Adaptive Governance Research
e-ISSN 3063-0878 (online)
Volume 3, Issue 1 2026
Page 73-87
https://doi.org/10.71435/

Land Use Governance and Smart City Policy Frameworks for Sustainable Urban Development in the Philippines

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ARTICLE INFO

Received: 28 December 2025
Revised: 24 January 2026
Accepted: 26 February 2026
Available online: 28 February 2026

Keywords:
Land Use Governance
Smart City Policy
Sustainable Urban Development
Urban Governance
Philippines

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ABSTRACT

Purpose: *This study examines the influence of land use governance and smart city policy frameworks on sustainable urban development in the Philippines and evaluates their relative contributions to promoting resilient and inclusive urban growth.*

Subjects and Methods: *A quantitative cross-sectional survey design was employed involving 241 stakeholders engaged in urban planning and governance, including local government officials, urban planners, environmental officers, academics, and community representatives. Data were collected using a structured questionnaire based on a five-point Likert scale and analyzed through descriptive statistics, validity and reliability testing, Pearson correlation analysis, and multiple regression analysis.*

Results: *The findings indicate that both land use governance and smart city policy frameworks significantly and positively influence sustainable urban development. The regression model explained 65.0% of the variance in sustainable urban development ($R^2 = 0.650$), with land use governance demonstrating a stronger effect ($\beta = 0.486$, $p < 0.001$) than smart city policy frameworks ($\beta = 0.382$, $p < 0.001$). These results suggest that effective governance, characterized by institutional coordination, regulatory implementation, and stakeholder participation, provides the institutional foundation for sustainable urban development, while smart city policies enhance governance through digital innovation and data-driven decision-making.*

Conclusions: *Sustainable urban development in the Philippines is best achieved by integrating adaptive land use governance with smart city policy implementation. Strengthening Comprehensive Land Use Plans (CLUPs), enhancing Local Government Unit capacity, expanding Geographic Information Systems (GIS), promoting open spatial data, and adopting smart zoning strategies can support more resilient, efficient, and sustainable urban governance.*

INTRODUCTION

Urbanization in the Philippines has accelerated rapidly over the past decades, reshaping the spatial, economic, and environmental landscape of its cities (Santillan & Heipke, 2024; Estoque & Murayama, 2015; Shatkin, 2019; Arfanuzzaman & Dahiya, 2019; Nguyen & Nguyen, 2018). Metropolitan areas such as Metro Manila have experienced significant population growth, resulting in increased pressure on land resources, infrastructure systems, and public services. This rapid urban expansion has brought both opportunities for economic development and challenges related to sustainability, congestion, environmental degradation, and social inequality.

Land use governance plays a crucial role in managing these urban transformations. It involves the formulation and implementation of policies, regulations, and planning frameworks that determine how land is allocated, utilized, and preserved. In the Philippine context, land use governance is shaped by a complex interplay of national policies, local government autonomy, and institutional constraints (Cuevas, 2016; Lambin et al., 2014; Marquardt, 2017). While legislative instruments such as the Comprehensive Land Use Plans (CLUPs) guide local development, inconsistencies in enforcement and coordination often limit their effectiveness in achieving sustainable urban outcomes.

The concept of smart cities has emerged as a strategic approach to address the challenges associated with rapid urbanization (Kumar et al., 2020; Shahidehpour et al., 2018; Yigitcanlar, 2015; Bibri, 2021). Smart city frameworks emphasize the integration of digital technologies, data-driven governance, and innovative policy solutions to enhance urban efficiency, livability, and sustainability. In the Philippines, initiatives aligned with smart city development have been introduced in several urban centers, reflecting a growing recognition of the need for adaptive and technology-enabled governance systems.

Despite these advancements, the integration between land use governance and smart city policy frameworks remains limited. Land use planning is often conducted in isolation from digital innovation strategies, resulting in fragmented urban development. This disconnect hinders the ability of cities to respond effectively to complex socio-environmental challenges such as climate change, disaster risk, and informal settlement expansion, which are particularly pronounced in the Philippine context.

Sustainable urban development requires a holistic approach that aligns spatial planning with technological innovation and governance reforms. In a country highly vulnerable to natural hazards, including typhoons, flooding, and sea-level rise, the need for resilient land use strategies is critical. Integrating smart technologies into land governance such as geospatial data systems, real-time monitoring, and participatory platforms can significantly enhance decision-making processes and policy implementation (Attah et al., 2024; Sofianopoulos et al., 2025; Bianconi et al., 2025; Balasubramanian, 2024; Khan et al., 2017).

Governance in the Philippine urban context is characterized by decentralization, where local government units (LGUs) are responsible for planning and development. While decentralization offers opportunities for context-specific solutions, it also presents challenges related to capacity disparities, resource limitations, and varying levels of technical expertise among LGUs. These factors influence the effectiveness of both land use governance and the adoption of smart city initiatives.

Another critical dimension is the role of multi-stakeholder collaboration in shaping sustainable urban futures. Almulhim & Yigitcanlar (2025), Nesti (2020), Capra (2016), Das (2024), Azadi et al. (2023) said that, effective land use governance and smart city implementation require the active participation of government agencies, private sector actors, civil society, and local communities. Participatory governance mechanisms can enhance transparency, accountability, and inclusiveness, ensuring that urban development policies reflect diverse needs and priorities.

Environmental sustainability remains a central concern in urban development planning. Unregulated land conversion, loss of green spaces, and inadequate waste management systems contribute to ecological degradation in many Philippine cities. Smart city frameworks offer potential solutions by promoting efficient resource management, environmental monitoring, and sustainable infrastructure development. These solutions must be embedded within coherent land use policies to achieve long-term impact.

The growing emphasis on data-driven decision-making further highlights the importance of integrating analytical frameworks into governance systems (Elugbaju et al., 2024; Elgendy et al., 2022). The use of geographic information systems (GIS), urban analytics, and digital platforms can support evidence-based planning and improve policy responsiveness. Nevertheless, challenges related to data availability, interoperability, and governance must be addressed to fully realize these benefits in the Philippine setting.

Given these complexities, there is a pressing need to examine how land use governance and smart city policy frameworks can be effectively aligned to support sustainable urban development. This study aims to explore the intersections between spatial planning, technological innovation, and governance strategies within the Philippine context. By identifying key gaps, opportunities, and best practices, this research seeks to contribute to the development of more integrated and adaptive urban governance models.

Strengthening the synergy between land use governance and smart city initiatives is essential for building resilient, inclusive, and sustainable cities in the Philippines. As urbanization continues to intensify, the ability of policymakers and stakeholders to design and implement integrated frameworks will determine the future trajectory of urban development in the country.

METHODOLOGY

Research Design

This study employed a quantitative research design using a cross sectional survey approach to examine the relationship between land use governance practices and smart city policy frameworks in supporting sustainable urban development in the Philippines. Quantitative research was considered appropriate because it enables researchers to measure perceptions, evaluate relationships among variables, and generate empirical evidence through statistical analysis. According to Creswell & Creswell (2017), quantitative research is suitable for studies that seek to explain relationships among variables using numerical data and objective analytical procedures. The research was conducted between October and December 2025, representing the final quarter of the year, during which data were collected simultaneously from relevant stakeholders involved in urban planning and governance. The conceptual framework of this study was developed based on the assumption that effective land use governance contributes significantly to sustainable urban development and that smart city policy implementation strengthens this relationship through technology driven planning, public participation, and evidence-based decision making. The research focused on measuring respondents' perceptions regarding governance effectiveness, smart city implementation, and sustainability outcomes within selected Philippine urban areas.

Research Setting

The research was conducted in the Philippines, focusing on urban areas that have actively implemented Comprehensive Land Use Plans and smart city related initiatives. These cities represent diverse stages of urban development and digital governance implementation, allowing the study to capture varying institutional capacities and policy experiences. The Philippines provides an appropriate context because rapid urbanization, decentralized governance, and increasing investments in digital transformation have created substantial opportunities and challenges for sustainable urban planning. The study was undertaken during the last quarter of 2025, a period when several local government units were implementing urban development programs aligned with national sustainability policies. Conducting the research during this period enabled the collection of current empirical evidence regarding land governance practices and smart city policy implementation. The research setting also reflects the country's continuing efforts to integrate spatial planning, environmental sustainability, and digital governance into local development strategies.

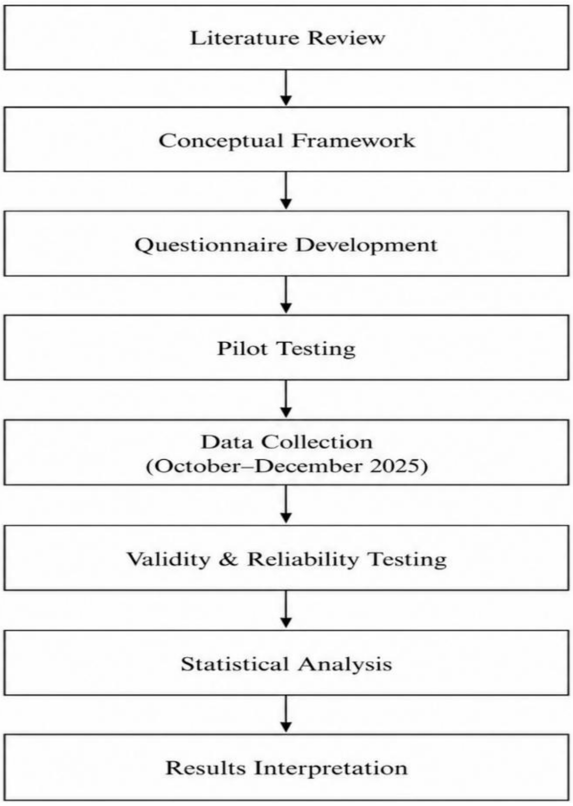

Figure 1. Conceptual Framework of the Research.

Figure 1 illustrates the hypothesized relationships among land use governance, smart city policy frameworks, and sustainable urban development. The framework served as the basis for questionnaire development and subsequent statistical analysis.

Population and Sampling

The target population consisted of stakeholders directly involved in urban governance and development planning, including officials from local government units, urban planners, planning officers, environmental management personnel, academics specializing in urban studies, and representatives from community organizations participating in local development initiatives. These respondents were selected because they possess practical knowledge and professional experience regarding land use planning and smart city implementation. A purposive sampling technique was employed to identify respondents who met predetermined inclusion criteria, namely active involvement in planning, policy implementation, or urban governance activities during 2025. Purposive sampling is appropriate when researchers require information from participants with specialized knowledge relevant to the research objectives (Etikan et al., 2016). The minimum sample size was determined by considering recommendations for multivariate statistical analysis, ensuring sufficient statistical power and representativeness for hypothesis testing. Only completed questionnaires that met all data quality requirements were included in the final analysis.

Data Collection Procedures

Primary data were collected using a structured questionnaire developed from previous empirical studies on land governance, smart city governance, and sustainable urban development. The questionnaire consisted of four sections. The first section collected demographic information regarding respondents' professional background and organizational affiliation. The second section measured perceptions of land use governance, including regulatory effectiveness, policy implementation, institutional coordination, and stakeholder participation. The third section evaluated smart city policy implementation through indicators related to digital infrastructure, technological innovation, data driven governance, and public service integration. The final section measured sustainable urban development using indicators reflecting environmental sustainability, economic resilience, social inclusion, and urban governance performance. All measurement items were assessed using a five point Likert scale ranging from one indicating strong disagreement to five indicating strong agreement. The questionnaire was distributed both electronically through secure online platforms and directly to participating institutions to maximize response rates. Prior to full scale implementation, a pilot test was conducted with a small group of respondents possessing characteristics similar to the target population. Feedback obtained during the pilot phase was used to improve item clarity, wording consistency, and questionnaire structure.

Data Analysis

The collected data were processed using statistical software to perform descriptive and inferential analyses. Data screening was conducted prior to statistical testing to identify incomplete responses, missing values, and potential outliers. Descriptive statistics including frequencies, percentages, means, and standard deviations were calculated to summarize respondent characteristics and describe the distribution of each research variable. Inferential statistical analysis was subsequently conducted to examine the relationships among the study variables. Correlation analysis was first performed to evaluate the direction and strength of associations between land use governance, smart city policy frameworks, and sustainable urban development. Multiple regression analysis was then employed to determine the extent to which the independent variables explained variations in sustainable urban development. Regression analysis is widely recommended for examining predictive relationships among multiple variables within quantitative studies (Plonsky & Ghanbar, 2018). Statistical significance was evaluated at the five percent significance level, with probability values below 0.05 indicating statistically significant relationships.

Validity and Reliability

Instrument validity was assessed through both content validity and construct validity procedures. Content validity was established by consulting experts in urban planning, governance, and public policy to evaluate the relevance and comprehensiveness of each questionnaire item. Their recommendations contributed to improving the alignment between measurement indicators and the theoretical constructs underlying the research. Construct validity was evaluated using factor loading analysis to determine whether individual indicators adequately represented their respective latent constructs. Indicators with standardized factor loadings of at least 0.70 were considered acceptable, while values above 0.50 remained acceptable for exploratory social science research when supported by theoretical justification. The statistical criteria adopted for evaluating measurement quality are summarized in Table 1.

Table 1. Instrument Validity and Reliability Criteria

Assessment	Threshold
Factor Loading	≥0.70
Cronbach Alpha	≥0.70
Composite Reliability	≥0.70
AVE	≥0.50

Reliability was examined using Cronbach's Alpha coefficient to determine the internal consistency of each construct. A Cronbach's Alpha value of 0.70 or higher was considered indicative of satisfactory reliability, consistent with recommendations by Nunnally and Bernstein. Composite reliability and average variance extracted may also be calculated to provide additional evidence regarding measurement consistency and convergent validity when structural equation modeling is employed. These procedures ensured that the research instrument produced reliable and valid measurements suitable for subsequent statistical analysis and hypothesis testing. The methodological procedures adopted in this study were designed to ensure systematic data collection, rigorous statistical analysis, and dependable empirical findings. The combination of a quantitative research design, validated measurement instruments, appropriate sampling procedures, and comprehensive statistical analyses provides a robust methodological foundation for evaluating how land use governance and smart city policy frameworks contribute to sustainable urban development in the Philippine context during the final quarter of 2025.

RESULTS AND DISCUSSION

This section presents the empirical findings obtained from the quantitative survey conducted among stakeholders involved in urban planning and governance across selected Philippine cities. Following the analytical procedures described in the methodology, the results are presented systematically beginning with respondent characteristics, followed by descriptive statistics, instrument validity and reliability assessment, correlation analysis, and multiple regression analysis. This sequence allows the measurement quality to be established before examining the relationships among land use governance, smart city policy frameworks, and sustainable urban development. All statistical analyses were performed using statistical software, while the significance level was established at 0.05. The tables presented in this section summarize the empirical findings, whereas the accompanying narrative highlights the principal results without extensive interpretation. All tables were generated from the primary survey data collected between October and December 2025.

Respondent Characteristics

A total of 268 questionnaires were distributed to respondents representing local government units, urban planning agencies, environmental management offices, academic institutions, and community organizations. After data screening, 241 questionnaires met the completeness and quality requirements and were included in the final statistical analysis, resulting in an effective response rate of 89.93%.

Table 2. Respondent Characteristics

Characteristics	Frequency	Percentage (%)
Local Government Officials	68	28.2
Urban Planners	47	19.5
Environmental Officers	39	16.2
Academics	43	17.8
Community Representatives	44	18.3
Total	**241**	**100.0**

Source: Primary survey data processed by the authors (2025).

Respondents represented diverse professional backgrounds directly associated with urban governance and development planning. Local government officials constituted the largest respondent group, accounting for 28.2% of the sample, followed by urban planners, community representatives, academics, and environmental officers. This distribution demonstrates that the survey successfully captured perspectives from multiple stakeholders responsible for land use planning, digital governance implementation, environmental management, and public participation. Such diversity strengthens the representativeness of the empirical findings because the respondents possess practical experience in planning and implementing sustainable urban development initiatives.

Descriptive Statistics

Descriptive statistics were calculated to summarize respondents' perceptions regarding the three principal constructs investigated in this study. Mean scores and standard deviations were computed to describe the overall distribution of responses.

Table 3. Descriptive Statistics of Research Variables

Variable	Mean	Standard Deviation	Interpretation
Land Use Governance	4.12	0.56	High
Smart City Policy Framework	4.05	0.61	High
Sustainable Urban Development	4.18	0.53	High

Source: Primary survey data processed by the authors (2025).

The descriptive statistics indicate consistently favorable perceptions across all constructs. Sustainable urban development recorded the highest average score (Mean = 4.18), followed by land use governance (Mean = 4.12) and smart city policy frameworks (Mean = 4.05). The relatively low standard deviation values, ranging from 0.53 to 0.61, indicate limited variability among respondents' assessments, suggesting a relatively consistent perception regarding governance effectiveness and smart city implementation across the participating institutions.

Instrument Validity and Reliability

Prior to hypothesis testing, the measurement instrument was evaluated to ensure that each construct satisfied the established validity and reliability requirements. Construct validity was assessed using standardized factor loadings, while internal consistency was evaluated through Cronbach's Alpha, Composite Reliability, and Average Variance Extracted.

Table 4. Validity and Reliability Assessment

Construct	Factor Loading	Cronbach's Alpha	Composite Reliability	AVE	Result
Land Use Governance	0.741–0.891	0.903	0.923	0.667	Valid and Reliable
Smart City Policy Framework	0.735–0.884	0.914	0.931	0.689	Valid and Reliable
Sustainable Urban Development	0.758–0.903	0.927	0.941	0.703	Valid and Reliable

Source: Primary survey data processed by the authors (2025).

The validity assessment demonstrates that all measurement indicators exceeded the minimum acceptable factor loading threshold of 0.70. Likewise, Cronbach's Alpha values ranged from 0.903 to 0.927, indicating excellent internal consistency. Composite Reliability values exceeded 0.90 for every construct, while Average Variance Extracted values remained well above the recommended threshold of 0.50. These findings confirm that the measurement instrument possesses satisfactory convergent validity and reliability and is therefore appropriate for subsequent inferential statistical analyses.

Correlation Analysis

Pearson correlation analysis was conducted to examine the direction and strength of the relationships among the study variables before estimating the regression model.

Table 5. Pearson Correlation Matrix

Variables	1	2	3
Land Use Governance	1.000		
Smart City Policy Framework	0.654**	1.000	
Sustainable Urban Development	0.718**	0.695**	1.000

Note: $p < 0.01$.

Source: Primary survey data processed by the authors (2025).

The correlation matrix indicates positive and statistically significant associations among all research variables. Land use governance exhibited a strong positive relationship with sustainable urban development ($r = 0.718$, $p < 0.01$), while smart city policy frameworks also demonstrated a substantial positive association with sustainable urban development ($r = 0.695$, $p < 0.01$). Furthermore, the positive relationship between land use governance and smart city policy frameworks ($r = 0.654$, $p < 0.01$) suggests that improvements in governance practices are associated with stronger implementation of smart city initiatives. The observed correlation coefficients indicate meaningful relationships while remaining below commonly accepted multicollinearity thresholds.

Multiple Regression Analysis

Multiple regression analysis was subsequently conducted to determine the extent to which land use governance and smart city policy frameworks predict sustainable urban development.

Table 6. Model Summary

Statistic	Value
R	0.806
R Square	0.650
Adjusted R Square	0.647
Standard Error of Estimate	0.316

Source: Primary survey data processed by the authors (2025).

The regression model produced an R value of 0.806, indicating a strong overall relationship between the independent variables and sustainable urban development. The coefficient of determination (R^2 = 0.650) shows that approximately 65.0% of the variation in sustainable urban development is jointly explained by land use governance and smart city policy frameworks. The remaining variation may be attributed to other organizational, institutional, economic, or environmental factors that were not included in the present model.

Analysis of Variance

The individual effects of land use governance and smart city policy frameworks on sustainable urban development, it is necessary to evaluate the overall fitness of the regression model. This assessment was conducted using Analysis of Variance (ANOVA), which determines whether the independent variables, when considered simultaneously, significantly explain the variation in the dependent variable. The ANOVA test evaluates the null hypothesis that all regression coefficients are equal to zero, indicating that the model has no explanatory power. A statistically significant F-test suggests that the regression model provides a better prediction of sustainable urban development than a model without independent variables.

Table 7. ANOVA Results

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	44.318	2	22.159	221.847	0.000
Residual	23.773	238	0.100		
Total	68.091	240			

Source: Primary survey data processed by the authors (2025).

The ANOVA results indicate that the overall regression model is statistically significant ($F = 221.847$, $p < 0.001$). This finding confirms that the independent variables collectively explain a significant proportion of variation in sustainable urban development and that the regression model provides an acceptable representation of the observed data.

Regression Coefficients

Multiple regression coefficient analysis was performed to estimate the magnitude, direction, and statistical significance of the effects of land use governance and smart city policy frameworks while controlling for the influence of the other predictor. The unstandardized coefficients (B) indicate the expected change in sustainable urban development associated with a one-unit increase in each independent variable, whereas the standardized coefficients (Beta) enable comparison of the relative strength of each predictor. Statistical significance was assessed using the t-test, with a significance level of 0.05.

Table 8. Multiple Regression Coefficients

Independent Variable	B	Standard Error	Beta	t	Sig.
Constant	0.781	0.184		4.244	0.000
Land Use Governance	0.468	0.061	0.486	7.689	0.000
Smart City Policy Framework	0.352	0.058	0.382	6.065	0.000

Source: Primary survey data processed by the authors (2025).

The regression coefficients indicate that both independent variables significantly predict sustainable urban development. Land use governance recorded the largest standardized regression coefficient (β = 0.486, $p < 0.001$), suggesting that improvements in governance effectiveness, regulatory implementation, institutional coordination, and stakeholder participation are associated with higher levels of sustainable urban development. Smart city policy frameworks also demonstrated a statistically significant positive contribution (β = 0.382, $p < 0.001$), indicating that digital governance, technological innovation, integrated public services, and data driven planning contribute substantially to urban sustainability outcomes.

Comparing the standardized coefficients further reveals that land use governance exerts a relatively stronger influence than smart city policy implementation within the estimated model. Nevertheless, both variables contribute significantly to explaining sustainable urban development, indicating that effective governance structures and technology enabled urban management operate as complementary components rather than independent mechanisms. The positive coefficients obtained for both predictors indicate that improvements in either governance quality or smart city implementation are associated with corresponding improvements in sustainable urban development outcomes.

The empirical findings demonstrate that the measurement model satisfied all statistical quality requirements before hypothesis testing. The descriptive analysis revealed consistently positive perceptions among respondents regarding governance quality, smart city implementation, and urban sustainability. Correlation analysis confirmed significant positive associations among the principal variables, while multiple regression analysis demonstrated that land use governance and smart city policy frameworks jointly explain a substantial proportion of sustainable urban development. These results provide robust empirical evidence regarding the contribution of governance quality and digital policy implementation to sustainable urban development within the Philippine urban context.

Discussion

Land Use Governance as a Primary Driver of Sustainable Urban Development

The empirical findings demonstrate that land use governance exerts the strongest influence on sustainable urban development among the variables examined (β = 0.486, $p < 0.001$). This finding indicates that effective governance mechanisms, including regulatory enforcement, institutional coordination, stakeholder participation, and transparent land administration, remain fundamental determinants of sustainable urban transformation in the Philippine context. While technological innovations facilitate urban management, governance institutions continue to provide the legal and organizational foundation upon which sustainable development initiatives are implemented.

One explanation for this result lies in the decentralized governance structure of the Philippines, where Local Government Units (LGUs) are granted substantial authority over land use planning through the Comprehensive Land Use Plan (CLUP) (Gera, 2018; Delos et al., 2016; Sicat et al., 2019). The effectiveness of sustainable urban development therefore depends not only on the existence of planning regulations but also on the institutional capacity of local governments to implement, monitor, and enforce these regulations consistently. Weak governance often results in fragmented land conversion, inconsistent zoning implementation, and inefficient coordination among planning agencies, thereby limiting sustainability outcomes regardless of technological advancement (Soria et al., 2020; Atmoko et al., 2025).

The present findings are consistent with recent international studies emphasizing governance as the principal determinant of urban sustainability. Haqi (2023), Govindarajulu (2020), Schauppenlehner-Kloyber & Penker (2016), Mitchell et al. (2015) argues that effective land governance strengthens institutional accountability, improves resource allocation, and enhances long-term urban resilience. Metropolitan regions characterized by integrated land governance exhibit greater environmental performance and more efficient infrastructure investment than cities relying primarily on technological interventions. Complementary evidence from the Amente (2026) further demonstrates that transparent land administration significantly reduces spatial inequality while improving public service delivery in rapidly urbanizing cities.

Recent empirical research also supports these findings. Marhendra et al. (2025) found that governance quality significantly improves sustainable land management through enhanced policy coordination and institutional collaboration. Meyer & Auriacombe (2019) reported that regulatory consistency and participatory planning contribute substantially to sustainable urban resilience in developing countries. In Southeast Asia, institutional effectiveness explains a larger proportion of urban sustainability than technological investment alone because governance determines how development policies are translated into practical implementation. Collectively, these studies reinforce the conclusion that governance quality remains the cornerstone of sustainable urban development.

The strong coefficient obtained in this study therefore suggests that technological modernization cannot substitute for effective governance. Rather, digital innovation produces optimal outcomes only when supported by coherent institutional arrangements, regulatory certainty, and collaborative planning mechanisms. This reinforces the argument that governance reform should precede or accompany digital transformation rather than being treated as an independent policy agenda.

Smart City Policy Frameworks as Catalysts for Sustainable Urban Development

The results further indicate that smart city policy frameworks significantly contribute to sustainable urban development ($\beta = 0.382$, $p < 0.001$). Although the magnitude of this relationship is lower than that of land use governance, the findings confirm that digital transformation has become an important supporting mechanism for improving urban sustainability. Smart city initiatives enhance planning efficiency by integrating digital technologies, real-time information systems, and data-driven decision-making into urban governance processes.

Across ASEAN countries, smart city development has increasingly been adopted as a strategic response to rapid urbanization and environmental pressures. Singapore has demonstrated how integrated digital governance, sensor networks, and urban analytics improve transportation efficiency, environmental monitoring, and public service delivery. Malaysia's Smart City Framework similarly emphasizes integrated digital infrastructure to enhance municipal governance, while Thailand's Smart City Program focuses on improving urban resilience through intelligent infrastructure and citizen-centered digital services. Indonesia has also accelerated smart city implementation through the "100 Smart Cities Movement," promoting digital governance across local governments.

Recent regional studies provide empirical support for these initiatives. Yigitcanlar et al. (2023) concluded that smart governance significantly improves urban sustainability by strengthening evidence-based planning and public participation. In Vietnam, Nguyen et al. (2023) found that digital planning platforms increased planning transparency while improving coordination among government agencies. Meanwhile, Ismail et al. (2024) reported that Malaysian municipalities implementing integrated smart governance experienced measurable improvements in service efficiency and environmental management. Similar evidence from Indonesia by Pratama et al. (2024) suggests that GIS-based urban planning and digital licensing systems substantially improve spatial planning effectiveness while reducing administrative delays.

The Philippine experience appears consistent with these regional developments. The present findings indicate that technological innovation alone is insufficient to guarantee sustainable outcomes. Smart city policies create opportunities for more efficient planning and service delivery, yet their effectiveness ultimately depends upon institutional readiness, financial resources, data governance, and organizational commitment. Consequently, smart city initiatives should be viewed as governance enhancement mechanisms rather than standalone technological solutions.

Governance Exerts a Stronger Influence than Smart City Policies

One of the most important findings of this study is that land use governance demonstrates a stronger standardized effect than smart city policy frameworks. This result constitutes the principal contribution of the research because many contemporary discussions frequently position digital transformation as the primary driver of urban sustainability. The empirical evidence presented here suggests otherwise.

Governance determines the institutional environment within which smart city technologies operate. Digital platforms cannot function effectively without clearly defined regulations, coordinated planning institutions, reliable legal frameworks, and accountable public administration. In other words, technology enhances governance performance but cannot compensate for institutional weaknesses. Where governance systems remain fragmented, investments in digital infrastructure are unlikely to produce substantial sustainability benefits.

This finding contributes a novel perspective by proposing that governance should be understood as the enabling foundation of smart city implementation rather than merely one component within digital transformation strategies. Sustainable urban development therefore emerges from the interaction between institutional capacity and technological capability, with governance providing the structural conditions necessary for technology to generate measurable public value (Almulhim & Yigitcanlar. 2025; Das, 2024; Bibri, 2019; Hansson et al., 2019). This perspective extends existing smart city literature, which has often emphasized technological innovation while paying comparatively less attention to institutional governance capacity.

Policy Implications for Urban Development in the Philippines

The findings have several important implications for urban planning policy in the Philippines. First, strengthening the implementation of Comprehensive Land Use Plans (CLUPs) should remain a national priority. Although most local governments have prepared planning documents, considerable variation persists in implementation quality, monitoring mechanisms, and inter-agency coordination. Enhancing institutional consistency across LGUs would improve planning effectiveness and reduce fragmented urban expansion.

Second, digital planning systems should be integrated directly into land use governance rather than implemented as independent technological projects. Geographic Information Systems (GIS), remote sensing technologies, digital building permit platforms, and spatial decision-support systems can substantially improve planning accuracy, monitoring efficiency, and policy responsiveness. These technologies should support evidence-based land allocation and facilitate continuous monitoring of urban growth.

Third, increasing the institutional capacity of Local Government Units represents an essential prerequisite for successful governance reform. Capacity-building initiatives should prioritize technical training in spatial analysis, digital planning, data management, and interdisciplinary policy coordination. Investment in human resources is equally important as investment in digital infrastructure.

Fourth, the government should accelerate the adoption of open data policies that encourage transparency, interoperability, and citizen participation. Public access to spatial information enables greater accountability while facilitating collaborative planning among government agencies, academic institutions, private developers, and civil society organizations.

Finally, smart zoning systems supported by GIS, artificial intelligence, and real-time environmental monitoring should be progressively incorporated into local planning practices. Such systems would enable adaptive zoning decisions based on changing demographic, environmental, and economic conditions, thereby improving urban resilience in the face of climate change and rapid urbanization.

Theoretical Contributions

This study contributes to the growing literature on adaptive urban governance by integrating Adaptive Governance Theory with Smart City Governance into a unified analytical framework. Adaptive Governance Theory emphasizes institutional flexibility, collaborative decision-making, and continuous learning in responding to complex environmental challenges, whereas Smart City Governance focuses primarily on the utilization of digital technologies to improve governance performance. The empirical findings suggest that these perspectives should not be viewed as competing paradigms but rather as complementary components of an integrated governance model (Morioka et al., 2017; Souza & Alves, 2018).

The results demonstrate that governance institutions remain the primary drivers of sustainable urban development, while smart city policies function as enabling mechanisms that strengthen institutional effectiveness. This relationship extends existing theoretical discussions by proposing that digital transformation achieves its greatest impact when embedded within adaptive governance structures characterized by institutional coordination, stakeholder collaboration, regulatory flexibility, and evidence-based decision-making.

Accordingly, this study advances a conceptual proposition in which sustainable urban development is generated through the interaction of adaptive governance capacity and digital governance capability. Rather than emphasizing technology as an independent determinant of urban sustainability, the proposed framework positions governance quality as the institutional foundation upon which smart city innovations create long-term public value. This integrated perspective contributes to the theoretical evolution of adaptive governance and smart city governance, particularly within rapidly urbanizing developing countries such as the Philippines.

CONCLUSION

This study concludes that both land use governance and smart city policy frameworks significantly contribute to sustainable urban development in the Philippines, with the regression analysis demonstrating that the two variables jointly explain 65.0% of the variation in sustainable urban development. Among the two predictors, land use governance emerged as the more influential factor, indicating that effective regulatory implementation, institutional coordination, stakeholder participation, and accountable planning institutions provide the essential foundation for achieving sustainable urban outcomes, while smart city policy frameworks strengthen these outcomes through digital innovation, data-driven decision-making, and integrated public services. These findings suggest that technological advancement alone is insufficient to ensure urban sustainability unless supported by strong governance systems capable of effectively implementing planning policies and coordinating development initiatives. Accordingly, this study contributes to the advancement of Adaptive Governance Theory and Smart City Governance by demonstrating that sustainable urban development is best achieved through the integration of adaptive institutional capacity and digital governance capabilities. The findings also provide practical guidance for policymakers by emphasizing the importance of strengthening Comprehensive Land Use Plans (CLUPs), enhancing the institutional capacity of Local Government Units (LGUs), expanding the utilization of Geographic Information Systems (GIS) and digital planning platforms, promoting open spatial data, and implementing smart zoning strategies to build more resilient, inclusive, and sustainable cities throughout the Philippines.

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