

The Impact of AI Applications on Smart Decision-Making in Smart Cities: The Mediating Roles of the Internet of Things and Smart Governance

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Abstract: Smart cities increasingly depend on digital technologies to manage urban services, use resources efficiently, and respond to the changing needs of citizens. Artificial intelligence (AI) can help city authorities analyse complex information, predict future conditions, and make informed decisions. However, the success of AI-based systems depends on more than their analytical capabilities. They also require reliable data from the Internet of Things (IoT) and governance practices that ensure transparency, accountability, and responsible use of technology. This paper examines how AI applications may influence smart decision-making in smart cities, with particular attention to the mediating roles of IoT integration and smart governance. Recent research published between 2024 and 2026 is reviewed to understand developments in AI-enabled urban services, connected infrastructure, and responsible digital governance. Based on this review, an integrated conceptual framework is proposed to explain the relationships among AI applications, IoT integration, smart governance, and decision-making outcomes. The framework considers decision accuracy, responsiveness, transparency, and resource efficiency as important dimensions of effective urban decision-making. It also highlights challenges related to data quality, privacy, cybersecurity, algorithmic bias, and public trust. Eight research hypotheses and a quantitative research methodology are proposed for future empirical investigation. The paper contributes a structured basis for examining how technological capabilities and governance arrangements may work together to support better urban decisions. The proposed relationships require validation through data collection and statistical analysis

Keywords: Artificial Intelligence, Smart Cities, Internet of Things, Smart Governance, Smart Decision-Making, Urban Management, Digital Transformation, Data-Driven Governance

I. INTRODUCTION

Cities are becoming more complex to manage as populations grow, public-service demands increase, and environmental challenges become more difficult to address. City authorities must make decisions about transportation, energy consumption, waste collection, public safety, infrastructure, and the delivery of government services. Traditional decision-making methods can be limited when information is incomplete, data sources are disconnected, or decisions need to be made quickly.

Smart-city development offers a way to address these challenges through the use of connected infrastructure, digital platforms, and data-driven management. Among the technologies contributing to this transformation, artificial



intelligence has attracted particular attention because it can identify patterns in large datasets, generate predictions, and assist decision-makers in evaluating different options.

For example, AI can help predict traffic congestion, identify unusual energy consumption, forecast environmental conditions, and improve the allocation of public resources. These applications can support more timely decisions, but their usefulness depends on whether the information being analysed is accurate, relevant, and available when needed.

The Internet of Things plays an important role in this process. IoT devices, including environmental sensors, smart meters, traffic-monitoring equipment, and connected infrastructure, collect information about the current condition of a city. When these data are integrated with AI systems, urban authorities can obtain a more detailed understanding of changing conditions and use predictive analysis to plan their responses.

However, the availability of data and advanced analytics does not automatically result in better public decisions. A city may have sophisticated AI systems but still face difficulties if responsibilities are unclear, citizens cannot understand how decisions are made, or sensitive information is not adequately protected. Smart governance is therefore an important part of the discussion. It includes transparency, accountability, public participation, data protection, and appropriate human oversight.

Bokhari and Myeong (2023) examined the relationship between AI applications and smart decision-making through the mediating roles of IoT and smart governance. Their research provides a direct foundation for the present topic. More recent studies published in 2024, 2025, and 2026 extend the discussion by examining AI applications, connected urban infrastructure, digital governance, and responsible AI implementation.

Building on these developments, this paper proposes an integrated framework for understanding how AI applications may contribute to smart decision-making through IoT integration and smart governance. Rather than assuming that technology automatically improves urban management, the paper considers the technical and institutional conditions that may determine whether AI-supported decisions are effective and trustworthy.

1.1 Problem Statement

AI technologies provide opportunities to improve urban planning and public-service delivery, but their effectiveness depends on how they are implemented and governed. Fragmented data systems can limit the usefulness of AI predictions, while weak accountability arrangements can make it difficult to evaluate or challenge automated recommendations.

The central problem addressed in this paper is the need to understand how IoT integration and smart governance may help convert the capabilities of AI applications into effective smart-city decisions. It also considers whether these two mechanisms operate separately or together to influence decision quality.

1.2 Research Objectives

The objectives of this study are:

1. To examine the relationship between AI applications and smart decision-making in smart cities.
2. To investigate the mediating role of IoT integration in this relationship.
3. To examine how smart governance may mediate the relationship between AI applications and smart decision-making.
4. To develop a conceptual framework connecting AI applications, IoT integration, smart governance, and decision-making outcomes.
5. To identify the technological, ethical, and institutional challenges associated with AI-supported urban decisions.

1.3 Research Questions

RQ1: How do AI applications contribute to smart decision-making in smart cities?

RQ2: How does IoT integration help connect AI capabilities with urban decision-making?



RQ3: What role does smart governance play in the relationship between AI applications and decision-making outcomes?

RQ4: Can IoT integration and smart governance jointly explain the relationship between AI applications and smart decision-making?

RQ5: What challenges may prevent AI-based systems from producing reliable, transparent, and accountable urban decisions?

II. LITERATURE REVIEW

2.1 AI Applications in Smart Cities

Artificial intelligence has become an important component of smart-city development because it can support the analysis of large volumes of information and help identify patterns that may not be immediately visible through conventional methods. Applications include traffic prediction, environmental monitoring, energy management, infrastructure maintenance, and digital public services.

Wang et al. (2026) examine the relationship between AI and sustainable smart-city governance, emphasizing the importance of data governance and algorithmic governance. Their review indicates that the use of AI must be considered alongside questions about how data are collected, managed, analysed, and used in public decisions.

Research published in Smart Cities in 2024 also reviews the applications, barriers, and future directions of AI in smart cities. This broader perspective highlights that AI adoption involves technological opportunities as well as practical implementation challenges.

AI can provide valuable analytical support, but the quality of its recommendations depends on the data used, the suitability of the algorithms, and the context in which the results are interpreted. An inaccurate prediction or a recommendation that ignores local conditions may lead to inappropriate decisions.

For this reason, the impact of AI should be examined in relation to the systems and institutions surrounding it, rather than by considering algorithmic capabilities alone.

2.2 The Role of IoT in Smart Decision-Making

The Internet of Things connects physical objects and infrastructure to digital systems, allowing information to be collected and exchanged with limited manual intervention. In a smart city, IoT devices can monitor traffic flow, air quality, electricity consumption, water systems, and the condition of public infrastructure.

The data collected by these devices can help AI systems identify current problems and anticipate future needs. For example, traffic sensors can provide information about congestion, while AI models can use these observations to forecast traffic conditions and support traffic-management decisions.

Sacoto-Cabrera et al. (2025) review research on IoT, AI, and digital twins in smart cities. Their work highlights the importance of integrating these technologies and identifies interoperability and limited empirical evidence as continuing research challenges.

Similarly, Sofianopoulos et al. (2025) discuss the contribution of spatial data infrastructure, IoT, and AI to smart governance. Their review illustrates how connected information systems can support monitoring, prediction, and data-driven decision-making.

These studies suggest that IoT integration may act as an important link between AI capabilities and practical urban decisions. However, the presence of connected devices does not guarantee useful information. Incomplete sensor coverage, inconsistent data formats, connectivity problems, and poor data quality can reduce the reliability of AI outputs.

Therefore, this study treats IoT integration as a potential mediator that helps explain how AI applications may influence smart decision-making.



2.3 Smart Governance and Responsible AI

Smart governance concerns the ways public institutions use information, digital technologies, and administrative processes to make decisions and deliver services. It includes coordination between government departments, transparency in decision-making, accountability for outcomes, citizen participation, and the protection of public interests.

The use of AI in government creates new governance questions. If an AI system recommends a particular allocation of public resources, for example, officials need to understand the reasons for the recommendation, assess its suitability, and remain accountable for the final decision.

Kaiser (2026) examines adaptive, ethical, and responsible AI governance for smart cities and nations. The paper discusses issues such as algorithmic bias, weak oversight, regulatory gaps, public trust, and human–AI collaboration. It emphasizes that governance arrangements must adapt as AI systems and their roles in public administration change.

Poudel et al. (2026) present a hybrid human–AI governance framework for accountable decision-making in urban infrastructure management. Their research highlights the importance of defining responsibilities between AI systems and human professionals, especially when AI-generated outputs need contextual interpretation or ethical review.

These studies reinforce the idea that smart governance is not simply an additional feature of a digital city. It can influence whether AI-supported recommendations are transparent, appropriate, and acceptable to the people affected by them.

In the proposed framework, smart governance is therefore considered a second potential mediator between AI applications and smart decision-making.

2.4 Integrating AI, IoT, and Smart Governance

AI, IoT, and smart governance perform different but complementary roles in a smart city. IoT provides information about urban conditions, AI analyses that information, and governance arrangements establish how the resulting recommendations should be evaluated and used.

Villegas-Ch et al. (2025) investigate a decentralized urban governance system incorporating AI and blockchain-enabled IoT. Their work provides an example of how connected infrastructure and institutional arrangements can be considered together when designing urban systems.

Bibri and Huang (2025) examine generative AI of things for sustainable smart cities, connecting AIoT capabilities with operational efficiency, adaptability, cybersecurity, and environmental performance. Their work further demonstrates the importance of considering interconnected technical systems rather than isolated technologies.

Research on governing smart-city IoT interventions also highlights the complexity of coordinating technologies, stakeholders, and institutional responsibilities in urban environments.

Taken together, these studies provide a basis for investigating the relationships among AI applications, IoT integration, and smart governance. Nevertheless, the strength and direction of these relationships must be established through an appropriate empirical research design rather than assumed from conceptual similarities alone.

III. RESEARCH GAP

Existing research provides valuable insights into AI applications, IoT-enabled infrastructure, and the governance of digital urban systems. However, there is an opportunity to examine these dimensions together using a clearly specified model of smart decision-making.

The first research opportunity concerns the integration of technological and institutional factors. AI performance and data connectivity are important, but their relationship with actual decision-making also depends on the processes through which public authorities interpret and use information.

The second concerns mediation. IoT integration and smart governance may explain different parts of the relationship between AI applications and decision-making outcomes. IoT integration may improve access to relevant information, while smart governance may help ensure that the information is used responsibly.



The third concerns the outcomes used to evaluate smart decision-making. Decision quality should not be understood only as speed. Accuracy, responsiveness, transparency, consistency, and resource efficiency are also relevant.

Finally, there is a need to consider implementation challenges, including data quality, privacy, cybersecurity, algorithmic bias, and accountability. These issues may influence whether an AI-enabled system produces useful outcomes in practice.

Accordingly, this study proposes an integrated framework in which IoT integration and smart governance are examined as separate and potentially sequential mediators. The proposed model is intended to be tested empirically and does not assume that these relationships have already been established.

3.1 Existing System Architecture

The existing smart-city decision-making system generally relies on a combination of conventional data collection, separate databases, traditional analytical methods, and administrative decision-making processes. Information is collected from sources such as traffic sensors, environmental monitoring devices, energy systems, public-service records, and citizen feedback. However, these data sources may operate independently, making it difficult to integrate information from different departments and obtain a complete picture of urban conditions.

In many conventional systems, data analysis is performed using basic statistical techniques, rule-based methods, or limited AI applications. Decision-makers may need to examine reports manually before selecting an appropriate course of action. When information is delayed, incomplete, or inconsistent, the decision-making process can become slower and less effective.

Another limitation is the lack of integration between the Internet of Things (IoT), AI applications, and smart governance mechanisms. Although some systems use connected sensors or automated analytics, the resulting information may not be consistently incorporated into transparent and accountable governance processes. Limited interoperability, inadequate data quality, privacy concerns, and unclear responsibilities can further affect the reliability of decisions.

Fig.1 illustrates the general architecture of this existing approach, showing the flow from urban data sources through data collection and storage, traditional analytics, and administrative decision-making to smart-city services. The architecture represents a conceptual baseline rather than a claim that every existing smart city follows the same process. The limitations of this approach motivate the proposed system, which integrates IoT-enabled data management, AI-based analytics, and smart governance to support more timely, informed, transparent, and accountable decisions.



Fig. 1. Existing System Architecture for Smart-City Decision-Making.

IV. PROPOSED RESEARCH FRAMEWORK

4.1 Overview of the Framework

The proposed framework explains how AI applications may contribute to smart decision-making through two connected mechanisms: IoT integration and smart governance.

AI applications represent the use of intelligent analytical and predictive techniques in urban services. IoT integration represents the ability to collect, connect, and use information from urban devices and infrastructure. Smart governance represents the institutional practices used to oversee data and AI-supported decisions.



Smart decision-making is the outcome of interest. It includes the ability to make informed, timely, transparent, and resource-efficient decisions.

The framework also allows for a direct relationship between AI applications and smart decision-making, because AI may provide useful analytical support even when its effects are not fully explained by the two mediators.

4.2 Proposed System Architecture



Fig. 2: Integrated AI-IoT-Smart Governance Architecture for Smart Cities

The proposed architecture consists of five connected stages:

Stage 1: Urban data collection. Sensors, smart meters, traffic-monitoring systems, and other connected devices collect information about city conditions.

Stage 2: IoT integration and data preparation. Data from different sources are integrated, checked for quality, and prepared for analysis.

Stage 3: AI-based analysis. AI applications analyse urban data to identify patterns, predict future conditions, and generate recommendations.

Stage 4: Governance and decision review. Public officials and authorized stakeholders evaluate AI-generated recommendations using transparency, accountability, privacy, and human-oversight procedures.

Stage 5: Decision implementation and feedback. Decisions are implemented, their outcomes are monitored, and the results are used to improve future processes.

The architecture is intended to represent an integrated approach. Governance and security safeguards should apply across all stages, not only when a final decision is made.

4.3 Proposed Conceptual Model

The framework contains four principal constructs:

- Independent variable: AI applications.
- Mediator 1: IoT integration.
- Mediator 2: Smart governance.
- Dependent variable: Smart decision-making.

The proposed relationships are:

1. AI applications may influence smart decision-making directly.
2. AI applications may improve IoT-enabled data integration, which may contribute to better decisions.
3. AI applications may be associated with improved smart governance, which may contribute to better decisions.
4. IoT integration may support governance processes, creating a possible sequential pathway from AI applications through IoT integration and smart governance to smart decision-making.

This framework allows the two mediators to be examined separately and together.



4.4 Proposed Hypotheses

H1: AI applications are positively associated with smart decision-making in smart cities.

H2: AI applications are positively associated with IoT integration in smart cities.

H3: IoT integration is positively associated with smart decision-making.

H4: AI applications are positively associated with smart governance.

H5: Smart governance is positively associated with smart decision-making.

H6: IoT integration mediates the relationship between AI applications and smart decision-making.

H7: Smart governance mediates the relationship between AI applications and smart decision-making.

H8: IoT integration and smart governance sequentially mediate the relationship between AI applications and smart decision-making.

These hypotheses express the expected relationships to be investigated. Their acceptance or rejection will depend on the results of the empirical analysis.

V. RESEARCH METHODOLOGY

5.1 Research Design

A quantitative explanatory research design is proposed to investigate the relationships among the four constructs. A structured survey can be used to collect information from stakeholders who are familiar with smart-city technology, digital public services, or urban administration.

The literature review provides the foundation for developing the conceptual framework and research hypotheses. The quantitative stage would then test whether the proposed relationships are supported by the collected data.

5.2 Target Population and Sampling

The target population may include municipal officials, urban planners, smart-city technology professionals, AI and IoT practitioners, and public-service managers.

Respondents should have sufficient knowledge of AI-enabled systems or smart-city decision-making to provide meaningful answers. A suitable sampling method and sample size should be determined before data collection, taking into account the research objectives, target population, model complexity, and statistical power requirements.

If the study is conducted in Indian smart cities, the selected locations and relevant urban services should be clearly defined. Findings from a limited set of cities should not automatically be generalized to all smart cities.

5.3 Data Collection

A structured questionnaire can be developed using clearly defined measurement items for AI applications, IoT integration, smart governance, and smart decision-making.

The questionnaire should be reviewed for clarity and pilot-tested before the main survey. Established measurement scales should be considered where suitable, with appropriate adaptation to the smart-city context.

Participation should be voluntary, and respondents should receive clear information about the purpose of the study. Personal and organizational information should be protected, and data should be used only for the stated research purpose.

Where access is available, survey responses may be supplemented with operational information such as service-response times, prediction errors, resource utilization, or the availability of decision audit records.

5.4 Measurement of Variables

Variable	Suggested indicators
AI applications	Predictive capability, analytical support, automation
IoT integration	Data availability, timeliness, reliability, interoperability
Smart governance	Transparency, accountability, public participation, oversight



Smart decision-making	Accuracy, responsiveness, consistency, resource efficiency
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These indicators are proposed measurement dimensions and should be refined through a review of established scales and pilot testing.

5.5 Data Analysis

The analysis can be conducted using a statistical package and structural equation modelling.

First, descriptive statistics should be used to summarize the sample and the main study variables. The data should then be checked for missing observations, unusual values, and other quality issues.

Next, the measurement model should be evaluated for reliability and validity. The structural model can then be used to examine the hypothesized relationships among AI applications, IoT integration, smart governance, and smart decision-making.

Bootstrapping can be used to estimate confidence intervals for the indirect effects associated with the proposed mediation pathways. The analysis should distinguish the individual mediating effects from the possible sequential effect.

PLS-SEM may be appropriate if the research emphasizes prediction and the proposed model's characteristics support its use. The final method should be selected based on the research questions, data properties, measurement model, and statistical requirements.

The results should report effect estimates, confidence intervals, and relevant model-quality measures. No numerical results or claims of statistical significance should be reported until the analysis has actually been completed.

VI. DISCUSSION

The proposed framework provides a way to examine the contribution of AI applications to smart-city decision-making without treating technological adoption as sufficient evidence of success.

AI applications may help authorities identify patterns, anticipate problems, and compare possible responses. However, the usefulness of these capabilities depends partly on whether relevant and reliable information is available. IoT integration is therefore important because it connects AI systems with the conditions they are intended to analyse.

At the same time, data integration does not determine how recommendations should be used. Smart governance provides the institutional arrangements through which officials can assess recommendations, consider public interests, and remain accountable for decisions.

The two mediators may consequently represent different but related mechanisms. IoT integration concerns the technical availability and quality of information, whereas smart governance concerns the processes and responsibilities surrounding its use. Investigating both mechanisms may provide a more complete understanding of AI-enabled decision-making.

The framework also highlights the need to consider the limitations of AI. Predictions may be inaccurate, training data may contain biases, and automated recommendations may overlook local circumstances. Governance arrangements should therefore provide appropriate opportunities for review, explanation, correction, and human intervention.

These arguments explain why the proposed relationships deserve empirical investigation. They do not, by themselves, demonstrate that either mediator has a statistically significant effect.

VII. EXPECTED CONTRIBUTIONS

7.1 Theoretical Contribution

The study brings AI applications, IoT integration, and smart governance into a single conceptual framework. It distinguishes the technical role of data integration from the institutional role of governance and proposes separate and sequential mediation pathways for empirical testing.



7.2 Practical Contribution

The framework may help city administrators assess AI initiatives beyond their technical performance. It encourages consideration of data reliability, coordination between systems, accountability, and the quality of the decisions produced.

For example, a city introducing AI-based traffic management should evaluate not only prediction accuracy but also sensor coverage, data integration, the transparency of traffic-control decisions, and the availability of human review.

7.3 Governance Contribution

The study emphasizes that responsible AI use requires clearly defined roles and procedures. Data protection, cybersecurity, transparency, and accountability should be incorporated into the design and operation of smart-city systems.

Citizen participation is also relevant because public acceptance depends partly on whether digital services respond to community needs and whether consequential decisions can be appropriately explained or challenged.

VIII. CONCLUSION

AI applications provide opportunities to improve smart-city decision-making by helping authorities analyse complex information, identify emerging problems, and evaluate possible responses. Nevertheless, their practical value depends on the quality of the data infrastructure and the governance arrangements through which their recommendations are used.

The literature reviewed in this paper illustrates three complementary dimensions of smart-city development: AI applications, IoT-enabled data integration, and responsible smart governance. Building on these perspectives, the paper proposes a conceptual framework in which IoT integration and smart governance may mediate the relationship between AI applications and smart decision-making.

The framework contributes research questions, hypotheses, suggested measurement dimensions, and a methodology for future empirical investigation. It also emphasizes the importance of privacy, cybersecurity, accountability, and human oversight in urban decision systems.

Ultimately, the purpose of AI in a smart city should not be simply to automate more activities. It should be to help public institutions make decisions that are informed, timely, transparent, and responsive to citizens' needs. Whether the proposed mediating relationships produce these outcomes remains an important question for future empirical research.

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