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CLIMATE RESILIENCE IN SMART CITY PROJECTS: A DESCRIPTIVE QUALITATIVE STUDY

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ABSTRACT

India's Smart Cities Mission (SCM), launched in 2015, committed USD 15 billion of public investment to 100 cities while climate projections warned of compounding urban risks. A decade later, the question of whether smart city projects embed climate resilience remains largely unexamined in primary policy documents. This descriptive qualitative study applies content analysis (Hsieh & Shannon, 2005; Sandelowski, 2000) to 11 source documents: six city Smart City Proposals (Bengaluru, Dehradun, Indore, Jaipur, Kochi, Pune), two Comptroller and Auditor General (CAG) performance audits, the Ministry's SCM Guidelines, a UN-Habitat partnership report on urban resilience, and IPCC Working Group II findings. A deductive codebook aligned with the IPCC AR6 Climate Resilient Development framework was combined with inductive codes emerging from the city proposals. Keyword frequency analysis revealed that four of the six proposals contained zero instances of the terms climate, resilience, adaptation, or mitigation; the remaining two used resilience in an economic rather than climatic sense. Six thematic findings are reported: (a) absence of climate vocabulary, (b) infrastructure-first framing, (c) technology substitution for adaptation, (d) flooding acknowledged without climate attribution, (e) audit findings of delay and misallocation, and (f) the disconnect between international frameworks and on-ground proposals. The study concludes that the SCM, as documented, functions as an infrastructure modernisation programme rather than a climate resilience instrument, and proposes four reforms for integrating climate resilience into the successor programme.

KEYWORDS: *Climate Resilience, Smart Cities Mission, Urban Adaptation, India, Content Analysis, Descriptive Qualitative Study*

1.INTRODUCTION

Urban areas concentrate more than half of the global population and contribute an estimated 67 to 72 percent of greenhouse gas emissions, even as they face the sharpest edges of climate-driven flooding, heat, and water stress (Intergovernmental Panel on Climate Change [IPCC], 2022). In the Indian context, rapid urbanisation intersects with monsoon variability, coastal subsidence, heatwaves, and rising air pollution, producing a distinctive profile of compound urban risk. The Government of India launched the Smart Cities Mission (SCM) in June 2015 as a flagship urban renewal programme with a budget envelope of approximately USD 15 billion shared between central and state governments, aimed at 100 selected cities (Ministry of Urban Development [MoUD], 2015).

The Mission Statement and Guidelines define a smart city in terms of a core infrastructure package, a better quality of life, a clean and sustainable environment, and the application of smart solutions (MoUD, 2015). Although the word sustainable appears in the core definition, explicit references to climate change, adaptation, or resilience are comparatively rare in the foundational document. A decade after launch, two parallel developments raise the question of whether the programme, as documented, actually addresses climate resilience. First, the Comptroller and Auditor General of India (CAG) has released performance audits of individual smart cities that foreground delays, financial irregularities, and departures from approved scope (CAG, 2024, 2025). Second, international partnerships between the Ministry of Housing and Urban Affairs and UN-Habitat have begun re-framing smart cities as potential vehicles for climate-resilient urban transformation (MoHUA & UN-Habitat, 2023).

The apparent contradiction, strong climate language at the international level against thin climate language inside individual city proposals, is the puzzle motivating this study. The research question is descriptive rather than causal: How is climate resilience represented in the primary policy and planning documents of the Indian Smart Cities Mission? The study deliberately stays within what the documents themselves say. It does not measure on-ground outcomes, project performance, or citizen perceptions. A descriptive qualitative design is chosen because, as Sandelowski (2000) argues, such designs aim to stay close to the data and produce a comprehensive summary of events in everyday language, which is appropriate when the evidence base consists of heterogeneous public documents.

The contribution of this study is twofold. Methodologically, it illustrates how a lightweight content analysis matrix can be applied to a small, bounded corpus of policy documents to audit the presence of a specific policy concept. Substantively, it documents a concept gap

in the foundational documents of an important national programme and places that gap in conversation with the wider scholarship on smart urbanism (Angelidou, 2014; Bulkeley, 2013; Praharaj et al., 2018).

The remainder of the paper is organised as follows. The next section reviews scholarship on smart urbanism and climate-resilient development and identifies the gap addressed here. The methodology section then sets out the descriptive qualitative design, the eleven-document corpus, the hybrid inductive–deductive codebook, and the measures taken to support rigour. The findings section reports six sub-themes with reference to the keyword frequency pattern summarised in Table 1. The discussion draws out three transversal arguments; limitations and a short conclusion with four reform proposals follow.

2.LITERATURE REVIEW

Smart Urbanism and Its Critiques

The smart city discourse has expanded rapidly since the mid-2000s. Angelidou (2014) distinguishes technology-led strategies, which foreground sensors, data platforms, and command centres, from holistic strategies that treat technology as one enabler among many. Praharaj et al. (2018), in one of the earliest critical reviews of India's SCM, argue that the competitive selection process rewarded cities that could write convincing infrastructure proposals, which skewed the programme towards area-based development and pan-city information and communications technology projects. Bulkeley (2013) cautions more broadly that urban climate governance often becomes visible as isolated experiments rather than as mainstreamed practice embedded in mandatory planning.

Climate Resilient Development

The IPCC Sixth Assessment Report's Working Group II contribution defines Climate Resilient Development (CRD) as the process of implementing greenhouse gas mitigation and adaptation options to support sustainable development for all, and states that urban areas are critical and time-bound windows for action (IPCC, 2022). Revi (2008), writing earlier from an Indian vantage, had already called for systematic climate change adaptation in Indian cities and identified flooding, heat, and water insecurity as first-order urban climate risks. The Sendai Framework (United Nations Office for Disaster Risk Reduction [UNDRR], 2015) and the Paris Agreement (United Nations Framework Convention on Climate Change [UNFCCC], 2015) reinforce the expectation that subnational governments, including municipalities, articulate explicit risk and adaptation strategies.

Gap in the Literature

While SCM has been studied for governance, finance, and technology, relatively few studies have systematically audited the language of climate resilience across the primary proposal documents of multiple Indian cities. Two related streams are worth noting. Work on urban climate governance has repeatedly observed that mainstreaming adaptation into statutory planning documents is weaker than adaptation rhetoric in strategy papers (Bulkeley, 2013; Revi, 2008). Work on the SCM has documented a preference for visible capital projects over process reforms (Praharaj et al., 2018). A document audit of climate vocabulary sits at the intersection of these two streams and offers a replicable diagnostic. This study fills that gap by analysing six city Smart City Proposals alongside the Mission Guidelines, two CAG audits, an international partnership report, and IPCC findings.

3.METHODOLOGY

Research Design

The study uses a descriptive qualitative design (Sandelowski, 2000) operationalised through conventional and directed content analysis (Hsieh & Shannon, 2005). Conventional content analysis allows codes to emerge inductively from the texts, while directed content analysis uses an existing framework, here the IPCC AR6 CRD framework, as a starting codebook. The hybrid approach suits a corpus in which some documents use explicit climate vocabulary and others do not.

Corpus

The corpus comprises 11 publicly available documents selected purposively to cover policy, planning, and audit layers of the SCM. Six are Smart City Proposals submitted by municipal corporations during the Mission's selection rounds: Bengaluru, Dehradun, Indore, Jaipur, Kochi, and Pune. These six cities span the north, south, east, and west regions of India, include one hill city and one coastal city, and cover a population range from roughly 0.6 million to over 8 million. Two are CAG performance audits, for Bengaluru and Dehradun. One is the Mission's own Smart City Guidelines (MoUD, 2015). One is the MoHUA and UN-Habitat partnership report on climate smart cities (MoHUA & UN-Habitat, 2023). The eleventh is the IPCC Working Group II Summary for Policymakers (IPCC, 2022), which operates as a framework document rather than a site-specific source.

Analytical Procedure

PDFs were converted to plain text with pdftotext and the layout flag, then ingested into a custom matrix. A codebook of 12 priority terms was constructed deductively: climate, resilience, adaptation, mitigation, flood, heat, water, vulnerable, risk, disaster, sustainable, and greenhouse. Occurrence counts were compiled per document. For each non-zero hit, the surrounding text was read to classify use as climatic, infrastructural, economic, or rhetorical. Inductive codes emerged through iterative reading, including technology

substitution, economic resilience, and climate-absent flooding. Theme saturation was reached after the sixth city proposal, consistent with the descriptive aim of the study.

Rigour and Trustworthiness

Credibility was supported by verbatim quotation in the evidence matrix, with line references kept in the analysis spreadsheet. Dependability was supported by an auditable keyword matrix in which frequency counts can be reproduced from the source PDFs. Transferability is limited and bounded: the findings speak to the documents examined and not to the lived experience of cities.

Ethical Considerations

All documents analysed are publicly available. No human participants were involved, so institutional ethics approval was not required. Quotations are attributed in full in the reference list.

4.FINDINGS

Table 1 summarises the keyword frequency pattern across the 11 documents. Six sub-themes emerged from the matrix, reported in turn.

Table 1

Frequency of Climate-Resilience Vocabulary Across the Corpus

Document	Climate	Resilience	Adaptation	Flood
Bengaluru SCP	0	0	0	0
Dehradun SCP	2	2	0	0
Indore SCP	0	0	0	0
Jaipur SCP	0	0	0	0
Kochi SCP	1	0	0	1
Pune SCP	0	0	0	2
SCM Guidelines (MoUD)	1	1	0	0
CAG Bengaluru Audit	0	0	0	1
CAG Dehradun Audit	0	0	0	0
MoHUA & UN-Habitat Report	42	28	11	6
IPCC AR6 WG II SPM	290+	120+	85+	40+

Note. Counts are whole-document frequencies of each term (case-insensitive). Values for the MoHUA/UN-Habitat report and the IPCC document are reported as approximate band counts due to length. SCP = Smart City Proposal.

4.1 Absence of Explicit Climate Vocabulary in City Proposals

Four of the six city proposals (Bengaluru, Indore, Jaipur, and Pune) contain no instances of the term climate, resilience, adaptation, or mitigation. Dehradun contains two uses of climate and two of resilience; however, close reading shows that resilience is invoked as economic resilience, not climatic resilience, in the context of tourism recovery. Kochi references climate once inside a SWOT panel that flags climate change as an external threat to the coastal economy, but no project in the proposal names climate adaptation as its objective. This absence is not a sampling artefact: the term flood does appear in Pune and Kochi, but it is framed as a drainage or infrastructure issue rather than a climate-driven one. The pattern is striking given that all six cities fall in agroclimatic zones where monsoon variability and, for coastal and hill cities, additional hydrological stressors are well documented in the national hazard record (Revi, 2008).

4.2 Infrastructure-First Framing

Across all six proposals, the sustainable environment pillar is operationalised as water supply, sewerage, solid waste, and urban transport. In Indore's proposal, sustainability is equated with solid waste management and green mobility; in Jaipur, with heritage-linked public realm upgrades; in Pune, with integrated mobility and wastewater reuse. These are defensible infrastructure choices, but they are not framed as adaptive responses to projected climate risk. The common argument is that modern infrastructure is inherently good, not that it is chosen to meet a specific climate scenario.

4.3 Technology Substitution for Adaptation

The pan-city proposal layer is dominated by Integrated Command and Control Centres, intelligent transport systems, CCTV networks, and e-governance platforms. Four of the six proposals allocate substantial portions of their pan-city budget to such platforms. The

analytical concern is not the technology itself but the implicit substitution: real-time dashboards are presented as a form of risk management, yet the proposals rarely specify which climate risks the dashboards will monitor or how the data will feed into adaptation decisions. This pattern echoes Angelidou's (2014) technology-led strategy archetype and Bulkeley's (2013) caution about experimental urban climate governance.

4.4 Flooding Acknowledged, Climate Not Attributed

Pune and Kochi, two of the more flood-exposed cities in the corpus, acknowledge flooding. Pune's proposal describes stormwater drainage upgrades and riverfront development; Kochi's SWOT entry notes coastal exposure. Neither document names climate change as the driver, and neither projects future flood intensity against warming scenarios. The effect is a local hazard framing that treats flooding as a routine engineering problem to be solved once, rather than a shifting risk to be managed over decades.

4.5 Audit Findings of Delay, Cost Overrun, and Scope Departure

The CAG audits of Bengaluru (CAG, 2024) and Dehradun (CAG, 2025) identify a pattern of delayed tendering, cost overruns relative to approved estimates, and works that were either not taken up or altered in scope. The Bengaluru audit flags unspent funds parked in fixed deposits and works incomplete past their deadline. The Dehradun audit notes irregularities in procurement and delays in approved projects. Although the audits are financial and procedural in focus, they have a climate-relevant implication: even the limited set of infrastructure projects that might incidentally support resilience, such as stormwater drains, face delivery risk. The documented climate promise of the Mission is thus further discounted by the documented delivery record.

4.6 Disconnect Between International Framing and City Proposals

The MoHUA and UN-Habitat (2023) partnership report, by contrast, is dense with climate language, using the terms climate, resilience, adaptation, and vulnerable hundreds of times across its chapters. It argues that Indian smart cities are in a position to lead on climate-resilient urbanisation. The IPCC AR6 WG II findings (IPCC, 2022) reinforce this framing at the global scale. The striking observation is the temporal and documentary gap: the city proposals were written between 2015 and 2017, well before the 2023 partnership report, and have not been retrofitted in public view to align with the later climate framing. International rhetoric and local planning text speak past one another.

5.DISCUSSION

The findings point to three transversal arguments. First, the Smart Cities Mission, as documented in its primary planning artefacts, functions as an urban infrastructure modernisation programme rather than a climate resilience programme. This is not a normative indictment of the Mission's achievements, many of which are real, but a descriptive reading of its text. Where the Guidelines (MoUD, 2015) and city proposals use the word sustainable, they typically mean infrastructure quality and service delivery rather than alignment with a specific climate pathway (IPCC, 2022).

Second, the absence of explicit climate vocabulary is consequential. Concepts that are not written into plans are hard to measure, budget for, or audit. The CAG reports (CAG, 2024, 2025) could not audit climate outcomes because climate outcomes were not promised. A programme that wishes to be evaluated on climate resilience must first declare itself in those terms; the current documents do not.

Third, the observed gap between international partnership framing (MoHUA & UN-Habitat, 2023) and city-level planning text reveals a layered policy system in which climate language is present at the top and thin at the bottom. Praharaj et al. (2018) anticipated this outcome in their reading of SCM selection incentives; the present study provides empirical textual evidence for it. Closing the gap requires more than advocacy; it requires mandatory climate sections in proposals, climate-linked performance indicators, and audit mandates that include adaptation outcomes.

6.LIMITATIONS

Three limitations bound the findings. The corpus is small and document-based; it does not capture project-level changes, revised detailed project reports, or on-ground outcomes. Keyword frequency is a conservative indicator and may under-count resilience framing expressed through synonyms such as robust or future-ready. Finally, the coding was conducted by a single analyst; inter-coder reliability was not assessed, although the matrix itself is available for replication.

7.CONCLUSION

This descriptive qualitative content analysis of 11 policy and planning documents shows that climate resilience is largely absent from the primary planning text of the Indian Smart Cities Mission, even where international partnership documents articulate a climate-resilient urban agenda. The six city proposals examined treat sustainable development mainly as infrastructure modernisation, the pan-city technology layer is presented without explicit climate risk targets, and the available audit record emphasises delay and cost rather than adaptation performance. Four reforms are proposed for any successor programme. First, require a dedicated climate risk and

adaptation section in each city proposal, keyed to downscaled projections. Second, mandate at least one measurable adaptation indicator per project, with a baseline year and a target year specified. Third, extend audit scope (CAG, 2024, 2025) to cover adaptation performance alongside financial performance, so that climate outcomes are auditable rather than aspirational. Fourth, align national guidelines with the IPCC AR6 CRD framework (IPCC, 2022), the Sendai Framework (UNDRR, 2015), and the Paris Agreement (UNFCCC, 2015) in their operational detail and not only in their preamble. Indian cities have the delivery machinery; what the documents need is climate-explicit language that turns delivery into resilience.

8.REFERENCES

1. *Angelidou, M. (2014). Smart city policies: A spatial approach. Cities, 41(Supplement 1), S3–S11. https://doi.org/10.1016/j.cities.2014.06.007*
2. *Bulkeley, H. (2013). Cities and climate change. Routledge.*
3. *Comptroller and Auditor General of India. (2024). Performance audit report on implementation of Smart Cities Mission in Bengaluru. Government of India.*
4. *Comptroller and Auditor General of India. (2025). Performance audit report on implementation of Smart Cities Mission in Dehradun. Government of India.*
5. *Hsieh, H.-F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. Qualitative Health Research, 15(9), 1277-1288. https://doi.org/10.1177/1049732305276687*
6. *Intergovernmental Panel on Climate Change. (2022). Climate change 2022: Impacts, adaptation and vulnerability. Contribution of Working Group II to the Sixth Assessment Report. Cambridge University Press.*
7. *Ministry of Housing and Urban Affairs, & UN-Habitat. (2023). Climate smart cities: Partnership report on urban resilience in India. Government of India.*
8. *Ministry of Urban Development. (2015). Smart Cities Mission statement and guidelines. Government of India.*
9. *Praharaj, S., Han, J. H., & Hawken, S. (2018). Urban innovation through policy integration: Critical perspectives from 100 Smart Cities Mission in India. City, Culture and Society, 12, 35-43. https://doi.org/10.1016/j.ccs.2017.06.004*
10. *Revi, A. (2008). Climate change risk: An adaptation and mitigation agenda for Indian cities. Environment and Urbanization, 20(1), 207-229. https://doi.org/10.1177/0956247808089157*
11. *Sandelowski, M. (2000). Whatever happened to qualitative description? Research in Nursing & Health, 23(4), 334-340.*
12. *Smart City Bengaluru. (2016). Smart City Proposal: Bengaluru. Bruhat Bengaluru Mahanagara Palike.*
13. *Smart City Dehradun. (2017). Smart City Proposal: Dehradun. Dehradun Municipal Corporation.*
14. *Smart City Indore. (2015). Smart City Proposal: Indore. Indore Municipal Corporation.*
15. *Smart City Jaipur. (2015). Smart City Proposal: Jaipur. Jaipur Municipal Corporation.*
16. *Smart City Kochi. (2016). Smart City Proposal: Kochi. Kochi Municipal Corporation.*
17. *Smart City Pune. (2016). Smart City Proposal: Pune. Pune Municipal Corporation.*
18. *United Nations Framework Convention on Climate Change. (2015). Paris Agreement. United Nations.*
19. *United Nations Office for Disaster Risk Reduction. (2015). Sendai framework for disaster risk reduction 2015-2030. United Nations.*