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DATA-DRIVEN DECISION-MAKING FOR SMART CITY INVESTMENTS: A MULTI-CRITERIA FRAMEWORK FOR STRATEGIC DIGITAL GOVERNANCE

AKILLI ŞEHİR YATIRIMLARI İÇİN VERİ ODAKLI KARAR VERME: STRATEJİK DİJİTAL YÖNETİŞİM İÇİN ÇOK KRİTERLİ BİR ÇERÇEVE

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ABSTRACT

The strategic alignment of smart city investments with public governance priorities has become a critical issue in the digital transformation of urban management, especially in developing and non-Western contexts. This study develops a hybrid Analytic Hierarchy Process (AHP)–Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) model to evaluate smart city initiatives in Konya Metropolitan Municipality in Türkiye. By integrating semi-structured interviews with decision-makers and a multi-criteria decision-making (MCDM) framework, we assess eight smart city dimensions—ranging from Smart People to Smart Environment—across five criteria: technical adequacy, cost-efficiency, integration, sustainability, and citizen impact. The findings reveal a strong prioritization of human capital and economic development, while environmental and infrastructural dimensions remain underemphasized. The analysis highlights persistent gaps in artificial intelligence (AI) adoption, interdepartmental data

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governance, and participatory citizen engagement, limiting governance maturity and long-term sustainability. Policy recommendations include embedding AI-supported decision-making, institutionalizing open data and interoperability standards, aligning investments with Sustainable Development Goals (SDGs), and designing inclusive co-creation platforms to enhance citizen-centric innovation.

ÖZ

Akıllı şehir yatırımlarının kamu yönetişim öncelikleriyle stratejik uyumu, özellikle gelişmekte olan ve Batı dışı bağlamlarda kentsel yönetimin dijital dönüşümünde kritik bir mesele haline gelmiştir. Bu çalışma, Türkiye'de Konya Büyükşehir Belediyesi örneğinde akıllı şehir girişimlerini değerlendirmek üzere hibrit bir Analitik Hiyerarşi Süreci (AHP) – İdeal Çözüme Benzerlik Yöntemi (TOPSIS) modeli geliştirmektedir. Karar vericilerle yapılan yarı yapılandırılmış mülakatlar ve çok kriterli karar verme (ÇKKV) çerçevesi kullanılarak, sekiz akıllı şehir boyutu (Akıllı İnsan'dan Akıllı Çevre'ye) teknik yeterlilik, maliyet verimliliği, entegrasyon, sürdürülebilirlik ve vatandaş etkisi kriterleri üzerinden değerlendirilmiştir. Bulgular, insan sermayesi ve ekonomik gelişimin güçlü biçimde önceliklendirildiğini; çevresel ve yapısal boyutların ise görece geri planda kaldığını göstermektedir. Analiz, yapay zekâ (YZ) uygulamaları, birimler arası veri yönetişimi ve katılımcı vatandaşlık süreçlerinde süregelen boşluklara işaret etmekte; bu eksiklikler yönetişim olgunluğunu ve uzun vadeli sürdürülebilirliği sınırlamaktadır. Politika önerileri arasında YZ destekli karar sistemlerinin yerleşik hale getirilmesi, açık veri ve birlikte işlerlik standartlarının kurumsallaştırılması, yatırımların Sürdürülebilir Kalkınma Amaçları (SKA) ile uyumlu hale getirilmesi ve vatandaş odaklı inovasyonu güçlendirmek için kapsayıcı eş-tasarım platformlarının geliştirilmesi yer almaktadır.

Keywords: Smart City, Digital Transformation, Data Governance, Artificial Intelligence, Urban Resilience.

Anahtar Kelimeler: Akıllı Şehir, Dijital Dönüşüm, Veri Yönetişimi, Yapay Zekâ, Kentsel Dayanıklılık.

INTRODUCTION

In an era marked by rapid technological advancement, the transformation of public administration through digital innovation has become a global imperative. The proliferation of smart city initiatives -urban systems embedded with data-driven technologies, IoT infrastructure, and algorithmic governance- has positioned cities as critical arenas for public sector digital transformation (Kitchin, 2014; Meijer, Granier & Kudo, 2016). These transformations are not merely technical but deeply governance-oriented, demanding redefinitions of policy priorities, investment logic, and decision-making methodologies (Batty et al., 2012; Mergel et al., 2019).

Smart cities operate at the intersection of urban planning, technology, and governance, offering the promise of improved service delivery, sustainability, and participatory democracy (Nam & Pardo, 2011; Albino et al., 2015). Yet the challenge of aligning technology-driven investments with long-term public policy goals remains unresolved. As previous scholarship has shown, the success of smart initiatives depends less on the technologies themselves and more on the institutional, strategic, and evaluative capacities of local governments (Angelidou, 2017; Cappa et al., 2022).

In our earlier research we observed that the misalignment between smart city project selection and governance priorities can undermine both efficiency and legitimacy (Batty et al., 2012). While open data platforms, digital services, and AI-enabled infrastructures are increasingly common, their integration into accountable, strategic, and participatory governance systems is still fragmented, particularly in developing-country contexts.

This raises a set of interrelated research problems: First, how can local governments systematically prioritize smart city investments in a way that reflects not only technical feasibility but also public value, policy alignment, and governance maturity (Wirtz et al., 2019)? Second, how can AI and digital decision-support tools contribute to more strategic, evidence-based public investment processes while maintaining transparency and democratic oversight (Sun & Medaglia, 2019; Gil-García et al., 2016)?

To address these concerns, this study poses a central question: To what extent can multi-criteria decision-making (MCDM) methodologies be operationalized to support strategic alignment between smart city investments and public policy objectives in local governance?

Although the literature on smart cities and digital governance has expanded rapidly, particularly across the Global North, there remains a significant gap in examining how MCDM methods and AI-enabled tools can be adapted to mid-sized municipalities in non-Western contexts. Türkiye provides a particularly relevant case. National policy frameworks such as the Smart Cities Strategy and Action Plan (2020–2023) emphasize interoperability, data governance, and sustainability, yet municipal practices vary widely. Studies mapping Türkiye's smart city initiatives show that cities like Istanbul and Konya lead in infrastructure and analytics capacity, while others lag in citizen participation and environmental integration (Can, 2019; Akpınar & Ceyhan, 2023). Moreover, Ünal and Işıklar Alptekin (2023) demonstrate through a national MCDM ranking that governance and social inclusion are the most decisive components of urban smartness.

This study responds to that contextual gap by introducing a data-driven, AI-augmented AHP–TOPSIS framework and applying it to the case of Konya Metropolitan Municipality, a pioneer within Türkiye's digital transformation agenda. The model integrates technical, social, economic, and governance criteria to rank investment alternatives not only by efficiency but also by their strategic fit with public value frameworks.

Specifically, the research explores three questions:

1) How can public administrations integrate sustainability, efficiency, citizen impact, and legal compliance into a unified evaluative model for digital investments?
2) What role does AI-supported data infrastructure play in enhancing the maturity and legitimacy of public sector decision-making frameworks?
3) How can cities ensure that smart city investments are not merely technologically "smart" but also strategically smart in governance terms?

By addressing these questions, the paper contributes to ongoing debates in three ways. First, it offers a transparent, replicable MCDM model to evaluate smart city investments (Greco et al., 2019). Second, it extends the literature on AI and digital governance by conceptualizing data infrastructures as governance mechanisms, not just service enhancers (Cappa et al., 2022; Mergel et al., 2019). Third, it advances the demand for evidence-based, accountable decision frameworks in public-sector innovation (OECD, 2020b; Dawes et al., 2016), bridging the gap between digital capability and strategic oversight.

1. LITERATURE REVIEW

This literature review synthesizes recent works on smart-city governance, investment prioritization, and the fusion of multi-criteria decision-making (MCDM) with AI-driven analytics. Organized into four thematic strands—

conceptual foundations, strategic-alignment challenges, MCDM evolution, and AI for governance—it situates the proposed AHP–TOPSIS framework within current debates on accountable, context-specific digital governance (OECD, 2020a).

1.1. Conceptual Foundations of Smart Cities and Digital Governance

Smart-city thinking has evolved from technology-centric projects toward socio-technical governance ecosystems in which data and algorithms enable transparency and participation (Caragliu et al., 2011; Batty, 2013). ICT, IoT, and AI infrastructures act as enablers of public-value creation (Kitchin, 2014; Zanella et al., 2014), yet their benefits depend on institutional maturity rather than on technology itself (Meijer & Bolívar, 2016; Nam & Pardo, 2011).

Critiques of “techno-optimism” warn that digital initiatives may reproduce existing inequalities unless embedded in participatory and collaborative frameworks (Söderström et al., 2014; Cowley, 2020). Grossi & Welinder (2024) reinterpret smart cities through the paradigms of New Public Management, Digital-Era Governance, and Collaborative Governance, highlighting socio-technical complexity. In parallel, Cappa et al. (2022) and Katzenbach & Ulbricht (2019) underline AI's dual nature—enhancing predictive governance but introducing bias risks—thereby reinforcing the need for hybrid human-AI oversight models (Anthopoulos, 2017).

In non-Western settings, such as Türkiye, adoption patterns reveal hybrid challenges: national digital agendas clash with local capacities, leading to fragmented implementations. Turkish scholarship similarly emphasizes that municipal administrations must invest in robust digital infrastructure and exploit digital tools to turn emerging economic and social opportunities into public value for city residents (Kayan, 2019). In this sense, the national and local digitalization agendas intersect unevenly in Türkiye. Can (2019) mapped 46 municipalities and found that infrastructure-focused projects dominate, while citizen participation and environmental sustainability remain limited. Akpınar & Ceyhan (2023) linked such patterns to Sustainable Development Goal 11, positioning Konya as advanced in digital infrastructure yet still consolidating participatory and environmental capacities. Ünal & Işıklar Alptekin (2023) further confirmed—through an entropy–TOPSIS ranking of 48 cities—that governance and social inclusion are decisive for smart-city maturity.

1.2. Challenges in Strategic Alignment of Smart City Investments

Strategic misalignment persists where short-term technological goals eclipse long-term governance and sustainability priorities (Angelidou, 2015; Trindade et al., 2017). Economic-technical criteria dominate while social and environmental values are marginalized (Mora et al., 2017a). Institutional immaturity—siloed budgeting, fragmented regulation, and weak participation—undermines impact (Cappa et al., 2022).

Recent global analyses amplify these concerns. The OECD (2020b) estimates that 70 % of smart-city projects fail to meet SDG coherence. Beckers & Mora (2025) and Silva et al. (2025) advocate adaptive innovation ecosystems to overcome planning and coordination gaps. Within Türkiye, Konya illustrates tension between municipal autonomy and national directives (Yigitcanlar & Bulu, 2015; Konya Büyükşehir Belediyesi, 2022). UN-Habitat (2025) and Akpınar & Ceyhan (2023) stress that unchecked digitalization widens divides unless investments are aligned with people-centered policies. These findings reinforce the inadequacy of traditional cost–benefit logic and the need for MCDM frameworks embedding governance values (Chatterjee et al., 2021).

1.3. Multi-Criteria Decision-Making (MCDM) in Public Sector Investments

MCDM methods—AHP (Saaty, 1980), TOPSIS (Hwang & Yoon, 1981), and their hybrids—provide structured evaluation of complex public-investment trade-offs (Zopounidis & Doumpos, 2013). In urban studies, hybrid models reconcile quantitative efficiency with qualitative governance criteria (Greco et al., 2019; Chatterjee et al., 2021).

Recent extensions demonstrate geographic and methodological diversity. Farooq et al. (2018, 2019a, 2019b, 2021) integrated GIS with AHP, BWM, and PROMETHEE II to evaluate transport and mobility systems in Beijing and Peshawar, proving the scalability of hybrid models for developing-country contexts. Ekin & Sarul (2022) compared AHP, BWM, FUCOM, and DEMATEL for Turkish municipalities, ranking smart governance and environment as top priorities. Ünal & Işıklar Alptekin (2023) applied Entropy–TOPSIS to 48 global cities, highlighting the policy relevance of data-driven weighting. Collectively, these studies validate MCDM's robustness and justify the present paper's AHP–TOPSIS integration for evaluating municipal investment alignment.

Despite these advances, scholars note persistent subjectivity in weighting and limited AI integration (Belton & Stewart, 2002; Doumpos et al., 2022). Lloret et al. (2025) bridge this gap through a data-driven digital-transformation model linking AI-readiness, IoT integration, and governance maturity—an approach directly informing this study's policy-matrix design.

1.4. Artificial Intelligence for Strategic Urban Governance

Artificial Intelligence (AI) and advanced data infrastructures increasingly underpin the evolution of smart-city governance, moving beyond service digitization toward anticipatory and evidence-informed management frameworks (Dawes et al., 2016; Zuiderwijk et al., 2014). AI supports predictive analytics, performance dashboards, and participatory decision-support tools that enhance both operational efficiency and strategic foresight. Yet, these benefits depend on institutional capacity, ethical safeguards, and transparent algorithmic oversight (Katzenbach & Ulbricht, 2019; Gil-García et al., 2016). Recent frameworks link these capabilities to digital maturity: Lloret et al. (2025) demonstrate that AI-enabled dashboards and interoperable IoT systems represent the highest stage of governance development, where explainability and algorithmic auditing ensure accountability and citizen trust. Alongside AI, emerging technologies such as blockchain are being explored as 'trust machines' for public services, promising greater transparency, traceability, and security in government transactions (Bozdoğanoğlu, 2023).

In this context, AI is conceived not as a substitute but as a maturity accelerator for public governance, amplifying legitimacy when embedded within hybrid decision-making systems (Wirtz et al., 2019; Mergel et al., 2019). Integrating AI with MCDM methods bridges algorithmic precision and deliberative legitimacy, transforming quantitative modeling into a vehicle for participatory governance. The convergence of AI analytics and structured evaluation tools such as AHP and TOPSIS thus enables multi-dimensional prioritization grounded in transparency and public value.

In emerging economies, however, these practices remain uneven. Türkiye's early adoption of AI in urban systems illustrates both opportunity and fragmentation, as algorithmic coordination is not yet matched by institutionalized evaluation frameworks (Yigitcanlar, 2015; Vatamanu & Tofan, 2025). To address this gap, the present study operationalizes an AI-augmented AHP–TOPSIS model, aligning expert-derived criteria weights with qualitative insights from municipal stakeholders. Applied to Konya Metropolitan Municipality, this model offers a replicable blueprint for aligning digital investments with governance maturity, accountability, and participatory legitimacy—extending the emerging paradigm of strategically smart governance.

2. METHODOLOGY

This study adopts a multi-phased framework to operationalize a hybrid multi-criteria decision-making (MCDM) model aligning smart-city investments with public-governance priorities (Ünal & Alptekin, 2023). Built on an exploratory sequential mixed-methods design, it begins with qualitative data collection to elicit context-specific criteria from stakeholder perspectives and integrates these insights into quantitative AHP–TOPSIS modeling for prioritization (Saaty, 1980; Hwang & Yoon, 1981). The sequential design ensures theoretical robustness and contextual sensitivity to digital-governance realities in emerging economies (Creswell & Plano Clark, 2017; Mele & Belardinelli, 2018; Yigitcanlar et al., 2019). Ethical protocols—voluntary participation, informed consent, and confidentiality—followed TÜBİTAK and institutional standards.

2.1. Research Design and Case Selection

The two-stage design comprises:

1) a qualitative phase using semi-structured interviews to identify evaluation criteria, and
2) a quantitative phase applying AHP and TOPSIS to rank projects. This structure grounds the model in real governance experience while leveraging MCDM's analytical strength (Ivankova et al., 2006; Fetters & Molina-Azorín, 2017), responding to critiques of technocratic smart-city planning by embedding qualitative nuance within algorithmic reasoning (Belton & Stewart, 2002; Meijer & Bolívar, 2016).

The case of Konya Metropolitan Municipality—a national pioneer in AI-supported municipal services and digital infrastructure (Yigitcanlar & Bulu, 2015)—ensures contextual validity and transferability to mid-sized cities with comparable governance structures.

2.2. Qualitative Phase: Interviews and Coding

Between June and August 2025, fourteen interviews were conducted with stakeholders representing four functional groups (Table 1). Purposive and snowball sampling secured diversity while minimizing elite bias (Guest et al., 2006; Patton, 2015). Interviews lasted 20–30 minutes and followed a nine-theme protocol covering digital-strategy orientation, investment criteria, AI and data use, stakeholder participation, coordination, and future policy directions.

Functional Group	Example Roles	Number
Academic experts	Scholars in public policy / digital governance	3
Senior officials	Department or unit heads	4
Mid-level managers	Program / project coordinators	4
Technical staff	IT, data, and AI specialists	3
Total		**14**

The bilingual (Turkish–English) guide was pilot-tested and refined for clarity. Open-ended questions elicited narrative-rich responses revealing implicit evaluation logics; scalability, integration capacity, citizen-centricity, and SDG alignment. Interviews were recorded with consent, transcribed verbatim, and coded thematically in NVivo. Thematic saturation was reached by the fourteenth interview, after which no new categories emerged (Saunders et al., 2018). Reflexive memos supported analytic transparency.

2.3. Framework Development and Quantitative Modeling

Interview themes were integrated with constructs from the smart-city and digital-governance literature (Mora et al., 2017a). Thematic analysis (Braun & Clarke, 2006) yielded five main categories; Technical Feasibility, Economic Efficiency, Social Impact, Environmental Sustainability, and Governance Alignment, comprising fourteen measurable sub-criteria. Member-checking confirmed conceptual validity (Birt et al., 2016).

Using AHP, experts performed pairwise comparisons via an online 1–9 Saaty-scale survey. Inconsistent matrices (CR > 0.10) were revised (Forman & Gass, 2001). Weights were aggregated with geometric means, and sensitivity tests examined robustness (Zopounidis & Doumpos, 2013).

TOPSIS then evaluated five candidate projects -smart traffic, open-data portal, e-municipality app, AI-assisted waste management, and public-safety dashboard- using AHP weights. Expert scores (1–10 Likert) and municipal performance data supplied the decision matrix. Normalization, weighting, and Euclidean distance calculations produced closeness coefficients ranking project alternatives (Opricovic & Tzeng, 2004; Sharma et al., 2023).

2.4. Validation and Triangulation

Model validation combined (1) expert feedback on rankings, (2) weight-perturbation sensitivity checks (± 20 % on Governance Alignment), and (3) benchmarking against alternative methods (VIKOR, PROMETHEE) (Doumpos et al., 2022). No rank reversals occurred among the top three projects.

Triangulation across qualitative coding, expert surveys, and municipal data strengthens validity by integrating interpretive and numerical evidence. A prototype interactive dashboard allowed users to adjust weights and simulate strategic scenarios, extending the model from analysis to decision support (Mergel et al., 2019; Wirtz et al., 2019).

2.5. Limitations

As a single-case study, generalization beyond Konya is limited. Interview duration restricted depth of individual narratives, yet methodological triangulation mitigates this through convergent qualitative–quantitative evidence.

3. FINDINGS

This study presents the thematic analysis of semi-structured interviews conducted with fourteen individuals from the Konya Metropolitan Municipality, including academics, unit directors, mid-level managers, and technical staff. The interviews, lasting approximately 20–30 minutes each, were transcribed and analyzed using MAXQDA software. The findings are structured around the main research questions, integrating insights from the Analytic Hierarchy Process (AHP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) analyses, as well as related literature.

3.1. Critical Factors Influencing Smart City Investment Decisions

Interview participants emphasized data security, cyber-resilience, and environmental sustainability as decisive determinants of smart-city investments. These priorities reflect the principles of intergenerational responsibility embedded in the Brundtland Report and the UN Sustainable Development Goals (United Nations, 2015). Respondents also highlighted social-service integration and public safety as central to ensuring digital inclusion and equity in service delivery (Gil-García et al., 2016). Typical examples included real-time traffic monitoring, emergency-response coordination, and environmental-monitoring systems such as air-quality sensors and electric-vehicle infrastructure. Together, these insights suggest that local government's view "smartness" not merely as technological modernization but as a mechanism for social protection, ecological stewardship, and public trust—dimensions increasingly recognized in recent urban-governance research.

Codes:

- Data & Cybersecurity
- Environmental Sustainability
- Social Service Integration
- Transportation Infrastructure
- Digital Inclusion

3.2. Project Evaluation Criteria and AHP Weighting

Interviewees identified a set of interrelated technical and governance-oriented criteria guiding project evaluation. Cost-efficiency emerged as the most heavily weighted dimension (30%), underscoring fiscal prudence and the need to deliver high public value under budget constraints. Technical adequacy (25%) -covering scalability, interoperability, and cybersecurity- ranked second, while integration capability (20%) reflected the importance of reducing fragmentation across municipal systems. Sustainability and citizen-centricity (each 15%) captured long-term environmental and social considerations.

These results, formalized through the AHP process (Saaty, 1980), indicate that Konya's digital-governance logic privileges operational resilience and value efficiency over experimental innovation. Such prioritization mirrors global findings on the institutionalization of smart-city governance, where fiscal accountability and system interoperability are viewed as prerequisites for legitimacy and scalability (Granier & Kudo, 2016; Gil-García et al., 2016).

Table 2: Weighted Evaluation Criteria for Smart City Project Selection (AHP Results)

Criterion	Weight (%)	Description
Cost-Efficiency	30%	Emphasizes fiscal responsibility by assessing whether the project delivers high public value relative to its financial cost and resource demands.
Technical Adequacy	25%	Evaluates the technological robustness of the solution, including scalability, security, interoperability, and standard compliance.
Integration Capability	20%	Measures the extent to which the proposed solution can be seamlessly integrated into existing systems, reducing fragmentation and data silos.
Sustainability	15%	Considers long-term environmental, operational, and institutional sustainability, aligning with SDGs and climate-resilient urban development goals.
Citizen-Centricity	15%	Assesses the project's potential to enhance citizen experience, participation, accessibility, and equity in public service delivery.

3.3. Current Usage of Smart City Data

Participants consistently described fragmented data systems and the absence of a unified governance structure. While IoT sensors generate large volumes of traffic, environmental, and public-safety data, there is no central data warehouse or integrative analytics platform to consolidate information across departments. As a result, analytical capacity remains weak, with decision-making often based on incomplete or outdated datasets—an issue widely documented in emerging smart-city contexts (Mora et al., 2017b; Sun & Medaglia, 2019).

These fragmentation patterns mirror the early stages of data-governance maturity, where municipalities accumulate data assets faster than they can institutionalize interoperability (Lloret et al., 2025). Limited technical standards and insufficient cross-departmental coordination further reinforce organizational silos, constraining evidence-based policymaking and cross-sectoral collaboration. A practical technical pathway includes establishing a centralized data warehouse supported by an API gateway and standardized data schemas, allowing departments to contribute and retrieve structured datasets through interoperable interfaces.

Codes:

- Lack of Data Integration
- Data Quality Issues

- Weak Analytical Capacity
- Departmental Silos

3.4. Use of AI, Analytics, and Decision Support Systems

Despite pilot efforts—such as AI-assisted traffic monitoring—participants reported a limited institutional capacity for artificial intelligence and decision-support systems. Decision-making remains largely experience-based and politically influenced, supported mainly by basic business-intelligence tools like Excel dashboards. Advanced algorithmic governance or machine-learning applications have yet to be mainstreamed in municipal operations (Sun & Medaglia, 2019).

This reveals a persistent capability–expectation gap: while municipalities face growing pressure to adopt data-driven and AI-enhanced management systems, they often lack the technical, financial, and human-resource infrastructure to sustain them (Wirtz et al., 2019). Interviewees attributed these deficiencies to fragmented leadership structures and insufficient training in data analytics, reinforcing the earlier diagnosis of weak data integration and limited analytical maturity. Addressing this gap requires not only technological investments but also institutional learning and capacity-building, positioning AI as a complement—not a substitute—for informed governance.

Codes:

- Lack of AI Capacity
- Absence of Decision Support Systems
- Traditional Management Practices
- Experimental AI Pilots

3.5. Alignment with Strategic Municipal Plans

Interviews revealed only partial alignment between current smart-city projects and the municipality's broader strategic objectives—digital transformation, sustainability, and quality-of-life improvement. Most initiatives are guided by top-down mandates or political priorities rather than by systematic reference to the municipal strategic plan (Gil-García et al., 2016). As a result, strategic documents often serve a ceremonial rather than operational function, providing broad visions but few actionable mechanisms for project selection or monitoring.

This pattern reflects a wider tendency across Turkish municipalities, where strategic plans are formally adopted but rarely embedded into implementation cycles (Can, 2019). Participants cited organizational memory gaps, staff turnover, and weak horizontal coordination as key barriers. These findings echo OECD (2020a) and Akpınar & Ceyhan (2023), who emphasize that digital strategies must be institutionally anchored through budgeting, data integration, and performance indicators to achieve genuine alignment between smart-city programs and governance frameworks.

Codes:

- Partial Strategic Alignment
- Strategic Disconnect
- Weak Planning Integration
- Top-down Decision Dynamics

3.6. Consideration of Citizen Needs in Project Design

Although citizen satisfaction is a stated goal in most municipal projects, genuine participatory mechanisms remain limited. Engagement typically occurs through reactive channels -such as complaint or feedback systems- rather than through co-design or deliberative consultation consistent with New Public Governance principles (Osborne, 2006; Meijer & Bolívar, 2016). Respondents acknowledged that while these systems provide quantitative feedback, they rarely capture the qualitative insights needed for inclusive urban planning.

This condition exemplifies the broader participatory deficit identified in smart-city governance, where public involvement is often procedural rather than substantive. Similar findings in other developing-country contexts show that digital initiatives prioritize efficiency and visibility over social empowerment (Meijer & Bolívar, 2016). Strengthening participatory design thus requires moving beyond satisfaction surveys toward co-creation frameworks that integrate citizen expertise into early planning and evaluation stages, an approach essential for legitimizing smart-city transformations.

Codes:

- Limited Participation Channels
- Reactive Feedback Models

- Lack of Co-Design Processes
- Superficial Citizen Satisfaction Metrics

3.7. Interdepartmental Data Sharing Practices

Interviewees underscored the persistence of departmental silos and limited data exchange between municipal units. Most information is shared manually, often via email or Excel spreadsheets, hindering real-time collaboration and the effective use of municipal data (Sun & Medaglia, 2019). The absence of shared digital platforms and standardized formats restricts interoperability, producing redundancy and inconsistent datasets.

These patterns reflect an early stage of data-governance maturity, where organizational culture and trust barriers impede open-data adoption (Lloret et al., 2025). Participants noted that while technical infrastructure exists, institutional reluctance to share data, stemming from perceived ownership and accountability concerns, continues to fragment decision-making. Overcoming these barriers requires not only technical integration but also incentive structures and governance protocols that promote cross-departmental transparency and collaborative analytics.

Codes:

- Institutional Silos
- Trust and Culture Barriers
- Lack of Standard Platforms
- Poor Open Data Adoption

3.8. Investment Priorities and TOPSIS Analysis of Smart City Components

Participants emphasized that municipal investments should prioritize scalable, citizen-centric, and high-impact domains—particularly those promoting digital equity, social resilience, and accessible service delivery. These qualitative insights were operationalized through the TOPSIS analysis, integrating AHP-derived weights across five evaluation criteria: cost-efficiency (30%), technical adequacy (25%), integration capability (20%), sustainability (15%), and citizen-centricity (15%). Expert assessments and municipal performance data informed the decision matrix and performance scores.

Table 3: Prioritization of Smart City Components Based on TOPSIS Closeness Scores and AHP-Derived Weights

Rank	Smart City Component	Closeness to Ideal	Priority Level
1	Smart People	Highest	Highest Priority
2	Smart Economy	Very High	High Priority
3	Smart Security	High	High Priority
4	Smart Space Management	Moderate-High	Medium Priority
5	Smart Health	Moderate	Medium Priority
6	Smart Governance	Moderate-Low	Lower Priority
7	Smart Buildings	Low	Low Priority
8	Smart Environment	Lowest	Lowest Priority

The results reveal a strong prioritization of human-centric and socio-economic dimensions of smart urbanism. Smart People ranked first, reflecting emphasis on digital literacy, civic participation, and workforce readiness. Smart Economy and Smart Security followed, underscoring a pragmatic orientation toward initiatives combining economic competitiveness with resilience and public trust. Mid-ranked dimensions—Smart Health and Smart Space Management—illustrate attention to core urban services with moderate scalability and integration challenges.

In contrast, Smart Buildings and Smart Environment scored lower, largely due to high implementation costs, longer return horizons, and institutional absorption limits. Similar findings in and Lloret et al. (2025) show that municipalities in emerging economies often defer capital-intensive, infrastructure-heavy projects in favor of socially visible and quickly scalable ones. This does not imply neglect of environmental goals; rather, it reflects a sequencing logic where human and governance capacities are strengthened before large-scale ecological investments are pursued.

Table 4: Comparative Prioritization of Smart City Components: Konya vs. Selected Studies

Smart City Dimension	Konya (TOPSIS Results, 2025)	Tan et al. (2020) – 44 Global Cities	Sharma et al. (2023) – Smart Waste/Services	Chatterjee et al. (2021) – Developing Economies Review
Smart People	1st priority (highest)	Mid-ranked (education & inclusion secondary to infrastructure)	Not emphasized	High priority (digital literacy, inclusion)
Smart Economy	2nd priority (very high)	High (innovation, entrepreneurship central)	Secondary	High (economic vitality linked to resilience)

Smart City Dimension	Konya (TOPSIS Results, 2025)	Tan et al. (2020) – 44 Global Cities	Sharma et al. (2023) – Smart Waste/Services	Chatterjee et al. (2021) – Developing Economies Review
Smart Security	3rd priority (high)	Not directly ranked (fragmented across infrastructure/ security)	Not emphasized	Emerging priority in fragile contexts
Smart Governance	6th priority (moderate-low)	High (accountability, transparency)	Medium	Frequently cited but weakly implemented
Smart Environment	8th priority (lowest)	High (climate resilience central)	High (waste/ sustainability core)	High (sustainability as normative pillar)
Smart Buildings	7th priority (low)	Medium (efficiency focus)	Not emphasized	Medium-low

Sources: Tan et al. (2020), Sharma et al. (2023), Chatterjee et al. (2021), Author's analysis of Konya case (2025).

As seen in Table 4, the comparative results indicate that investment prioritization in Konya—and similar mid-sized cities—centers on domains where institutional readiness, citizen benefit, and system integration converge most effectively. These findings provide actionable guidance for policymakers to structure future smart-city portfolios around balanced criteria of efficiency, inclusivity, and sustainability.

4. DISCUSSION

This study contributes to the theory of digital governance by conceptualizing strategically smart governance as the integration of AI, data governance, and MCDM within public value frameworks. It provides an empirically grounded perspective on how digital transformation unfolds in municipal settings, using Konya Metropolitan Municipality as a representative case. Findings reveal that while smart city initiatives have gained strategic momentum, their integration into governance, resource allocation, and policy-making remains fragmented and partially institutionalized.

Investment decisions continue to be guided primarily by cost-efficiency and technical adequacy, as reflected in the AHP-derived criteria weights (30% and 25%, respectively). Although citizen-centricity and sustainability are highlighted in policy rhetoric, their quantitative influence on decision-making remains modest (15% each). This imbalance reflects the enduring dominance of techno-economic rationality in urban innovation (Chatterjee et al., 2021;

Neirotti et al., 2014). The TOPSIS results further illustrate this pattern: Smart People and Smart Economy received the highest priorities, while Smart Environment ranked lowest—reflecting a broader trend identified in comparative MCDM studies, where infrastructure- and environment-focused projects often score lower due to higher implementation costs and longer realization timelines (Farooq et al., 2019a; Farooq et al., 2021). Similarly, Lloret et al. (2025) note that governance and technological maturity tend to advance faster than environmental integration, especially in cities still consolidating their data and AI capacities. The relatively low priority of the Smart Environment component is no coincidence; recent studies on the strategic plans of metropolitan municipalities in Türkiye also indicate that climate change mitigation goals often remain secondary or symbolic (Yapıcı Sapankaya, 2025). Therefore, the decline of environmental projects in Konya can be interpreted as a local reflection of a national strategic trend rather than a local deviation.

From a technological-governance standpoint, AI adoption remains experimental and uneven. Pilot projects exist, yet there is no systemic integration of AI into strategic planning or public service delivery. This aligns with the "capability–expectation gap" noted by Sun and Medaglia (2019) and Wirtz et al. (2019), in which institutional readiness lags behind technological ambition. Given these dynamics, AI deployment should include safeguards such as municipal ethics charters, model-auditing pipelines, and explainability protocols to mitigate bias and strengthen accountability. Such safeguards ensure that algorithmic recommendations remain intelligible to public managers and open to democratic scrutiny, aligning AI adoption with principles of transparency and responsible governance. Similarly, interdepartmental data fragmentation persists, preventing analytics from functioning as a strategic governance asset (Gil-García et al., 2016; OECD, 2020b). The weak linkage between smart city projects and formal strategic plans echoes prior findings on the intent–execution gap (Mora et al., 2017a; Meijer & Bolívar, 2016), while limited participatory mechanisms confirm a broader participatory deficit in smart-city governance (Osborne, 2006; Meijer & Bolívar, 2016).

Beyond empirical insights, this research advances the theoretical debate by framing governance maturity—not technological sophistication—as the decisive factor for sustainable digital transformation. The hybrid AHP–TOPSIS model operationalizes this claim, offering a replicable approach for embedding governance criteria—such as transparency, inclusivity, and fiscal responsibility—into digital investment evaluation. To operationalize AI within municipal workflows, this study emphasizes concrete use cases beyond conceptual advocacy. Practical deployment areas include machine-learning-based traffic and energy-demand forecasting, anomaly-detection systems for fraud and infrastructure failures, and natural-language-processing tools that classify and synthesize large-scale citizen feedback. These mechanisms illustrate how AI can augment existing decision routines and expand municipal analytical capacity while remaining aligned with public-value objectives.

Methodologically, combining qualitative thematic coding (MAXQDA) and quantitative multi-criteria modeling proved valuable for capturing both subjective perceptions and objective prioritization patterns. Future research may apply this hybrid framework across municipalities or over time to trace how digital maturity, AI integration, and participatory governance evolve. Expanding the scope to include ethical AI auditing and algorithmic transparency frameworks would further enhance the conceptual robustness of strategically smart governance. As Tuğaç (2023) notes in a broader SDG context, realizing the benefits of AI while avoiding negative distributional and ecological effects requires ethical oversight, legal safeguards and human–administrative capacity building, a point that is directly relevant for municipal AI deployments.

From a policy standpoint, municipalities can take incremental but cumulative steps toward institutional maturity. Establishing a data warehouse would mitigate interdepartmental silos and enhance analytical capacity, while adopting interoperability standards and open-data protocols could strengthen transparency and public trust. Equally, piloting living labs or co-design forums would embed participatory governance in service innovation, ensuring projects align with real citizen needs rather than top-down directives.

Table 5: Policy Implications Matrix for Strategically Smart Governance

Problem Area	**Short-Term Actions (1–2 years)**	**Medium-Term Actions (3–5 years)**	**Long-Term Actions (5+ years)**
Data Silos & Fragmented Analytics	▪ Establish basic data-sharing protocols between municipal units. ▪ Launch pilot open data portal. ▪ Train staff in data standardization.	▪ Develop a centralized municipal data warehouse. ▪ Adopt interoperability standards (ISO, EU INSPIRE). ▪ Integrate real-time dashboards for service delivery.	▪ Institutionalize data governance frameworks with legal mandates. ▪ Connect municipal data systems with national/regional platforms. ▪ Enable predictive analytics and AI-driven scenario planning.
Weak Citizen Engagement	▪ Expand feedback channels beyond complaints (mobile surveys, online forums). ▪ Raise awareness of citizen rights in digital services.	▪ Establish living labs and co-design platforms for urban services. ▪ Integrate participatory budgeting mechanisms. ▪ Use AI tools for analyzing citizen input at scale.	▪ Institutionalize citizen co-creation in policy cycles. ▪ Embed deliberative democracy forums (digital assemblies). ▪ Measure "citizen impact" as a formal KPI in strategic plans.
Low AI Capacity & Skills Gaps	▪ Provide AI literacy training for municipal employees. ▪ Map existing digital infrastructure and gaps. ▪ Pilot small-scale AI applications (e.g., traffic monitoring).	▪ Establish municipal AI innovation labs with universities/SMEs. ▪ Scale AI use in high-impact domains (mobility, energy, safety). ▪ Integrate AI ethics and accountability guidelines.	▪ Institutionalize AI-supported decision-making in governance routines. ▪ Build regional AI knowledge hubs. ▪ Implement algorithmic auditing and transparency systems.
Sustainability Underprioritized	▪ Introduce sustainability checklists for all new projects. ▪ Link municipal reporting to SDGs. ▪ Pilot green procurement standards.	▪ Align municipal KPIs with climate targets. ▪ Develop cross-sectoral resilience strategies. ▪ Mainstream circular economy practices in urban planning.	▪ Establish municipal climate & sustainability observatories. ▪ Adopt international benchmarking (ISO 37122 Smart Cities). ▪ Institutionalize long-term green investment funds.

As seen in Table 5, the policy implications suggest a phased roadmap for advancing strategically smart governance. In the short term, municipalities should prioritize foundational reforms—data standardization, citizen feedback channels, and small-scale AI pilots—to address immediate operational bottlenecks. The medium term involves scaling these efforts through institutionalized data warehouses, participatory budgeting, and applied AI in high-impact domains such as mobility, energy, and safety. Over the long term, transformation requires formalizing data governance frameworks, embedding citizen co-creation in policy cycles, auditing AI systems, and mainstreaming sustainability through climate observatories and international benchmarking (ISO 37122).

This trajectory emphasizes that the success of smart city investments lies not in the breadth of technology adoption, but in its institutional integration—where data, AI, and participation converge to produce governance that is inclusive, transparent, and sustainable.

CONCLUSION

This study's examination of smart city initiatives within the governance framework of Konya Metropolitan Municipality reveals a significant disconnect between strategic ambitions and implementation priorities. The findings show that while smart city projects are increasingly embedded in strategic plans, their implementation remains guided by cost-efficiency (30%) and technical adequacy (25%) rather than by normative dimensions such as citizen-centricity, sustainability, or integration capacity. This techno-managerial bias, consistent with previous studies (Gil-García et al., 2016; Wirtz et al., 2019), limits the transformative potential of digital initiatives. TOPSIS results similarly prioritized Smart People and Smart Economy, indicating growing recognition of human capital and innovation ecosystems, whereas Smart Environment and Smart Buildings remained underemphasized—mirroring global tendencies to postpone sustainability investments amid fiscal and institutional constraints (Chatterjee et al., 2021; United Nations, 2015).

Qualitative findings revealed institutional fragmentation, weak AI integration, and siloed data systems—patterns common in emerging digital governance contexts (Meijer & Bolívar, 2016; Angelidou, 2017). Although advanced projects exist, strategic plans remain loosely connected to data-driven decision-making. The lack of a unified data warehouse or analytics platform further constrains predictive modeling and cross-departmental learning (Sun & Medaglia, 2019).

Several policy priorities emerge. Municipalities should institutionalize AI-supported decision systems to shift from reactive to proactive governance; expand sustainability and inclusivity metrics to align with SDGs; and operationalize strategic documents through performance-based monitoring and feedback loops (Osborne, 2006; OECD, 2020a). Concretely, municipalities can formalize such monitoring using measurable indicators, including an e-participation rate (% of residents engaged through digital platforms), open-data coverage score (% of datasets publicly available), and a service-integration index capturing cross-departmental API usage and data exchange. Embedding these KPIs into strategic plans ensures that digital transformation outcomes remain traceable and publicly accountable. Embedding co-creation mechanisms—such as living labs, digital co-design forums, and deliberative assemblies—would strengthen legitimacy and citizen trust. Moreover, local governments should not only use AI to monitor and advance SDG-related indicators but also ensure that AI systems themselves are developed and operated in a sustainable, low-carbon and rights-respecting manner, in line with the 'sustainable AI' perspective advanced by Tuğaç (2023). Finally, standardizing data-sharing protocols and establishing data governance offices are critical for overcoming silos and fostering organizational learning.

Future research should adopt comparative and longitudinal perspectives to examine how governance maturity evolves as AI and data infrastructures become institutionalized. Investigating algorithmic transparency, ethical safeguards, and citizen experiences will further illuminate how smart city governance can balance efficiency with accountability and equity. Ultimately, the success of smart city investments depends not on technological sophistication alone, but on the institutional capacity and societal inclusiveness that govern their use. By embracing interoperable, participatory, and performance-driven digital strategies, municipalities like Konya can serve as models of strategically smart governance—cities that are not only technologically advanced but also transparent, equitable, and resilient.

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AKILLI ŞEHİR YATIRIMLARI İÇİN VERİ ODAKLI KARAR VERME: STRATEJİK DİJİTAL YÖNETİŞİM İÇİN ÇOK KRİTERLİ BİR ÇERÇEVE

Musab Talha AKPINAR

Cem KORKUT

GENİŞLETİLMİŞ ÖZET

Akıllı şehir yatırımlarının kamu yönetimi bağlamında stratejik olarak nasıl önceliklendirileceği, dijital dönüşüm süreçlerinin olgunluk düzeyini belirleyen temel bir yönetişim sorunu haline gelmiştir. Bu çalışma, Konya Büyükşehir Belediyesi örneğinde, akıllı şehir girişimlerinin karar alma süreçlerine nasıl entegre edildiğini incelemek amacıyla hibrit bir Analitik Hiyerarşi Süreci (AHP) ve TOPSIS modeli geliştirmektedir. Araştırma, yarı yapılandırılmış görüşmeler, tematik analiz ve çok kriterli karar verme (ÇKKV) yöntemlerinin birleşiminden oluşan açıklayıcı sıralı karma yöntem tasarımına dayanmaktadır. Bu yapı sayesinde hem nitel içgörülerin bağlamsal derinliği hem de AHP–TOPSIS modelinin sistematik değerlendirme kapasitesi bir araya getirilmektedir.

Çalışmanın ilk aşamasında, Konya Büyükşehir Belediyesi'nde görev yapan akademisyenler, birim amirleri, orta kademe yöneticiler ve teknik uzmanlardan oluşan on dört kişiyle görüşmeler yapılmış ve yönetişim önceliklerini belirleyen kriterler ortaya çıkarılmıştır. Elde edilen bulgular, akıllı şehir yatırımlarının değerlendirilmesinde maliyet etkinliği, teknik yeterlilik, entegrasyon kapasitesi, sürdürülebilirlik ve vatandaş etkisi olmak üzere beş ana kriterin belirleyici olduğunu göstermiştir. AHP analizi sonucunda bu kriterler arasında maliyet etkinliği (%30) ve teknik yeterlilik (%25) en yüksek ağırlıklara sahip olmuş; vatandaş odaklılık ve sürdürülebilirlik gibi normatif değerlerin ağırlığı ise %15 seviyesinde kalmıştır. Bu durum, literatürde sıkça vurgulanan "teknokratik yönetişim eğilimi" ile uyumludur ve belediyelerin teknolojik çözümleri stratejik dönüşüm araçlarından ziyade operasyonel iyileştirme araçları olarak gördüklerini ortaya koymaktadır.

Araştırmanın nitel bulguları, Konya örneğinde dijital yönetişimin kurumsal olgunluk düzeyini sınırlayan dört temel soruna işaret etmektedir: birimler arası veri bütünleşmesinin zayıf olması, yapay zekâ kapasitesinin sınırlı düzeyde bulunması, vatandaş katılım mekanizmalarının yüzeysel niteliği ve stratejik planların karar süreçlerine etkin biçimde yansıtılamaması. IoT sistemlerinden büyük ölçüde veri üretilmesine rağmen belediye genelinde bütünleşik bir veri ambarının bulunmaması, analitik kapasitenin gelişimini engellemekte; karar verme süreçlerinde çoğu zaman sezgisel veya politik yönelimlerin öne çıkmasına neden olmaktadır. Benzer biçimde, yapay zekâ uygulamaları henüz pilot düzeydedir ve kurumsal ölçekte sürdürülebilir bir karar destek sistemine entegre edilmemiştir. Bu durum literatürde "kapasite–beklenti açığı" olarak tanımlanan olgunluk sorunuyla örtüşmektedir.

Vatandaş katılımı cephesinde ise geri bildirimlerin çoğunlukla şikâyet mekanizmalarına dayalı olması, katılımcı yönetişim anlayışının henüz yerleşmediğini göstermektedir. Ortak tasarım laboratuvarları, dijital forumlar veya katılımcı bütçeleme gibi uygulamalar yaygın değildir ve bu nedenle karar süreçleri vatandaş perspektifinden sınırlı beslenmektedir. Stratejik planlarla mevcut uygulamalar arasındaki uyumsuzluk da yönetişim literatüründe sıklıkla tartışılan "niyet–uygulama açığı"nın yerel bir yansımasıdır.

Çalışmanın nicel bölümünde, AHP ile elde edilen kriter ağırlıkları TOPSIS modeline uygulanmış ve sekiz akıllı şehir bileşeni önceliklendirilmiştir. Sonuçlar, "Akıllı İnsan" ve "Akıllı Ekonomi" bileşenlerinin en yüksek önceliğe sahip olduğunu; "Akıllı Çevre" ve "Akıllı Binalar" bileşenlerinin ise en düşük öncelikte kaldığını göstermiştir. Çevresel bileşenlerin düşük önceliklendirilmesi hem maliyet ve kapasite sınırlılıkları hem de Türkiye'de büyükşehir belediyelerinin stratejik planlarında sürdürülebilirlik hedeflerinin çoğu zaman ikincil düzeyde yer aldığı yönündeki araştırma bulgularıyla paralellik göstermektedir. Bu durum, çevresel yatırımların öneminin reddedilmesinden ziyade, daha görünür ve kısa vadede sonuç veren sosyal ve ekonomik projelerin öncelemesine dayalı bir sıralama mantığına işaret etmektedir.

Sonuç bölümünde, belediyelerin dijital yönetişim kapasitelerini geliştirmek için üç temel politika alanına odaklanılması önerilmektedir: veri yönetişimi, yapay zekâ destekli karar sistemleri ve katılımcı yönetişim. Veri ambarı kurulması, birlikte işlerlik standartlarının benimsenmesi ve açık veri uygulamalarının kurumsallaştırılması ilk aşamada önceliklendirilmektedir. Yapay zekâ uygulamalarında ise etik gözetim mekanizmalarının, algoritmik şeffaflık standartlarının ve belediye personeline yönelik kapasite geliştirme programlarının gerekliliği vurgulanmaktadır. Vatandaş katılımının güçlendirilmesi için yaşayan laboratuvarlar, ortak tasarım platformları ve dijital meclisler gibi uygulamaların belediyelere rehberlik edebileceği belirtilmektedir.

Son olarak, çalışma gerek yöntemsel gerekse kuramsal açıdan stratejik açıdan "akıllı yönetişim" tartışmalarına katkı sunmaktadır. AHP–TOPSIS modelinin yerel yönetimlerde şeffaf, hesap verebilir ve çok boyutlu bir değerlendirme aracı olarak kullanılabileceği; nitel ve nicel verilerin birleştirildiği bu modelin karar alma süreçlerine nesnellik ve bütünlük kazandırdığı sonucuna varılmıştır. Konya örneği üzerinden yürütülen bu analiz, Türkiye bağlamındaki belediyelerin dijital dönüşüm yolculuklarına ışık tutmakta ve gelecekte karşılaştırmalı çalışmalar için güçlü bir analitik çerçeve sunmaktadır. Bu nedenle çalışma, teknolojik yatırımların yalnızca teknolojik "akıllılık" değil, aynı zamanda yönetişimsel "stratejik akıllılık" perspektifiyle değerlendirilmesi gerektiğini ortaya koymaktadır.