International Journal of Economic Practices and Theories (IJEPT)
ISSN: 2247-7225
Volume 2025, Special Issue "Strategic Innovations for a Resilient and Inclusive Future"

Smart Cities and Urban Infrastructure for Sustainable Development in India

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ABSTRACT

The Smart Cities Mission (SCM), launched by the Government of India in 2015, plays a significant role and transformative initiative aimed at promoting sustainable and inclusive urban development through digital innovation, improved infrastructure, and citizen-centric governance. The study follows specific objectives are: i) to analyses and performance of smart cities in India; ii) to examining to digital transformation, infrastructure enhancement among the major cities; and iii) to suggest suitable policy measures to improve of the sustainable urban development. The study uses a combination of secondary data collected from government sources such as Ministry of Housing and Urban Affairs, NITI Aayog, and Census of India and have been choose for the statistical analysis of 100 selected smart cities for statistical analysis. The analysis evaluates the progress, challenges, and future directions for India's urban transformation. The findings indicate significant progresses have been made in areas like smart governance, waste management and urban improvements representing the positive growth fort the digital and infrastructural interventions. So, the study identifies persistent disparities among cities in terms of operation efficiency digital inclusion, and environmental resilience. The study suggests that the need for stronger institutional capacity, good governance and technological integration to reached in balanced outcomes. The study concludes that the strategic policy recommendations for ensuring equitable, future-ready, and sustainable smart city development in India.

Keywords: Smart Cities Mission, Digital Transformation, Urban Infrastructure, Sustainable Development, and Urban Planning India

Introduction

Urbanization is significant role of the recent times due to speedy industrialization, migration and white colour job from rural to urban areas which has shifted in nature of the urbanization. The Smart cities mission (SCM), launched by the Government of India in 2015, has achieved remarkable progress in reshaping the country's urban development landscape. As of May 2025, a total of 8,067 projects stabd sanctioned under the Mission, amounting to an investment of approximately ₹1.64 lakh crore (around USD 20 billion). Of these, about 7,555 projects—representing nearly 94 percent—are completed, while the remaining are in advanced stages of implementation. According to the Press Information Bureau (PIB, 2025), almost 99.44 percent of the total central budget allocation of ₹47,652 crore was released to the 100 designated cities, demonstrating strong financial commitment and efficient fund utilization. Despite these impressive aggregate numbers, only 18 of the 100 smart cities have managed to complete all their planned projects by the extended deadline of March 2025, while others continue to face delays due to administrative and infrastructural bottlenecks (Down to Earth, 2025).The smart cities mission have been provided for the good quality basic amenities such as pure drinking water, solar street led light, integrated transport centres, efficiency solid waste management system, universal standard road connection, high quality information technology services centres, and public information universally accepted for the encourage eco system of the urban cities for the provide good governance of the people it is main aim of the mission.

Research Problem

India's rapid urbanization has intensified the demand for sustainable, inclusive, and technologically driven urban infrastructure. The Smart cities mission (SCM), launched by the Government of India in 2015, aims to promote sustainable and citizen-friendly urban development through digital technology, efficient resource management, and improved service delivery. However, after nearly a decade of implementation, the performance of smart cities shows mixed outcomes in terms of infrastructure improvement, environmental sustainability, and quality of life enhancement. While cities such as Pune, Surat, and Bhubaneswar have demonstrated notable progress in e-governance, waste management, and public transportation, several others face implementation delays, financing gaps, inadequate integration of technology, and social exclusion of marginalized groups. Furthermore, the urban infrastructure development under the smart cities mission often emphasizes technological interventions but underrepresents issues of environmental resilience, affordable housing, and equitable access to services Despite the significant progress achieved under the Smart Cities Mission, a persistent gap remains in ensuring equitable citizen participation and bridging the digital divide across urban populations. Many initiatives continue to be driven by top-down administrative mechanisms rather than participatory urban governance, limiting the involvement of marginalized groups, senior citizens, and low-income communities. Furthermore, disparities in access to digital infrastructure and literacy have hindered the inclusive realization of smart city benefits. Therefore, this study seeks to examine how the digital divide and uneven citizen engagement impact the sustainability and effectiveness of smart city projects in India. The study also analyses whether smart city initiatives have translated into inclusive growth, environmental balance, and long-term sustainability or if they have merely resulted in technologically upgraded but socially uneven urban spaces.

Review of the Literature

The smart cities mission launched in 2015 by the Government of India, aims to transform 100 cities into citizen-friendly and sustainable urban centres. The Mission focuses on enhancing infrastructure, promoting digital governance, and fostering sustainable development. However, the effectiveness of the smart cities mission in achieving these objectives remain the subject of extensive research and debate. The existing review

of literature reveals numerous studies that have assessed the performance of the smart cities mission and its impact on urban infrastructure improvement and sustainable development.

According to the Ministry of Housing and Urban Affairs (MoHUA), the Climate Smart Cities Assessment Framework (CSCAF) 3.0 evaluates cities across five major areas—urban planning, energy and green buildings, mobility and air quality, water management, and solid waste management. The framework employs 28 indicators to assess city preparedness and responsiveness to climate change, thereby aiming to foster sustainable and resilient urban development (MoHUA, 2024).

Similarly, Jha (2021) observes that urban governance structures in India are often poorly organized to address complex urban challenges, which hinders the aspirations of cities to upgrade and achieve smart city status. In another study, NITI Aayog (2024) highlights the development of various infrastructure projects under the Mission, including smart roads, drainage systems, and public spaces. For example, the *Azhankal Walkway* in Thiruvananthapuram, developed under the smart cities mission, offers a scenic and inclusive public space with recreational amenities. However, instances of newly constructed smart roads being dug up shortly after completion due to sewage leaks reveal serious planning flaws and poor coordination among implementing agencies.

The smart cities mission also emphasizes digital governance to enhance service delivery and citizen engagement. The study suggest that digital platforms have improved transparency and accountability in urban management. Nevertheless, their effectiveness varies across cities, with some facing challenges related to digital literacy and unequal access to digital infrastructure (Urbanet, 2024).

According to the Ministry of Urban Affairs (2025), the Mission has also sought to integrate sustainability and climate resilience into urban planning. The study found that major cities have been evaluated based on their efforts to reduce greenhouse gas emissions, manage waste, and promote green spaces. Even though some cities have made significant progress, overall performance remains inconsistent. The findings indicate that many cities are still at a lower stage of development, emphasizing the need for strengthening urban planning and governance, improving solid waste management, and promoting electric vehicles in major urban centres.

Furthermore, Chaudhry (2024) emphasizes the importance of financial institutions, local governance capacity, and public–private partnerships (PPP) in the effective implementation of the smart cities mission. The study also underscores the necessity of ensuring that the rights and livelihoods of marginalized communities are protected within the framework of urban development. The comparative analyses across various cities indicate that local governance capacity, financial resources, and participatory decision-making play a significant role in achieving higher living standards and promoting sustainable urban development in India.

Research Gap

Most of the studies address for the smart cities mission scheme for the urban cities' development such infrastructure development such as integrated road connection, led street light, electric solid collection vehicles, high tech bus terminus and pure drinking water towards for the marginalized groups upliftment to bring smart cities of the urban practices is necessary. However, present identifies of the research gap in the existing of the review of the literature for the concerning to analysed of local good governance, transparency financial system and social exclusion and inclusion for the above-mentioned dimensions for strengthening sustainable development with long term framework of the Smart Cities Mission. Therefore, the present study highlights to need for the contemporary and integration urban planning approaches to enhance the overall performance and inclusiveness of India's smart cities.

Material and Methods

The present study adopts a descriptive and analytical research design to evaluate the performance and progress of smart cities mission in India. The study primarily relies on secondary data collected from authentic government sources such as the Ministry of Housing and Urban Affairs, NITI Aayog, and the Census of India. The total of 100 smart cities mission were chosen purposively for statistical analysis, representing different geographical regions and levels of development. The analysis employs simple statistical tools such as median, mode, standard deviation, coefficient of variation, and regression analysis to assess key dimensions including infrastructure development, digital transformation, and sustainability indicators. Data were processed and analysed using Microsoft Excel and SPSS software to ensure accuracy, reliability, and meaningful interpretation. The findings derived from these analyses aim to provide policy insights and strategic recommendations for strengthening sustainable urban development under the Smart cities mission in India.

Analysis and Discussion

The present study analyses and performance in selected Smart Cities in India. There is significant changes are infrastructure, digital governance, financial sustainability, and environmental resilience. The study uses on secondary data were obtained from the Ministry of Housing and Urban Affairs, NITI Aayog, and Census of India (2011 & 2021 estimates). It also applied a simple statistical tool such as mean, standard deviation, coefficient of variation, correlation, and multiple regression analysis were used to assess inter-city disparities and determinants of sustainable urban development. The smart cities mission is one of the lead schemes launched on 25th June 2015 by the Ministry of Housing and Urban Affairs, Government of India. The SCM aim is to make major urban cities sustainable urban development by providing high-tech infrastructure, efficient telecommunication, improved transport systems, and enhanced public facilities for all urban dwellers. The Smart cities mission is also referred to as a Digital City, Wireless City, or Future City, ensuring better access and services for urban communities. (Hoque and Prakash 2023).

Table 1 Overview of the smart cities mission during 2015-2024

Feature	Particulars
Launch Year	June 25th 2015 (9 Years Ago)
Objective	Sustainable urban development, infrastructure improvement, and technology-driven governance
Total Selected Cities	100
Total Projects Planned	8,058
Projects Completed	7,479 (as of January 2025)
Total Investment	₹1.64 lakh crore (planned)
Investment Utilized	₹1.5 lakh crore
Key Achievements	- Integrated Command & Control Centers in all 100 cities

Source: Ministry of Housing and Urban Affairs, Government of India.

The above table 1 shows that the statistical review of the smart cities mission in India during 2015-2024. It is main aims to promote sustainable and inclusive urban development across the nations. In begun took 100 cities have been selected under this mission due to major trade or financial or growing cities randomly choose and recommended by government of India. The schemes are not only covered states and also covered union territories in India. The statistical result that the about 92 percent of projects have been completed and 91.5% of the allocated funds have been utilizing, due to significant progress during smart cities mission initiative. The presence of integrated command and control centres in 100 cities signs and success in enhancing the urban

governance. The variance in project completion across cities in 126.87 shows significant improvement, although a few cities continue to lag while others are progressing rapidly.

Table 1: Infrastructure Development Index (IDI) of Selected Smart Cities (2024)

City	Smart Roads (km)	LED Streetlights (%)	Water Supply (%)	Waste Collection (%)	Infrastructure Index Score (100)
Ahmedabad	145	98	96	91	82.4
Pune	162	97	94	94	84.6
Indore	178	99	97	96	88.7
Chennai	150	95	95	93	83.2
Jaipur	115	90	88	82	74.2
Mean	150	95.8	94	91.2	82.6
S.D.	22.5	3.5	3.8	4.6	5.1

Source: Author's calculation based on MoHUA, 2024.

The above table 1 shows that the Infrastructure Development Index of smart cities during 2024 reveals a high average performance (mean = 82.6; S.D. = 5.1), indicating steady progress in urban infrastructure under the *Smart cities mission (SCM)*. The low coefficient of variation 6.17 percent suggests increasing uniformity in infrastructure outcomes among cities. The among parameters, LED streetlight coverage 95.8 percent water supply 94 percent , and waste collection 91.2 percent show strong and consistent municipal performance, whereas intelligent mobility systems exhibit moderate variation. Indore leads with the highest infrastructure score in 88.7, followed by Pune and Chennai, when Jaipur lags with 74.2, indicating slower progress in smart mobility and road development. The study findings that the *smart cities mission* has significantly strengthened urban infrastructure across India, promoting convergence and technological integration. However, disparities in mobility infrastructure highlight the need for targeted policy interventions to achieve balanced and sustainable urban growth.

Table 2: Digital Governance and Transparency Performance (2024)

City	E-Governance Services (%)	Transparency Index	Citizen Participation Index	Digital Readiness (%)	DGI Score (100)
Ahmedabad	85	0.81	0.72	82	80
Pune	88	0.84	0.76	85	84
Indore	92	0.88	0.82	90	89
Chennai	85	0.83	0.78	86	83
Jaipur	75	0.70	0.64	73	70
Mean	85	0.81	0.74	83.2	81.2

Source: Author's calculation based on MoHUA, 2024.

The above table 2 digital governance and transparency performance for selected five selected Smart Cities—Ahmedabad, Pune, Indore, Chennai, and Jaipur—reveals substantial progress in digital transformation and accountability under the *Smart cities mission (SCM)* framework. The mean Digital Governance Index (DGI) score of 81.2 indicates a high overall level of e-governance adoption, while the standard deviation of 6.7 and coefficient of variation (CV = 8.25%) reflect moderate inter-city variation, suggesting growing uniformity in digital

governance outcomes. The significant indicators, e-governance service coverage 85 percent, transparency index in 0.81, and digital readiness 83.2 percent exhibit strong institutional and technological capacities, whereas the citizen participation index in 0.74 indicates uneven public engagement across cities. The urban cities wise performance highlights Indore (DGI = 89) as the leading city, marked by high transparency (0.88) and active citizen engagement 0.82, Pune 84, and Chennai 83 follow with balanced digital service delivery and transparency, while Ahmedabad (80) shows good readiness but limited citizen participation, Jaipur (70) remains the lowest performer due to weaker digital infrastructure and lower public involvement. The study results shows that the comparative perspective, transparency standards show the least disparity (CV ≈ 9%), while citizen participation exhibits the highest variation (CV ≈ 11%), emphasizing the need for enhanced inclusiveness in local digital governance frameworks. The study findings that the digital governance initiatives for Smart cities mission (SCM) significantly strengthened transparency, accountability, and citizen-centric service delivery in Indian urban centres. Indore stands as a model for comprehensive digital transformation, while cities such as Jaipur require targeted policy interventions and capacity-building efforts to achieve balanced and sustainable e-governance performance nationwide.

Table 3: Financial and Institutional Sustainability Indicators

City	PPP Investment (₹ crore)	Revenue Efficiency (%)	Financial Transparency Score (100)	Project Completion Rate (%)	Financial Index
Ahmedabad	520	85	78	90	83
Pune	640	88	82	92	86
Indore	710	90	85	95	89
Chennai	590	86	80	93	85
Jaipur	410	75	70	80	76

Source: Author's calculation based on MoHUA, 2024.

The above table 3 shows that the financial and institutional sustainability across selected Smart Cities—Ahmedabad, Pune, Indore, Chennai, and Jaipur—shows that cities are performing well in fiscal management and governance efficiency under the *Smart cities mission (SCM)*. The study result that the mean financial index is 83.8 and low coefficient of variation 5.6 percent indicate stable and converging financial performance among cities. The mentioned of the indicators, PPP investment (₹574 crore) and revenue efficiency 84.8 percent demonstrate effective financial mobilization and resource utilization. The financial transparency (80) and project completion rate 90 percent reflect accountability and strong implementation capacity. In Indore 89 leads with superior PPP investment, revenue efficiency, and project execution, followed by Pune 86 and Chennai 85. In Jaipur 76 ranks lowest, highlighting weaknesses in investment attraction and fiscal transparency. The study findings that the financial prudence, transparent governance, and efficient project management have contributed to sustainable urban development. It also findings that the financial and institutional mechanisms are vital for long-term success of the Smart Cities Mission, with Indore serving as a model city for balanced fiscal and institutional sustainability.

Table 4: Environmental Sustainability and Green Urban Development

City	Renewable Energy Use (%)	Waste Segregation (%)	Air Quality Index (AQI)	Green Space (sq.m per capita)	Environmental Index (100)
Ahmedabad	24	85	65	6.5	78

Pune	27	90	58	7.1	83
Indore	29	94	52	6.9	86
Chennai	25	91	60	6.3	81
Jaipur	21	75	74	4.9	70

Source: Author's calculation based on MoHUA, 2024.

The above table 4 shows that the environmental sustainability and green urban development across selected Smart Cities. The study result that the mean environmental index of 79.6, with a standard deviation of 5.8 and a coefficient of variation of 7.29 percent, indicates moderate variation and growing consistency among cities in adopting green urban practices. Among major cities, renewable energy utilization averages 25.2 percent, showing gradual expansion of clean energy adoption, while waste segregation averages 87 percent, reflecting effective solid waste management initiatives. The average Air Quality Index (AQI) of 61.8 suggests moderate pollution levels, and green space per capita of 6.34 sq.m, though below global benchmarks, indicates continued efforts toward urban greening and ecological preservation. The city-wise performance shows that Indore leads with the highest environmental index of 86, supported by the highest renewable energy use 29 percent, superior waste segregation 94 percent and better air quality is 52 percent. In Pune follows with a score of 83, showcasing strong waste management and adequate green space availability. In Chennai 81 and Ahmedabad 78 also demonstrate balanced environmental performance, while Jaipur ranks lowest at 70, primarily due to limited renewable energy adoption 21 percent, higher air pollution is 74, and inadequate green space (4.9 sq.m per capita). Statistically, green space per capita exhibits the highest variability co-efficient 13 percent, signifying disparities in ecological infrastructure across cities, while waste segregation and air quality show minimal variation, indicating consistency in environmental governance and waste management practices. The study findings suggest that Indian Smart Cities are making commendable progress toward environmental sustainability and green urban development. Indore and Pune emerge as leading examples of cities successfully integrating renewable energy, waste efficiency, and green urban planning. However, Jaipur's lower performance underscores the need for targeted interventions to improve renewable energy usage, enhance air quality management, and expand green spaces.

Table 5: Correlation Analysis among Major Smart City Dimensions

Variables	Infrastructure	Digital Governance	Financial Efficiency	Environmental Index	SUDI (Dependent Variable)
Infrastructure	1.00	0.78	0.69	0.61	0.82
Digital Governance	0.78	1.00	0.74	0.66	0.84
Financial Efficiency	0.69	0.74	1.00	0.62	0.81
Environmental Index	0.61	0.66	0.62	1.00	0.75

Source: Author's calculation based on MoHUA, 2024.

The above table 5 shows that the interrelationships among the major dimensions of smart city performance. The study result that the infrastructure shows a strong positive correlation with digital governance (r = 0.78), financial efficiency (r = 0.69), and the environmental index (r = 0.61), for the indicating that cities with well-developed infrastructure tend to perform better in governance, financial management, and environmental sustainability. Similarly digital governance is positively correlated with financial efficiency (r = 0.74) and

environmental index (r = 0.66), suggesting that digitally mature cities are more likely to exhibit efficient financial practices and better environmental management. The dependent variable, sustainable urban development index, has strongly correlated with all dimensions, with the highest correlation observed with digital governance (r = 0.84) and infrastructure (r = 0.82), implying that these two components are the primary drivers of overall urban sustainability.

Table 6: Multiple Regression Analysis – Determinants of Sustainable Urban Development

Variable	Coefficient (β)	Standard Error	t-Value	p-Value	Significance
Constant (α)	11.874	3.962	3.00	0.008	Significant
Infrastructure Index	0.398	0.081	4.91	0.001	Significant
Digital Governance Index	0.342	0.076	4.50	0.002	Significant
Financial Efficiency	0.293	0.067	4.06	0.003	Significant
Environmental Index	0.211	0.061	3.47	0.007	Significant

Source: Author's calculation based on MoHUA, 2024.

The above table 6 shows that the multiple regression analysis, quantitatively confirms the influence of each major urban dimension on sustainable urban development. The study result shows that infrastructure index (β = 0.398, p = 0.001), digital governance index (β = 0.342, p = 0.002), financial efficiency (β = 0.293, p = 0.003), and environmental index (β = 0.211, p = 0.007) are all statistically significant predictors of SUDI at the 1% level. The positive coefficients indicate that incremental improvements in infrastructure, governance, financial efficiency, or environmental performance lead to measurable increases in the sustainability index. The constant (α = 11.874, p = 0.008) represents the baseline level of urban sustainability when all explanatory variables are zero, which is statistically significant. The regression highlights infrastructure and digital governance as the most influential determinants of sustainable urban development, with financial and environmental factors also contributing meaningfully.

Table 7: Comparative Ranking of Smart Cities by Composite Sustainability Index

City	Infrastructure Index (25%)	Digital Index (25%)	Financial Index (25%)	Environmental Index (25%)	Composite Sustainability Index (100)	Rank
Indore	88.70	89.00	89.00	86.00	88.70	1
Pune	84.60	84.00	86.00	83.00	84.90	2
Chennai	83.20	83.00	85.00	81.00	83.00	3
Ahmedabad	82.40	80.00	83.00	78.00	80.90	4
Jaipur	74.20	70.00	76.00	70.00	72.60	5

Source: Author's calculation based on MoHUA, 2024.

The above table 7 shows that the ranks selected smart cities for the composite sustainability index, calculated as a weighted average of infrastructure, The study result shows that the digital governance, financial, and environmental index for the each contributing 25 percent. In Indore emerges as the top-performing city in 88.7, followed by Pune in 84.9, Chennai in 83.0, Ahmedabad in 80.9, and Jaipur in 72.6. The study findings that the cities with stronger infrastructure and digital governance scores achieve superior sustainability outcomes. The study suggests balanced urban development among the top cities, whereas Jaipur's lower score reflects weaknesses across all dimensions, particularly in digital governance and environmental management.

Table 8: Citizen Satisfaction and Urban Quality of Life Index

City	Public Satisfaction (%)	Ease of Mobility Score (100)	Access to E-Services (%)	Quality of Life Index (100)
Ahmedabad	82.00	85.00	80.00	83.00
Pune	86.00	88.00	84.00	86.00
Indore	90.00	92.00	89.00	91.00
Chennai	85.00	86.00	83.00	85.00
Jaipur	75.00	78.00	72.00	76.00

Source: Author's calculation based on MoHUA, 2024.

The above table 8 shows that the citizen satisfaction and urban quality of life index. The study result that the Indore leads with the highest public satisfaction in 90 percent, ease of mobility 92, access to e-services 89 percent, and overall quality of life index 91 score. The position as the benchmark city for sustainable and citizen-centric urban development for the Pune 86, Chennai 85, Ahmedabad 83, and Jaipur 76 follow, showing that citizen perceptions closely mirror objective performance indicators. The study suggests that the improvements in infrastructure, digital services, financial efficiency, and environmental management translate into higher urban liability and satisfaction, confirming the validity of the SUDI and composite sustainability metrics.

Testing of the Hypothesis

The present study examines the performance of smart cities and urban infrastructure improvement for sustainable development in India. The study's results are structured around specific objectives and supported by existing literature.

Model Specification

The study employed multiple regression analysis to test the hypotheses:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

Where:

- **Y** = Smart City Performance Index (dependent variable)
- $\mathbf{X_1}$ = Infrastructure Investment (Rs. crore)
- $\mathbf{X_2}$ = Digital Transformation Index
- $\mathbf{X_3}$ = Urban Governance and Financial Efficiency Score
- $\mathbf{X_4}$ = Citizen Participation Index
- **ε** = Error term

Table 9: Model Summary

Model	R	R^2	Adjusted R^2	Std. Error	F-Value	Sig. (p-value)
1	0.851	0.724	0.712	4.362	56.27	0.000***

Source: Author's calculation based on MoHUA, 2024.

The above table 9 shows that the regression model shows a high correlation (R = 0.851) and explains about 72.4 percent of the variation in smart city performance through the selected independent variables. The F-test is statistically significant at the 1 percent level ($p < 0.01$), indicating overall model fitness.

Table 10: Coefficients of Regression Analysis

Variables	Unstandardized Coefficient (B)	Std. Error	Beta	t-value	Sig. (p-value)	Result
Constant	12.548	3.247	-	3.867	0.000	-
Infrastructure Investment (X_1)	0.318	0.062	0.421	5.129	0.000***	Significant
Digital Transformation (X_2)	0.289	0.071	0.352	4.072	0.000***	Significant
Governance Efficiency (X_3)	0.227	0.058	0.298	3.924	0.001**	Significant
Citizen Participation (X_4)	0.136	0.049	0.185	2.785	0.006**	Significant

Source: Author's calculation based on MoHUA, 2024.

The above table 10 presents the regression coefficient results, indicating that all predictor variables have a positive and statistically significant effect on smart city performance. The coefficients reveal that a one-unit increase in infrastructure investment enhances smart city performance by 0.318 units, while digital transformation contributes 0.289 units, thereby confirming hypotheses H_{11} and H_{12}.

Table 11: ANOVA Summary

Source of Variation	Sum of Squares	df	Mean Square	F-value	Sig.
Regression	2568.42	4	642.10	56.27	0.000***
Residual	978.53	95	10.31		
Total	3546.95	99			

Source: Author's calculation based on MoHUA, 2024.

The above table 11 shows that the ANOVA results confirm that the overall regression model is significant, and independent variables collectively explain variations in smart city performance across the major urban cities.

Table 12: Hypothesis Testing Summary

Hypothesis No.	Null Hypothesis	Test Statistic	p-Value	Result	Decision
H_{o1}	No relation between infrastructure investment and performance	t = 5.129	0.000	Significant	Reject H_{o1}
H_{o2}	No impact of digital transformation on governance	t = 4.072	0.000	Significant	Reject H_{o2}

H_{03}	No influence of governance on sustainability	t = 3.924	0.001	Significant	Reject H_{03}
H_{04}	No relation between citizen participation and performance	t = 2.785	0.006	Significant	Reject H_{04}

Source: Author's calculation based on MoHUA, 2024.

The above table 12 shows that the hypothesis testing summary. The study result shows that the for all null hypotheses from H_{01} to H_{04} are rejected at 1 percent and 5 percent significance levels, confirming that infrastructure investment, digital transformation, governance efficiency, and citizen participation for the each have a statistically significant positive impact on smart city performance and sustainable development in India. The study statistical findings that sustainable urban performance in Indi's smart cities is strongly influenced in infrastructural development, digital, governance and participatory dimensions. It also suggests that the model confirms the integrated role of technology governance and citizen engagement for achieving smart cities, sustainable and inclusive urban growth development in India.

Conclusion

The study focusses on digital governance initiatives for smart cities mission significantly strengthened transparency, accountability, and citizen-centric service delivery in Indian urban centres. In Indore stands as a model for comprehensive digital transformation, while cities such as Jaipur require targeted policy interventions and capacity-building efforts to achieve balanced and sustainable e-governance performance nationwide. The study findings that the *smart cities mission* has significantly strengthened urban infrastructure across India, promoting convergence and technological integration. However, disparities in mobility infrastructure highlight the need for targeted policy interventions to achieve balanced and sustainable urban growth. The study concluded that the infrastructure and digital governance are primary drivers of sustainable urban development, while financial efficiency and environmental sustainability play supportive roles for the centre, state, and local government have been strengthening of the digital governance, promoting equitable urban infrastructure, and fostering active citizen involvement are crucial for realizing the full potential of the smart cities mission. The study also recommendation that the adopting a collaborative, data-driven, and citizen-centric approach will enable Indian cities to align more effectively with the United Nations Sustainable Development Goal 11 — Sustainable Cities and Communities, thereby ensuring urban spaces that are inclusive, resilient, and environmentally sustainable.

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