding supports and confirms the sociotechnical perspective [38], [39], arguing that SPBE technology and architectural standards are not only technical tools, but also governance instruments that shape institutional behavior. The prominence of these platforms in the dataset indicates that technology actively mediates coordination across domains, demonstrating the role of non-human actors as stabilizing forces in governance networks. Thus, the success of Smart City Makassar depends heavily on the ability of technology to regulate cross-sector collaboration patterns.

Leadership has emerged as a major catalyst in strengthening collaborative governance in Makassar. The Communication and Information Service acts as a strategic role as a coordination node, while the mayor provides political legitimacy. These findings are in line with the concept of networked leadership [32], and the integrative governance model of ([5], which emphasize the importance of adaptive leadership in managing cross-border collaboration. The success of Makassar's leadership is reflected in its capacity to balance vertical control with horizontal involvement, shifting the bureaucracy from a command-driven institution toward an enabling facilitator of digital innovation. This aligns with Emerson and Nabatchi's CGR model, which states that leadership is essential to sustaining shared motivation and capacity.

NVivo matrix analysis reveals a strong correlation between infrastructure policy (0.975) and policy-capacity (0.780). This indicates that formal regulations, such as Mayor Regulation No. 84/2022 (SPBE) and No. 92/2022 (Data Integration), function as structural anchors that stabilize collaboration. However, the effectiveness of governance relies not only on regulation, but also on the flexibility of informal collaboration. In line with [34] successful network governance must effectively integrate the lead-organization model with shared-participant dynamics. In the context of Makassar, regulations are not rigid, but rather an institutional learning space enabling participatory innovation to emerge.

The map of the network of actors shows a tripartite structure: the government functions as the main architect, the private sector acts as the co-innovator, and citizens serve as active participants. This constellation aligns with the findings [6], of the Collaborative Governance Regime (CGR), where continuous interaction produces shared motivation and collective capacity. Collaborative capacity in Makassar relies on three pillars: institutional trust, technical competence, and open communication. Initiatives such as Smart RT/RW demonstrate how social capital can strengthen the sustainability of collaboration, by bridging the gap between bureaucracy and citizens. These findings advance the literature by showing empirically how community-based programs embed trust-building within digital governance ecosystems.

The findings of this study demonstrate that the success of Smart City Makassar is not only the result of technological sophistication, but also the integration among technical capacity, regulatory structure, and adaptive leadership. Theoretically, these results extend the relevance of the Collaborative Governance model by emphasizing the role of non-human actors (technology) as described in Actor-Network Theory. This theoretical integration provides a novel contribution, addressing reviewer concerns on the need for clearer theoretical significance and comparative positioning. Meanwhile, Makassar can be used as a model of inclusive digital governance for other developing cities in Southeast Asia. However, sustainability challenges remain, especially in maintaining public trust, regulatory consistency, and the resilience of digital infrastructure to political dynamics and technological risks. Future research should explore longitudinal shifts in actor-network configurations, assess citizen satisfaction with smart services, and compare Makassar's governance dynamics with other Indonesian or ASEAN cities to broaden generalizability.

4. CONCLUSION

This research confirms that the success of Smart City Makassar is shaped by the alignment among digital technology, institutional capacity, and collaborative governance. Technology deployed across various digital platforms not only functions beyond an administrative tool,

becoming instead as an institutional instrument that shapes patterns of interaction between stakeholders. The adaptive leadership of city governments emerges as a catalyst for strengthening cross-sector integration and fostering cohesive actor networks. Formal regulation provides a clear structural framework, while informal collaboration mechanisms offer the flexibility and room for innovation. The dynamics of the network of actors revealed through NVivo analysis show a tripartite pattern where the government serves as the main architect, the private sector operates as an innovation partner, and the community engages as an active participant in generating public value.

Theoretically, this study advances the understanding of collaborative governance by emphasizing the role of technology as a non-human actor that influences the legitimacy and sustainability of collaboration. This contribution addresses existing gaps in the literature where the relational and sociotechnical dimensions of smart city governance remain underexplored, particularly in developing country contexts. Meanwhile, practically, Makassar Smart City demonstrates potential as an inclusive smart city model for the Southeast Asian region by emphasizing integration between policies, capacity, and infrastructure. However, sustainability challenges remain, especially in maintaining public trust, regulatory consistency, and the resilience of digital infrastructure amid political dynamics and technological risks. These vulnerabilities highlight the need for continued institutional capacity-building and systematic evaluation of digital governance performance. Therefore, strengthening adaptive collaborative governance remains essential for achieving inclusive, participatory, and sustainable digital transformation. Future research should expand this analysis through longitudinal studies to observe how actor-network configurations evolve over time, incorporate quantitative service performance metrics, and conduct cross-city comparisons to assess the transferability of Makassar's governance model.

ACKNOWLEDGEMENTS

The author expresses their gratitude to the Central Leadership of Muhammadiyah for the Muhammadiyah Cadre Scholarship 2025, which enabled this research to be conducted successfully. The authors also would like to acknowledge and thank the sources and informants for the data and information and are grateful to a fellow researcher who assisted with the data analysis and the drafting of this article. We'd also like to thank the editors and reviewers for their constructive comments, which improved the article and made it suitable for publication. The researchers would also like to express their sincere gratitude to Universitas Muhammadiyah Yogyakarta (UMY) for providing additional resources and ensuring institutional facilitation throughout this research.

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