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# Driving Urban Digitalisation through a National Mission— a multilevel governance perspective of India’s data smart cities strategy

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## ABSTRACT

This article analyses the Data Smart Cities Strategy, a key policy component under India’s ambitious 100 Smart Cities Mission, to understand how a national government-driven urban digitalisation agenda is being implemented in a federal political system where urban development responsibilities are shared between different tiers. A review of the implementation progress shows wide city-to-city variation in digitalisation and data readiness. Using the lens of multilevel governance as the analytical framework, our study highlights the importance of state-level factors in shaping city-level outcomes. Governance capacities and administrative attention towards urban issues vary significantly from state to state. This, in turn, impacts city performances as the institutional architecture of smart cities is dominated by state-level actors. We flag concerns that the top-down digitalisation agenda may widen the regional divide. While seed capital provided under the central scheme helped cities in poorer states to build expensive digital infrastructure, there are uncertainties regarding how these will be managed once the scheme ends.

## KEYWORDS

Data smart cities strategy; smart cities mission; Urban digitalization; multilevel governance; India

## Introduction

Across the world, cities are embracing technology to improve the management of urban infrastructure services and citizen interfacing through resource optimisation. The COVID-19 pandemic escalated the drive for digitalisation and the demand for smart city technologies. However, smart city technologies are expensive and require high levels of technical expertise to operate – which many cities, especially those in the developing world, find difficult to mobilise internally. Hence, cities are trying to forge partnerships with private sector technology companies and other corporate actors (Jayasena et al., 2021). A new model of “collaborative” urban governance, based on networks between state and corporate actors, has become popular in smart cities.

However, from a conceptual standpoint, the implementation of smart cities has faced criticism. While technology companies have been championing the idea of smart cities for the past two decades, Hollands (2008) and Kitchin (2015) argued that technology is not an

end in itself and questioned what smart cities deliver in tangible terms. Conventionally, smart cities are associated with the application of advanced information and communication technology (ICT) to digitally connect urban systems. However, there is no universally acceptable definition, and cities tend to define “smartness” in their own ways. There are apprehensions about the concept turning into corporate branding exercises without definitional clarity (Hollands, 2008; Kitchin, 2015). According to Datta (2015), smart cities express neoliberal ideology, prioritising urbanisation as a business model rather than a model of social justice. Cardullo et al. (2019) raised concerns that the influence of technology consultants in shaping urban policies and emergent forms of corporatised governance may increase social polarisation and widen the digital divide.

Meanwhile, the technical and financial capacities of cities taking up digitalisation projects have come under the spotlight. UN-Habitat (2022) suggests an integrated and multilevel governance approach towards building smart cities. While rolling out digital infrastructure, cities need to prioritise people’s needs, include different stakeholders, lower obstacles to participation, and evaluate digital services and infrastructure from a human rights viewpoint. As new digital infrastructure can strain municipal finances and lead to underused or misallocated digital services, cities must make prudent decisions. Moreover, local governments, especially those in developing countries, need technical, financial and policy support from national governments to meet these digitalisation challenges.

As a theoretical framework, multilevel governance articulates a polycentric, multi-pronged and heterogeneous approach towards governance. It recognises the growing importance of interconnectedness between actors operating at various government levels and between state and non-state actors (Jing & Li, 2019; Reardon et al., 2022). Applications of multilevel governance first started in the European Union to study policy integration across different government tiers (George, 2004; Pierre, 2019). Subsequently, it has been applied in other political contexts, such as China (Jing & Li, 2019; Xu, 2021) and India (Sethi et al., 2021; Stehle et al., 2020).

This article uses multilevel governance as the analytical lens to review how Indian cities are being digitalised through a national government-driven policy agenda under the Smart Cities Mission (SCM). India’s national government launched the SCM as a policy programme in June 2015 for a five-year period, later extended by three years and ending in June 2024 (Economic Times, 2023). The scope of the mission included 100 cities covering 35% of India’s urban population (Ministry of Urban Development, 2015). The overarching aim was to improve the quality of life for people in cities through the induction of digital technology. It was a key component under the “Digital India” initiative – an all-round vision of national development through the wide application of information and communication technologies to improve public service delivery.

However, in the SCM policy design, “smartness” was flexibly defined to permit participating cities to decide their digital technology requirements according to their local context (Ministry of Urban Development, 2015). Consequently, cities took up a wide range of digital projects. This, however, restricted the scope of national-level comparison of city performances only to fiscal data – to what extent had the cities been able to utilise allocated funds or generate additional resources? Subsequently, the Data Smart Cities Strategy was launched in 2018 as a subsidiary policy under the SCM, underscoring the importance of achieving data smartness as a key step towards the digitalisation of urban services. As part of this initiative, Data Maturity Assessment

Framework – a new benchmarking toolkit was also introduced (Smart Cities Mission, 2023b). This toolkit includes five key indicators (policy, process, people, technology, and outcome) that allow for a more granular understanding of city performances in managing digitalisation. The latest round of data maturity surveys shows that while a few cities have become digitally enabled, many more are lagging behind (Smart Cities Mission, 2023a).

This article focuses on the Data Smart Cities Strategy to explore how a national government-driven urban digitalisation agenda is being implemented in a federal political system where urban development responsibilities are shared between national, state and city governments. Focusing on the Data Smart Cities Strategy thus allows us to get a holistic and pan-India picture of urban digitalisation. It also allows us to use the multi-level framework, as the implementation of the strategy involves all three levels of the government as well as non-state actors. There are two key research objectives. The first is to explore the roles of key state and non-state actors driving India's urban digitalisation strategy at different government tiers. The second is to examine why cities under a national-level technology support scheme perform differently. Although many studies investigate the Indian Smart Cities programme (Datta, 2015; Praharaj & Han, 2019; Prasad & Alizadeh, 2020; Prasad et al., 2021; Roy & Chatterji, 2020), the Data Smart Cities Strategy, critical to addressing the digital turn in India's urban governance, has not received adequate attention.

The article is organised as follows. After introducing the topic and discussing the background, we review the literature on the political economy of urban digitalisation, focusing on multilevel governance. Next, we explain the study's methodological approach. The fourth section provides background information regarding the Indian smart cities programme's political-economic context and the salient features of its Data Smart Cities Strategy. The fifth section discusses the roles of key stakeholders in driving urban digitalisation initiatives in a multilevel-governance context. Next, we analyse the data readiness of Indian smart cities. Finally, we synthesise the lessons learned.

## **Urban digitalisation and multilevel governance**

Urban digitalisation has recently received considerable scholarly attention in the literature on smart cities. However, research is scarce on how digitalisation can be scaled up in cities of the Global South by implementing programmes initiated at upper governmental tiers. According to Tan and Taihagh (2020), budget constraints, lack of skilled human capital, inadequate technology-related infrastructure, and governance deficits are key barriers impacting urban digitalisation in developing countries. Retrofitting digital technologies in city infrastructure is expensive and difficult to meet with current funding. This results in the use of alternative options for funding smart cities, including public-private partnerships, municipal bonds, data digitalisation, and advertising (Jayasena et al., 2021; Ruhlandt, 2018). Moreover, the design, installation and operation of advanced ICT-enabled devices require specialised technological skills, not available within city governments. There is thus a clear trend of cities trying to collaborate with the private sector for financial and technical support. In doing so, the process of urban digitalisation has become a key arena for neoliberal state restructuring, marking a shift in the role of the

state from the provider of urban infrastructure services to a facilitator of private enterprise (Grossi & Trunova, 2021).

Collaboration between government and corporate actors in a network form of governance is a characteristic feature of neoliberal cities. One common goal of these networks is to achieve higher efficiency. The perceived efficiency is a result of outsourcing, the digitalisation of municipal services, and growing dependence on private capital and market-based arrangements to fund urban infrastructure investments (Brenner et al., 2010; Rossi & Vanolo, 2015). “Smart city” became an effective label for this techno-business endeavour (Hollands, 2008). The neoliberal political-economic environment had spurred competition between cities. Many cities are trying to leverage the “smart” prefix to attract new investments.

The political economy of smart cities cannot, however, be explained by neoliberalism alone and requires factoring processes of state digitalisation. In recent decades, information has become the new currency of capital, and the flow of this currency is made possible by developing digital infrastructure. Digital infrastructure shaping how data are produced, managed, stored and analysed, has far-reaching governance implications (Kitchin, 2015). With digital infrastructure increasingly mediating how and to what extent the government now interacts with people, the strengthening of digital infrastructure has become a central concern for the state, impacting its reach and influence, Kitchin (2015) argues. The informational power of the state is thus constituted and enhanced through mining, analysis, and storage of citizen data.

Infrastructural push by digitalising states are reconfiguring modalities of public administration, changing government – industry relationships and shaping a new form of public-private collaborative governance. Dunleavy claims that digital platforms and operating systems created by MNCs are replacing governmental management methods to produce more disparate, fragmented, and networked bureaucracies. Dunleavy calls them a “para-state” where contractors are brought into direct touch with state bureaucracy through digital infrastructure, supporting a “new world of huge governments, IT operations and their partnerships with major service providers” (Dunleavy et al., 2006, p. 218).

Datta (2022, p. 142) contends that state digitalisation strategies in the global south are closely linked to processes of urbanisation and terms it “digitalisation as urbanisation”. As state agencies extend their power and hold over metropolitan regions by rolling out digital infrastructure in conjunction with corporate partners, new forms of networked urban governance are taking shape. In the process, the roles of “information brokers”, transnational technology companies and management consultants are also expanding in the urban policy space. With the growing synergy between forces of digitalisation and urbanisation in smart cities, a new opportunity has opened for the state and its technology partners to reconfigure a regime of information and data-driven capital accumulation.

From a governance perspective, smart city projects involve substantial coordination between many public and commercial sector entities, where policy interconnectivity and collaboration are crucial (Dunleavy et al., 2006; Viale Pereira et al., 2017). In the Indian context, there is also a need for extensive collaboration between different levels of government. In India, the national government drives digitalisation policy through the SCM, unlike in rising economies such as Sao Paulo (Viale Pereira et al., 2017) and Johannesburg (Söderström et al., 2021) where the corresponding city governments are the key policy actors. However, implementing a centralised

programme such as the SCM requires extensive coordination across tiers, as urban governance responsibilities are split between national, state and city governments in the Indian federal system.

In recent decades, multilevel governance has emerged as a useful lens to study situations requiring collective actions through high degrees of vertical and horizontal policy interconnectedness. The need for such a framework first became apparent in the context of European integration as local governments started participating in various EU projects (George, 2004; Pierre, 2019). Thus, policymaking was no longer restricted within the nation-state but was simultaneously transnational and sub-national. As such, it required a new conceptual framework.

In federal political systems, constitutional mandates typically guide policy discussions among national, state, and local governments. However, multilevel governance allows for a more fluid, flexible interaction between policy actors operating at different levels that is not strictly hierarchical, according to Zürn (2010). Sub-national governments are seen as critical actors in the multilevel governance framework. Instead of remaining mere implementers of policies set at upper tiers, they have started to play key roles in various global policy networks such as climate change governance (Jørgensen et al., 2015) and localisation of the sustainable development goals (Croese et al., 2021). They also act as policy laboratories, and innovative sub-national policy interventions are often scaled up at upper levels (Schakel et al., 2015).

Moreover, multilevel governance also recognises the importance of non-state actors in policymaking. Conceptual framing of multilevel governance is, thus, wider and less hierarchical in scope rather than a purely state-centric approach (Bache et al., 2016). At its core, multilevel governance reflects a shift away from the exclusive authority of centralised governments towards a more inclusive and collaborative approach to governance. It also recognises that governance is not solely the government's responsibility but involves multiple actors, including non-state actors in civil society and corporate entities. This approach acknowledges the interdependencies and complexities of modern governance and aims to involve a broader range of stakeholders in policymaking processes.

Hooghe and Marks (2010) provide a further nuanced conceptualisation of the framework by classifying MLGs into two categories with regard to functionality and jurisdictions. In Type I multilevel governance, administrative power is primarily territorial in nature but general in terms of functional scope. Defined territorial jurisdictions such as state governments and municipal governments share administrative responsibilities. However, within their territories, the scope is wide ranging. Municipal governments typically provide diverse functions within their territories, such as water supply, waste management, public health service and primary education. As the functions are diverse and not necessarily interrelated, in most Type I MLG, administrative authorities are constituted in a hierarchical structure (Hooghe & Marks, 2010). In contrast, under Type II MLG, organisations are more specialised in terms of their functional responsibilities but may cover several jurisdictions (Hooghe & Marks, 2010). As task-specific organisations that can be deployed across jurisdictions, they generally increase operational flexibility and efficiency (Bache et al., 2016). For example, a water distribution authority may serve several municipalities to achieve greater economies of scale and efficiency, rather than each city running its own service.

However, Type I and Type II MLGs are not mutually exclusive, and governance arrangements of cities often incorporate both categories together. In a city, certain functions may be delivered through territorially constituted Type I MLGs like municipal governments, and others by Type II MLGs like metro rail authorities and housing boards. However, the distribution of functions and degrees of autonomies enjoyed by different categories of MLGs are situation specific. National political settlements determine the diffusion of authority across national, state, and local levels. The ability of city governments to take appropriate policy steps greatly depends upon political empowerment and financial autonomy.

### ***Multilevel governance in the Indian context***

Researchers have applied the multilevel governance framework to study climate change (Beermann et al., 2016; Sethi et al., 2021; Stehle et al., 2020), developmental schemes (Reardon et al., 2022; Tillin, 2022) and centre-state relations (Swenden et al., 2022) in the Indian context. There is a broad consensus within this diverse body of work that the national government strongly influences the Indian federal system, and city governments are weak. Although the states had gradually gained much power following the reforms of the 1990s, the centre remains considerably stronger compared to the states, politically and economically (Reardon et al., 2022; Sethi et al., 2021; Stehle et al., 2020; Swenden et al., 2022; Tillin, 2019, 2022). Tillin (2019, p. 4) describes the Indian system as a “centralised model with a strong degree of interdependence between the central government and the states”.

In recent years, the central government launched several urban-centric schemes, such as smart city missions, anchored at the top by the Ministry of Housing and Urban Affairs. However, implementing the schemes requires active state support, as state governments are primarily responsible for urban development under the Indian constitution. State governments exercise tight control over cities in a top-down manner (Beermann et al., 2016) and State Urban Development Departments are required to monitor their performances in implementing centrally funded programmes (Figure 3 shows multilevel governance arrangements for the Smart Cities Mission).

The institutional structure of urban governance in India is fragmented, as there is no overarching authority at the city level. Municipal governments, administrative autonomy and financial capacity (Jacob & Jacob, 2021, Reardon et al., 2022, Vachana, 2018). Barring a few exceptions, in most cities their responsibilities remain restricted to waste management and a few minor functions. Elected mayors have limited authority on policy matters, while Municipal Commissioners (state government-appointed bureaucrats) exercise executive powers. Constitutional reforms of 1992 sought to empower elected municipal bodies by demarcating their responsibilities vis-à-vis the state governments. However, implementation of the reforms has been slow and uneven across the states.

Instead of strengthening traditional municipal bodies, which are Type I institutions, state governments prefer to manage key urban services through bureaucrat-run quasi-public agencies, which could be classified as Type II category according to Hooghe and Marks’s (2010) classification. Moreover, there is a growing trend to corporatise urban governance and attract private investments in urban infrastructure by creating special purpose agencies (Kennedy & Sood, 2019; Sinha, 2021). These are often formed as public

sector companies that allow private sector equity participation. Kennedy and Sood (2019) attribute these companies to the neoliberal rescaling of the Indian state that favours governance functions to be outsourced to non-elected bodies outside the purview of democratic institutions. Sinha (2021) argues that the incorporation of these companies within the urban governance sphere has altered existing power hierarchies, blurred boundaries between state and private actors, and further cemented the top-down planning approach. Moreover, the multiplicity of agencies makes inter-agency coordination difficult as no overarching coordinating body exists.

## Methodological approach

The research aims to provide a nuanced understanding of how the Data Smart Cities Strategy is being implemented in a regionally diverse country in a theoretically grounded way by using the multilevel-governance framework as its analytical prism. The central research questions are: (1) Who are the actors driving India's urban digitalisation strategy? and (2) Why do cities under a national-level support scheme perform differently?

The research is exploratory. According to Stebbins (2001), exploratory research is particularly beneficial when the subject area is broad, complex, or relatively unexplored. In the case of investigating India's smart cities policy, the exploratory research approach can be particularly useful as it is a relatively new policy area with limited research available (Prasad et al., 2021). As per our understanding, there had not been any previous academic research on the Data Smart Cities Strategy, which is a significant sub-policy within the SCM.

The research proceeds in three steps. First, we focus on the national level. We map the institutional architecture behind India's urban digitalisation strategy by analysing the roles of key state and non-state actors in the Type I and Type II categories. Having established the basic governance structure, we review data readiness levels achieved by the cities under the SCM in the second step. We show that even though the Data Smart Cities Strategy is a national agenda, its outcome is regionally uneven. We attribute this to sub-national factors. In the final step, we provide a further fine-grained analysis of the sub-national governance by comparing the four most advanced cities regarding data readiness versus the four most backward cities.

The research has taken a case study approach. As per Yin (2014), a case study is an empirical enquiry that investigates a contemporary phenomenon in its real-life context. It is particularly appropriate when the boundaries between the phenomenon and its context are not clearly evident. The subject of focus is a single case – the Data Smart Cities Strategy. However, the Data Smart Cities Strategy is part of the SCM, a national government programme covering 100 cities. Therefore, the single case study offers opportunities for a comparative analysis at a national scale. The research also includes a more detailed comparison between eight of these cities regarding data readiness to understand how the roles of sub-national governments matter in a multilevel governance framework. These eight sub-case study sites are Bhopal, Imphal, Jhansi, Patna, Pune, Pimpri-Chinchwad, Shillong, and Surat. These cities were identified based on their ranks as per the Data Maturity Assessment survey carried out by the Smart Cities Mission directorate under the Ministry of Housing and Urban Affairs, Government of India. All these cities have



similar institutional architecture of smart city governance, being part of the national mission. However, they belong to different states, and state-level governance capacity significantly differs in India (Jacob & Jacob, 2021).

The research involves both quantitative and qualitative data analysis. Quantitative data were collected from the SCM documents and other authentic government sources (e.g., Census, Niti Aayog, Reserve Bank of India). Qualitative data were collected through “elite” interviews of key policymakers and stakeholders. These are particularly helpful in getting deep insights in policy research (Yin, 2014). Semi-structured interviews of 22 key respondents (senior government officials, chief executive officers (CEO) of smart city companies, and senior executives of technology consulting firms) were conducted between December 2022 and February 2023. Interviewees were primarily asked questions about the implementation challenges of the Data Smart Cities Strategy. Each interview lasted between 60 to 90 minutes. The interviews were coded alphanumerically. Three codes were used -“G” (government officers), “C” (consultants and technology companies), and “P” (policy analysts and academics). The data obtained were triangulated by analysing key policy documents.

### **Political-economic context of India’s smart cities mission**

The flagship SCM mission combines two key national priorities – fast-tracking digitalisation and improving the quality of urban life. In doing so, it exemplifies “digitalisation as urbanisation”, where the state plays a significant facilitative role to “bolster its operational logics of governance” in alliance with corporate capital represented by transnational technology firms and consultants (Datta, 2022, p. 146). SCM was launched in 2015, following the election of the Bhartiya Janata Party government in 2014. The party’s manifesto pledged to build 100 smart cities and set out an urban development-centric aspirational agenda powered by digital technology. India is undergoing a process of massive urban shift. The share of the urban population, which was 31% in Census 2011, is estimated to cross 50% by 2047 (UN, 2018).

However, in the Indian context, “digitalisation as urbanisation” is not a new phenomenon and is deeply rooted in post-liberalisation policy discourse. Following the structural reforms of the early 1990s and gradual integration with the global economy, India’s national government sought to bring about greater efficiency in the functioning of public institutions by ICT integration and encouraging e-governance applications at all tiers (Aghion et al., 2008). At the time, India was becoming a crucial global sourcing destination for software and various other ICT-enabled back-office services. The rapid success of the ICT services sector in penetrating the global knowledge economy market made a deep impression among the policy elites. The sector started receiving various fiscal and non-fiscal incentives and became entwined with nation-building aspirations (Chatterji, 2018).

Alongside a focus on service-sector-led economic growth, the national government also began to pay greater attention to urban development by launching the National Urban Renewal Mission in 2005. This programme, covering 65 cities, sought to liberalise urban policy by encouraging a greater role for the private sector. It also spearheaded ICT integration in municipal bodies by dovetailing with the National e-Governance Plan

(Chatterji, 2018). Cities were provided with additional financial grants to introduce management information systems for municipal services. However, despite national support, many cities struggled to implement e-governance applications.

State digitalisation efforts received another round of policy push when the Digital India Initiative was launched in 2015, significantly expanding the scope of technology applications in daily life. Digital technology usage in India has substantially gone up in recent years. Between 2014 and 2018, the number of smartphones per 100 people increased from 5.4 to 26.2; internet users went up from 239 m to 560 m; and cashless transactions jumped from 2.2 to 18 per person per year (McKinsey Global Institute, 2019).

The SCM takes forward Digital India's objectives by facilitating the integration of the Internet of Things, artificial intelligence, blockchain and big data with urban services. In doing so, we argue, it marks a further emphatic turn towards neoliberal urbanism that began under the National Urban Renewal Mission in three specific ways. First, the SCM institutionalised a new practice of competition between cities to access national funds. Initially, cities competed within their states, followed by national-level competition among the state champions (Ministry of Urban Development, 2015). Second, the SCM has vastly expanded the market for technology companies and ICT consulting firms in the urban infrastructure segment. Third, and most significantly, the SCM marks a distinct shift towards the corporatisation of urban governance. The SCM requires all participating cities to setup a public sector company as a special purpose vehicle to implement the mission projects (Ministry of Urban Development, 2015). Smart City special purpose vehicles are public limited companies. While special agencies had previously provided urban services in a few cities, the SCM has significantly expanded the scale and scope of their involvement in urban governance (Roy & Chatterji, 2020).

Neoliberalism, however, unfolds in geographically varied ways. As a political-economic practice, the neoliberal mode of regulations relies on existing sociocultural institutional settings and local contexts (Brenner et al., 2010; Rossi & Vanolo, 2015). Even though neoliberalism is commonly associated with a shrinking government in the West, state-led developmentalism is common in developing Asian economies (Kohli, 2014) and is evident in most smart city projects (Joo & Tan, 2020). However, in multilevel systems, which actor plays what role remains context-specific. For example, under the "All in one eco-city" pilot project initiated by the Chinese national government to facilitate green economy transition, the municipal governments are leading the actual development process (Höffken & Limmer, 2019). In contrast, China's "Internet +" national strategy gives extensive scope for private enterprises to offer an array of digital services.

The proactive role of the national government, India's SCM has broad similarities with the above Chinese examples. Although centre – local equations play out differently due to contextual differences. We argue in the following section that by rolling out programmes like the SCM, the national state has inserted itself as a key actor at the city stage, spearheading neoliberal ideas along with nation-building narratives. However, the corporatisation of urban governance has shrunk space for elected municipal bodies.

### ***Smart cities mission and its data smart Strategy***

The SCM is a central government-sponsored scheme with a complex financing mechanism involving public and private funds. The overall budget is INR 2,050,180 million. Out of

this, direct government grant accounts for 45%. The rest include public-private partnerships (21%), convergence with other government programmes (21%), loans and miscellaneous sources (13%) (Smart Cities Mission, 2021). As of Feb 2023, a total of 5002 projects worth INR 925,610 million have been completed, and 2740 projects amounting to INR 890,000 million are ongoing, thus accounting for 90% of the planned budget (Ministry of Housing and Urban Affairs, 2022).

Projects under the SCM are divided into two components (Ministry of Urban Development, 2015). The “area-based development” component focused on comprehensive urban renewal of a specific urban precinct. The “pan-city” component sought to provide ICT-enabled smart solutions for the entire city (e.g., automated traffic signalling, monitoring garbage collection, mobile apps for grievance tracking) and led to the setting up of Integrated Command and Control Centres in all cities. These command centres use sensors to combine data from numerous applications and act as nerve centres of smart cities.

Initially, the “area-based” strategy received four-fifths of the mission budget, but from 2018 onwards, the SCM began to lay greater emphasis on digital technology applications and data smartness by launching Data Smart Cities Strategy as a sub-policy component (Smart Cities Mission, 2023b). The strategy aims to reduce gaps between the outcomes and the desired goals in governance systems by focusing on data management. Based on principles of “People – Platform – Process” as its three guiding pillars, the strategy aims to develop well-capacitated institutional structures across all tiers of governance, facilitate the formation of networks and alliances between state and non-state actors, and put in place process enablers for operationalisation of technology platforms. Conceptually, the Data Smart Cities Strategy is aligned with the National Urban Digital Mission, launched in 2021 (Ministry of Housing and Urban Affairs, 2021) and is considered version 2.0 of the SCM (See Figure 1).

The Data Smart Cities Strategy, together with the Urban Digital Mission, envisages extensive application of data platforms in urban governance. and its architecture includes three broad constellations of national-level digital platforms (Ministry of Housing and Urban Affairs, 2021):

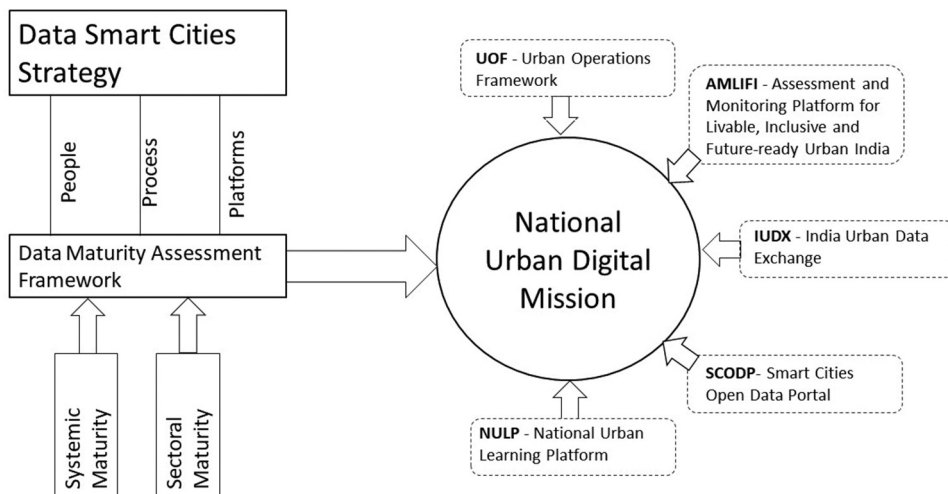
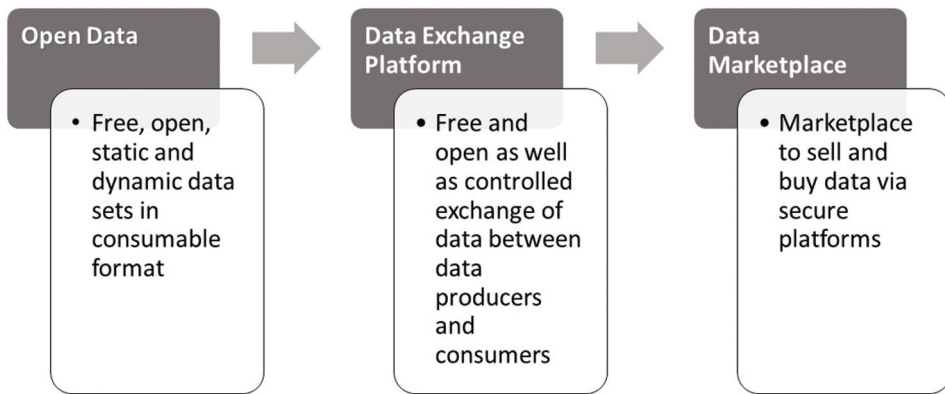


Figure 1. Convergence between the data smart cities strategy and the National Urban Digital Mission.

- Urban Outcomes Framework – Performance monitoring of cities against environmental and financial indicators
- India Urban Data Exchange – Information exchange between urban data producers and consumers
- National Urban Learning Platform – Capacity building of city officials

In addition to improving day-to-day urban management capacities, the data smart strategy also has an economic angle. That is to facilitate innovations through academia and industry exchanges through open data portals, spur a startup ecosystem and generate opportunities for data monetisation (see [Figure 2](#)).



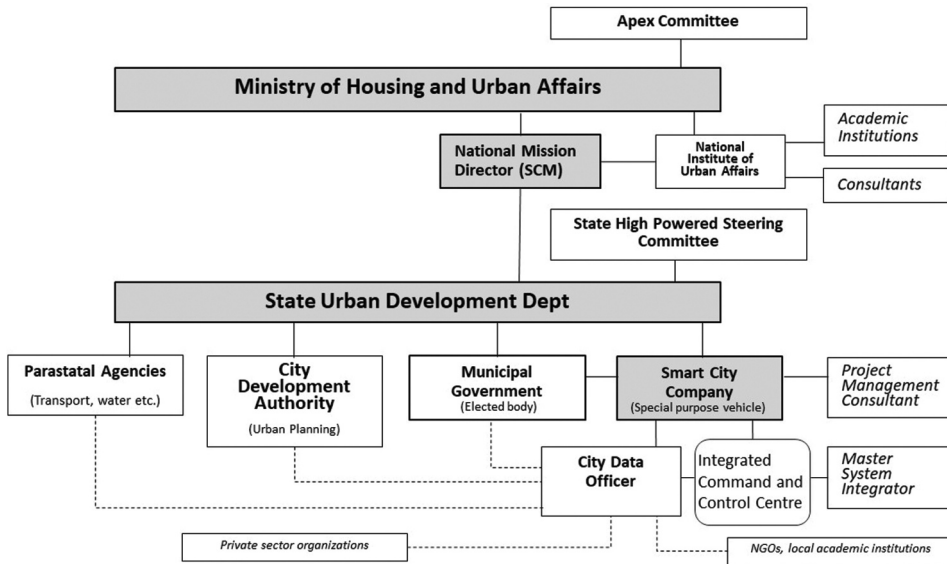
**Figure 2.** Data monetisation concept.

While framing data for the strategy, the SCM considered various operational challenges facing Indian cities (Smart Cities Mission, 2023a). Firstly, there are data consolidation problems due to the multiplicity of agencies. Data captured by different city agencies are typically kept in silos. As a key Ministry official put it, “Most city agencies neither analyse data to create insights and actionable intelligence nor do they share with different stakeholders” (Interview G03: 5 December 2022). Secondly, cities lack defined data policies, which are essential to determine protocols regarding data sharing, privacy, security, and ownership. Thirdly, there are problems regarding data sharing between government and private agencies. Finally, the absence of appropriate data platforms makes data sharing ineffective and arduous.

The data smart strategy sought to overcome these challenges by encouraging a data culture in cities and putting in place a new multilevel institutional mechanism for urban data governance by tweaking the original implementation framework of the SCM, as we discuss next.

### Multilevel smart city data governance

This section uses the multilevel governance framework to examine the roles of key actors involved in the SCM and its data strategy. First, we discuss the roles of state actors at national, state and city levels, followed by non-state actors at all three levels. [Figure 3](#) shows the multilevel governance arrangement for the SCM and its data strategy.



**Figure 3.** Multilevel governance structure for the SCM and its data smart cities strategy.

### **National level**

The Ministry of Housing and Urban Affairs helms the Smart Cities Mission. As the apex institution, it defined the aims, objectives, institutional structure, progress monitoring guidelines, timeframes, and various operational protocols of the mission. An Apex Committee headed by the Secretary of the Ministry and comprising representatives from other ministries, state governments and smart cities is responsible for the overall monitoring of the mission (Ministry of Urban Development, 2015). The National Mission Director is the operational head of the mission and its nodal coordinator for interfacing with states, participating cities, and external stakeholders, like the UN-Habitat, the World Bank and policy think tanks.

In addition to the Ministry, policy design for the Data Smart Cities Strategy involved two other institutions. The Indian Institute of Science Bangalore, a leading academic institution, framed digital technology specifications, and the National Institute of Urban Affairs, a New Delhi-based policy think tank, provided inputs by curating global best practices and organising training courses for city officials (Smart Cities Mission, 2023a).

The data smart strategy has further expanded the scope for central monitoring of city performances compared to the SCM's original policy design (Interview P01: 6 December 2022). Under SCM, smartness is loosely defined, and consequently, participating cities developed various projects. This, in turn, restricted the scope for national-level city-to-city comparison only to fiscal data – to what extent had the cities been able to utilise allocated funds or generate additional resources? Meanwhile, the Data Smart Cities Strategy allows for more fine-grained information regarding digital infrastructure availability, human resource capacity, and the application of data to drive policy changes.

In a multilevel-governance context, the data strategy is thus linked to a growing emphasis on data platforms to monitor the performances of lower-tier governance

units. Since launching the Digital India Initiative in 2015, the national government has intensified benchmarking of states and cities in delivering public services and social welfare (Upadhyay et al., 2022). State/city performances are widely reported in the media, and the administrators tend to publicise good rankings as their achievements. Regarding sanitation, air quality, tax collection effectiveness, and other aspects, the Ministry of Housing and Urban Affairs has initiated the oversight of municipal service performance. This process is accelerated further by the Data Smart Cities Strategy, which publishes a ranking of the data maturity of cities. Moreover, enhancing the quality of urban data is the critical facilitator for this platform-governance, indicator-driven scheme.

### ***State level***

As the state governments are primarily responsible for urban development issues in India, they are key actors in the smart cities' implementation process, including its data strategy. States are required to part finance national urban schemes by providing matching grants to ensure their commitment. According to the SCM financing guidelines, the states are required to provide a 50% matching grant (Ministry of Urban Development, 2015). This means that for each city, the central and the state governments are equal stakeholders in financial terms.

States are also required to monitor the performance of cities. A High-Powered Steering Committee chaired by the Chief Secretary and comprising members from smart cities and state and national governments. The senior bureaucrat of the state government oversees SCM activities (Ministry of Urban Development, 2015). The committee includes representatives from various state ministries, smart cities within the state and the national government's Ministry of Housing and Urban Affairs. The Secretary of the State Urban Development Department acts as secretary to the committee and as the State Mission Director.

### ***City level***

While the SCM's national and state-level institutional arrangement is similar to all other centrally sponsored schemes, it differs at the city level and articulates a strongly corporatised approach. Unlike other centrally sponsored schemes where city-level responsibilities are vested in the municipal government, special purpose agencies, incorporated as public sector companies, are responsible for implementing the SCM projects. Although state and municipal governments jointly own majority shares of smart city companies, the SCM guideline allows transfer of 40% of the stock to private entities (Ministry of Urban Development, 2015).

The Data Smart Cities Strategy recommends that each smart city company have a dedicated Data Cell, headed by a city-data officer (Smart Cities Mission, 2023b). The Data Cell must be supported by a pool of data champions and coordinators in various city departments and governance agencies (Smart Cities Mission, 2023a). The city-data officer is responsible for formulating city-data policy, establishing city-data security guidelines and developing alliances with industries and academia for policy inputs.

As explained previously, smart city companies are Type II category institutions under the multilevel-governance framework (Hooghe & Marks, 2010; Reardon et al., 2022). At the

city level, smart city-related activities are thus coordinated by a Type II body, not the municipal government, a Type I institution. However, this corporatised governance model has sparked various debates. According to Sharma (2018), smart city companies are useful in overcoming capacity deficiencies in municipal governments, attracting external investments to finance infrastructure and speeding up project execution, as they are less constrained by regulatory requirements compared to municipal governments (Sharma, 2018). However, critics argue that these companies are fostering a “techno-utopian” fantasy to further the interests of urban elites (Datta, 2015) and undermining local democracy by strengthening the roles of state government-appointed bureaucrats over elected municipal bodies (Roy & Chatterji, 2020).

Indeed, entrusting SCM implementation responsibility to smart city companies as a parallel institutional entity at the city level has generated tensions and role conflicts. Making cities smart is not a stand-alone activity, and projects funded through the SCM (e.g., smart traffic signalling and smart waste management) have extensive interfaces with various other city services. Moreover, as discussed before, about 21% of the project funds must be mobilised through convergence with other central schemes which are coordinated by respective municipal bodies. The multiplicity of agencies working in silos, without a central coordinating body, has long been a key challenge facing Indian cities (Jacob & Jacob, 2021; Vachana, 2018). The institutional design for smart cities further complicated the situation.

In practice, most Indian cities have sought to overcome this role conflict by entrusting the commissioner of municipal corporation with the additional responsibility of being the CEO of the smart city company (Parker et al., 2023; Prasad & Alizadeh, 2020; Prasad et al., 2021). Moreover, an analysis of the composition of the board of directors of all 100 smart city companies by Zérah et al. (forthcoming) shows the dominance of state government-nominated bureaucrats. In contrast, the inclusion of elected municipal ward councillors is almost nil, although the SCM guideline has provisions. While some smart city companies have mayors on their boards, in real-life situations, they only have a token role in decision-making (Parker et al., 2023).

While the smart city companies constituted as special purpose vehicles are key actors at the local level, they have limited policy autonomy and report to the state governments. They also require financial support from the state governments as municipal governments are severely financially constrained. As the CEO of a smart city company put it, “the state governments are indeed pivots in making cities data smart. No smart city company can really decide on its data policy without consulting the state government” (Interview G05: 14 January 2023). Considering this reality, the data smart strategy suggested the need for a dedicated data analytics and management unit within state urban development departments to monitor city performances.

Therefore, the SCM shows a dual control system at the municipal level, with a significant role for the state government. States have more power over cities since they hold the de facto lever of control over the coordination of SCM-funded projects at the municipal level, even if this coordination is the job of a public sector business. This represents a major change in strategy for the federal government as well. Previously, it used programmes like the National Urban Renewal Mission to financially compel state governments to decentralise urban governance and give more authority to municipal bodies. However, the SCM shows no evidence of this kind of goal and unintentionally helped states further centralise their duties for urban governance.

## **Non-state actors**

In addition to the roles of the state actors discussed above, various categories of non-state actors – academic institutions, consultants, NGOs, think tanks, and technology companies – are actively involved in the SCM. Engagement between state and non-state actors is most visible at the national level and the city level. Among the non-state actors, most extensive are the roles of the global management consulting companies (Chakravarty et al., 2022; Purandare, 2021). Engagement of international consulting companies in India's urban development sector began to increase following the opening of the economy in the 1990s. However, under the SCM, a paradigm shift took place in the state-consultant relationship. Previously, consultants were thought of as external experts hired for a set amount of time to complete a specific assignment. Now, their roles have been institutionalised as important policy actors in urban governance processes. And they have also become far more extensive, ranging from ideation to planning to implementation to project administration (Purandare, 2021).

From the inception of the SCM, the Urban Affairs Ministry began to engage with external experts and received extensive input during the initial policy design phase. As a senior official who was involved with the SCM at its inception phase explained,

Launching of the Smart Cities Mission was a big challenge for all of us. . . . It was a completely new thing. . . . Digital infra are there in Dholera and GIFT City – but these are greenfield cities and small in scale. There were smart cities in developing countries like Sao Paolo and Johannesburg. But they have strong local governments. What would work in Indian context? So, we talked with a lot of people – UN-Habitat, LSE, Bloomberg, McKinsey – we talked with more than 50 organisations (Interview G04: 8 December 2022)

Subsequently, at the launch phase of the national challenge round competition, the Ministry engaged consultants to guide the shortlisted cities to prepare Smart City Proposals. Individual consulting firms and consortiums selected include Indian affiliates of international management consulting (e.g., Deloitte, KPMG), engineering (e.g., AECOM, Ecorys) and real-estate (e.g., Knight Frank, Jones Lang LaSalle) companies and also several well-known Indian firms (e.g., Engineers India, Darashaw) (Smart Cities Mission, 2015). Ministry officials reasoned that the cities would need handholding since they lacked internal capacities. However, allowing the cities to select their own consultants would have delayed the entire process. As a former Ministry official explained,

You see Smart Cities Mission is a national mission and has only a short time frame. We needed to move quickly. If we were to go through the regular municipal procurement process, then it would have taken a very long time. Many cities also would have found it difficult to get good consultants. So, it was decided to do it centrally. (Interview G03: 5 December 2022)

Thus, at the proposal preparation stage, consultants were involved at every step, shaping city-level strategic vision, conducting citizen engagement exercises, identifying digital infrastructure requirements, costing and scheduling. Subsequently, at the implementation stage, the sphere of influence of the consultants has further expanded. The ICT expertise needed for digital infrastructure installation, upkeep, and operation is lacking in government agencies.

The smart city companies are lean organisations, having only key staff such as CEO, Chief Data Officer, Chief Engineer and Company Secretary on their permanent



roll and depending substantially on private sector enterprises for other functions (Parkar et al., 2023; Purandare, 2021). For example, (a) management consultants advise on policy, strategy, and project monitoring; (b) project management companies deploy requisite technical personnel such as urban planners, engineers and accountants to assist smart cities; and (c) system integration for setting up and operation of integrated command centres and associated devices is outsourced to ICT companies.

Commenting on the dominance enjoyed by consultants in smart city governance in India, Purandare (2021) observed that they have become indistinguishable from the government. This is, however, not unique. According to Barns (2018), high dependence on a few consultants and technology vendors is common in the initial phase of the smart city development process and was also witnessed in advanced industrial countries. However, the evolution of the platform mode of governance reduces such dependence and increases the capacity of cities to engage with a far wider range of stakeholders (Barns, 2018). The Data Smart Cities Strategy policy document has scope for incorporation of newer actors, including data entrepreneurs, software developers and civil society groups in the city data ecosystem (Smart Cities Mission, 2023b). However, as discussed in the next section, its implementation is still at an early stage.

## Data readiness of Indian cities

This section first discusses the overall national scenario regarding data readiness achieved by the Indian cities under the SCM by analysing the Data Maturity Assessment survey results. The results show a high degree of unevenness between the cities in achieving data readiness. We then discuss why cities participating in a national scheme perform differently, using a case study comparing four top-performing cities with four bottom-ranked cities.

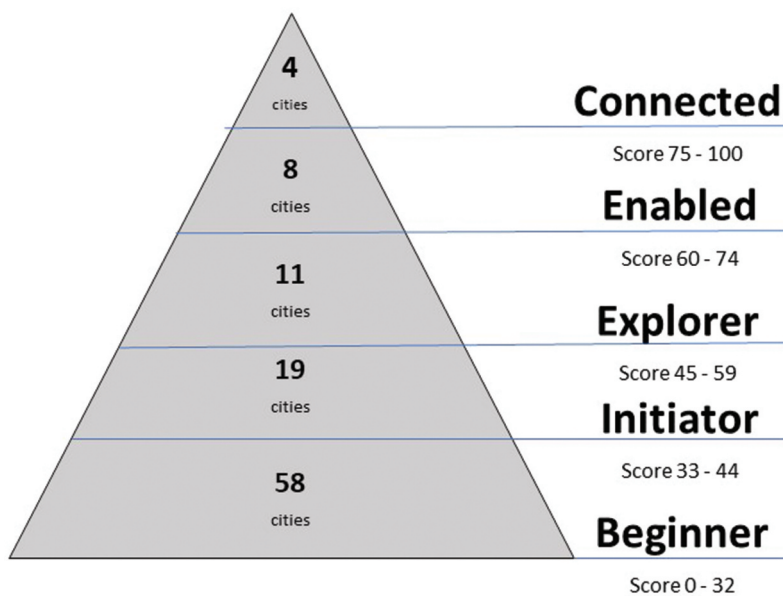
### *National scenario*

When launching the Data Smart Cities Strategy, the SCM simultaneously introduced the Data Maturity Assessment Framework to measure and rank the data readiness of the cities (Smart Cities Mission, 2023a, 2023b). The objective was to help cities undergo a process of self-evaluation, individual goal setting, and preparation for a data culture suited to their needs and requirements. The framework comprises two pillars – Systemic Maturity and Sectoral Maturity. Both pillars are further sub-divided into several components and criteria, with weights assigned to each. These weightages change in each cycle, based on how well the cities implement data strategies. The first assessment cycle was completed in December 2019, when only the Systemic Maturity pillar comprising five components (i.e., policy, people, process, technology and outcome) was measured. The second was completed in June 2021, during which the Systemic Maturity pillar, was measured with 90% weightage and a new component – “City Engagement” - was introduced with 10% weightage (Smart Cities Mission, 2023a). The Sectoral Maturity pillar, which comprises four components (i.e., data availability, data usage, data shareability and data maturity) is yet to be measured. Table 1 shows a breakdown of the components, criteria and weightage.

**Table 1.** Data maturity assessment framework - components and criteria.

Pillar	Pillar weightage	Component Weightage	Criteria	Component Score
Systemic Maturity (Weightage – 100% during first two cycles.)	90%	Policy (Cycle 2–15%)	1a. Approval of City Data Policy	1a +1b + 1c +1d
			1b. City Data Policy Components	
	People (Cycle 2–15%)	1c. Budget for data-related initiatives (2019–2020)	2a +2b + 2c + 2d + 2e	
		1d. Budget for data-related initiatives (2020–2021)		
		2a. City Data Officer		
		2b. Appointment of Data Coordinators		
		2c. Data Team		
	Process (Cycle 2–20%)	2d. Capacity Building (SCM initiative)	3a +3b + 3c + 3d	
		2e. Capacity Building (City initiative)		
		3a. City Data Alliances		
Technology (Cycle2–25%)	3b. Data Hackathons/Data Challenges	4a +4b + 4c + 4d + 4e		
	3c. Solving urban challenges using available datasets			
	3d. Analytics capability			
	4a. Sensors for collection of data			
	4b. Number of datasets			
Outcome (Cycle 2–25%)	4c. Schedule of updating of datasets on Open Data Portal	5a +5b + 5c +5d		
	4d. Number of APIs			
	4e. Spatial readiness (GIS)			
	5a. Data Stories/Blogs			
	5b. Data related use cases			
Sectoral Maturity (Weightage 0% during first two cycles)	10%	City Engagement (added during Cycle 2)	Not applicable	Not applicable
	0%	Data Availability (40%)		
		Data Usage (30%)		
		Data Shareability (15%) Data Management (15%)		

Source: Compiled by authors based on publicly available data from Smart Cities Mission Data Maturity Assessment Framework Dashboard.



**Figure 4.** Data readiness ranking classification of cities as per data maturity survey.

At the end of the Cycle-2 evaluation, all 100 cities under the SCM were graded on a scale of 0–100, after computation of their component scores. The national average score was 32. Forty-two cities, that scored above the average, were classified as “certified” and the remaining 58 were marked as “beginners”. The 42 Certified cities were then sub-grouped into four slots: connected, enabled, explorer, and initiator (Smart Cities Mission, 2023a). Figure 4 shows a summary of ranking and classification of cities.

The findings show that many cities have started to implement their data strategies by framing their city-specific data policies, expanding digital infrastructure, and putting management mechanisms in place. However, there is an enormous challenge ahead, as 58 out of the 100 cities under the SCM are still at a very preliminary stage. Based on the Cycle-2 data, only four cities are at a mature level of understanding the benefits of data and have started leveraging data into policymaking and service delivery. Another 8 “enabled” cities have data infrastructure in place to help them solve urban challenges (Smart Cities Mission, 2023a). Another 11 cities under the “explorer” category are trying to build their data governance structure to establish a presence on the Smart Cities Open Data Portal. A further 19 “initiator” cities have started their data journey by having a City-Data Officer in place but are yet to build the team. The results of Cycle-2 against the five components of the Systemic Maturity Pillar are discussed below:

- Policy** – The Data Smart Cities Strategy requires every city to frame its own data policy to ensure data security and privacy; enable citizen engagement and facilitate local innovations. Cities must also make dedicated budgetary allocations to implement data-related activities such as capacity-building workshops, enhancing data skills, purchasing data tools, etc. At the end of the Cycle-2 assessment, 45 cities have created their City-Data Policies, out of which 35 are approved. They are in the process

of implementation, and 32 cities have a dedicated city-data budget. However, many cities are lagging. As many as 47 cities have not shown any policy level activity and recorded a score of zero for this component, while another eight cities received very low scores (Smart Cities Mission, 2023a).

- **People** – The “people” component measures human resource capacity of the city-level data governance teams. Until now, this component has seen maximum activity at the city level, as all 100 cities have appointed City-Data Officers and 61 cities have appointed Data Coordinators (Smart Cities Mission, 2023a). Moreover, 25 cities have conducted their own capacity building training, over and above national-level training conducted by the SCM.
- **Process** – This component checks the effectiveness of the city-level processes around data collection, usage, management, security, privacy, collaboration, and innovation. The Data Smart Cities Strategy considered that in the contemporary world huge volumes of city-level data are being generated by the private sector and thus placed high emphasis on a collaborative approach (Smart Cities Mission, 2023b). Thus, all smart cities are required to set up city-level data alliances by involving non-state stakeholders in academia, private enterprises, and civil society organisations to aggregate disparate data and enable data-driven solutions to urban problems. However, Indian cities are still at an early stage. As per Cycle-2 results, only 12 cities have formed data alliances, ten cities have conducted data hackathons and 35 cities have started to leverage data analytical capabilities (Smart Cities Mission, 2023a).
- **Technology** - The “technology” component is designed to check the quality and robustness of the city’s ICT infrastructure, including digital platforms, sensors, Internet of Things devices, data exchanges, and analytics. Cycle-2 results show that after the “people” component, the “technology” component had maximum city-level activity (Smart Cities Mission, 2023a) 69 cities have deployed sensors for data collection across the city; 63 cities have published datasets on open portals, 16 cities have begun publishing data in form of Application Programming Interfaces; and 62 cities have created Geographical Information System layers to support urban planning (Smart Cities Mission, 2023b).
- **Outcomes** – This component measures to what extent cities are applying digital technology in urban governance regarding citizen engagement, ease of living, ease of doing business, building stakeholder collaborations, and fostering innovation in the city. During the first two evaluation cycles, this component was given only 10% weightage, as it was felt that it would take time for the cities to set up their data infrastructure and data team. Thus, real-life outcomes would be possible only after the basic systems were in place. As per Cycle-2 finding, 41 cities have datasets in creation of applications for service delivery, 32 cities are working on sectoral use cases and 50 cities have started citizen engagement through alerts and notifications (Smart Cities Mission, 2023b).

Overall, a component-wise review shows that the cities have started to digitalise by putting in place city level data governance teams and laying the foundation for a basic digital infrastructure network. However, there are also vast differences in city-level capacities. Even though all cities are funded under the same national programme, their progress attainments are far from being even. While there are 12 cities (see [Figure 4](#)) in

a relatively advanced stage, most cities are still at very preliminary stages of leveraging digital technology to drive developmental outcomes, form data alliances, engage citizens and frame city-specific data policies.

### **City case studies**

Having discussed the overall pan-Indian situation regarding data readiness, in this section we probe deeper to understand why there is such a wide performance gap between cities functioning under the same national programme (i.e., SCM). We do this through a comparative case study of, according to the latest survey, the four best performing cities (Surat, Pimpri-Chinchwad, Pune and Bhopal) and the four worst performing cities (Patna, Jhansi, Imphal and Shillong).

The eight case study sites include four state capital cities (Bhopal, Patna, Shillong and Imphal). Three of these cities are small by Indian standards, having a population of less one million (Jhansi, Imphal and Shillong) (Census, 2023). Three cities (Surat, Pune, Pimpri-Chinchwad) are in the relatively prosperous, urbanised and industrialised states of Gujarat and Maharashtra (Census, 2023), and are major industrial centres (Pune and Pimpri-Chinchwad are part of the same urban agglomeration). The remaining five cities are in poorer and predominantly rural states, with a per capita state GDP well below that of Gujarat and Maharashtra (RBI, 2023). Two (Imphal and Shillong) are in small, hilly states in northeastern India. Thus, these eight cities are highly distinct in terms of their political and economic setting, aside from the fact that they are all a part of the SCM. This is because the political mandate for the SCM was to have at least one city from each state (Ministry of Urban Development, 2015). Characteristics of the case study cities are summarised in Table 2.

Being part of the SCM, these cities depict similar institutional arrangements for multi-level governance. Thus, SCM project responsibilities are with the respective smart city companies (which are Type II institutions under a multilevel governance framework), not with municipal bodies (Type I institutions). Our research shows that the companies' Boards of Directors consist mainly of bureaucrats. Patna has the city mayor as a nominee director. Pune has provisions for the inclusion of the mayor and the municipal corporation's leader of the opposition on the board. Five of the smart cities are headed by the respective Municipal Commissioner as ex-officio CEO (See Table 2). Pune, Shillong, and Imphal have separate CEOs and Municipal Commissioners as ex-officio board members. The CEOs of these three cities are also senior state government officials.

Despite having a similar institutional structure, a component-wise analysis of the Data Maturity score brings out a sharp difference between the front-ranking and bottom-ranking cities in attaining maturity (see Table 3). While all four bottom-ranked cities have appointed their Chief Data Officer and started forming a data management team, they are lagging significantly in every other aspect. Jhansi, Patna, Shillong and Imphal recorded zero scores against three components – “policy”, “process”, and “outcomes”. They have neither defined city-data policies nor formed any data alliances. They have also not yet begun to use digital technologies to manage civic operations. While Jhansi and Shillong have started laying digital infrastructure hardware, Patna and Imphal have not. In contrast, Surat, Pune, Pimpri-Chinchwad, and Bhopal have consistently scored highly in all five Data Maturity Assessment Framework parameters. They have not only framed their

**Table 2.** Case study city characteristics

City	City population 2023 (million)	Smart City Company (special purpose vehicle)	City Government	State	State urbanisation level 2023(%)	State GDP per capita 2020–21 (INR)
Surat	6.17	Surat Smart City Development Ltd. Shalini Agarwal <i>Director and Chairperson</i>	Surat Municipal Corporation Shalini Agarwal <i>Commissioner</i>	Gujarat	42.6	213,936
Pimpri-Chinchwad	2.38	Pimpri-Chinchwad Smart City Ltd. Shekhar Singh <i>Director and CEO</i>	Pimpri-Chinchwad Municipal Corporation Shekhar Singh <i>Commissioner</i>	Maharashtra	45.2	202,130
Bhopal	2.48	Bhopal Smart City Development Corporation Ltd. V.S. Choudhary Kolsani	Pune Municipal Corporation V.S. Choudhary Kolsani <i>Commissioner</i>	Madhya Pradesh	27.6	98,418
Pune	4.31	Pune Smart City Development Corporation Ltd. Dr Sanjay Kolte <i>Director and CEO</i>	Pune Municipal Corporation Vikram Kumar <i>Commissioner</i>	Maharashtra	45.2	202,130
Jhansi	0.69	Jhansi Smart City Ltd. Pulkit Garg <i>Director and CEO</i>	Jhansi Municipal Corporation Pulkit Garg <i>Commissioner</i>	Uttar Pradesh	22.7	65,431
Shillong	0.19	Shillong Smart City Ltd. T V KrishnaMurthy <i>Director and CEO</i>	Shillong Municipal Board JK Lakiang <i>CEO</i>	Meghalaya	20.1	82,182
Patna	2.32	Patna Smart City Ltd. A.K. Parashar <i>Managing Director</i>	Patna Municipal Corporation A.K. Parashar <i>CEO cum Commissioner</i>	Bihar	11.3	46,292
Imphal	0.37	Imphal Smart City Ltd. Thingbavjam Singh <i>Director and CEO</i>	Imphal Municipal Corporation Thoudam Rabindra Singh <i>Commissioner</i>	Manipur	29.2	84,746

Source: City population and state urbanisation data are from Census (2023) based Census 2011 projection.<sup>1</sup> State GDP (2020–21) is from the Reserve Bank of India (2022)<sup>2</sup> Information about Municipal Commissioner and Smart City SPV are from respective websites

**Table 3.** Systemic data maturity assessment score for case study cities

City (State)	Systemic Maturity Assessment Score				
	Policy (15%)	People (15%)	Process (20%)	Technology (25%)	Outcome (25%)
Surat (Gujarat)	69	100	80	68	100
Pimpri-Chinchwad (Maharashtra)	100	90	80	60	90
Bhopal (Madhya Pradesh)	85	90	70	51	100
Pune (Maharashtra)	67	80	65	74	90
Jhansi (Uttar Pradesh)	0	10	0	15	0
Shillong (Meghalaya)	0	15	0	15	0
Patna (Bihar)	0	15	0	0	0
Imphal (Manipur)	0	10	0	0	0

Source: Data Maturity Assessment Cycle – 2 results

data policies, but have also started generating data sets on air quality, flood sensors, women’s safety etc., and uploading these to central data portals.

Explaining such wide differences between the cities in attaining data smartness, a senior official from the Urban Affairs Ministry observed,

Results are not very surprising. You see, states of Western India like Gujarat, Maharashtra, and Goa, are all highly urbanised and had been following urban-centric growth strategies for many years. Surat, Pune and Pimpri-Chinchwad had been at the forefront of digital adaptations from the beginning. Northeastern states are very small in size and lack capacities, even though Kohima (Nagaland) is doing rather well. (Interview G02: 3 December, 2022)

Broadly concurring with the above view, a policy analyst with a prominent Delhi-based think tank pointed out that there is a legacy issue,

Digital capacities cannot be built overnight. Patna and Pune are cities with vastly different governance capabilities. Pune had been focusing on digitalisation for a long time, much before the SCM was launched. But for Patna and most other cities this is a new beginning. (Interview P02: 7 December, 2022)

Incidentally, in 2017, Pune Municipal Corporation was the first city in India to appoint a City-Data Officer. This pioneering initiative was institutionalised at the national level with the Data Smart Cities Strategy. All smart city companies were advised to appoint a chief data officer under them. Thus, Pune acted as a policy lab but led by the municipal body, not the smart city company.

To understand if the wide performance gap is only restricted to the data strategy component, we compared the progress of the case study cities in implementing the entire smart city projects and the data maturity score (See Table 4). Table 4 shows the comparative progress achieved by the case study cities in implementing SCM projects in terms of project value, fund utilisation and the competition challenge round in which the city was selected.

Intuitively, the earlier a city is included in the SCM, the faster it will progress. Also, the data maturity score is likely to be higher for these cities. To test this hypothesis, we carried

**Table 4.** SCM project progress achieved by the case study cities.

Smart City	SCM Challenge Round	SCM project completion Rank*	Data Maturity Assessment Score	Total Projects # INR million	Projects Complete # INR million	Project Progress %	State/Centre Funding Ratio *
Surat	1	1	80	30700	25420	83%	1.01
Pimpri-Chinchwad	3	21	79	13050	6260	48%	1.00
Bhopal	1	5	76	34420	27370	80%	1.00
Pune	1	18	75	18230	15900	87%	1.00
Jhansi	3	28	11	18680	13140	70%	1.00
Shillong	4	98	11	10340	0	0	0.19
Patna	3	74	8	22480	7330	33%	1.00
Imphal	2	96	8	5120	460	9%	0.11

Source: Compiled by authors based on data obtained from SCM project dashboard; Details regarding SCM project completion rank and Centre – State funding ratio obtained from SCM Officials through personal correspondence (marked\*); Data regarding project completion value obtained from Minister's response to question in Parliament (marked #).

out a bivariate correlation analysis between the project progress and the SCM Challenge Round on one hand and between the Data Maturity score and the SCM Challenge Round on the other. The results are given in [Table 5](#).

The above results show that the project progress percentage is significantly positively correlated to the SCM Challenge Round. This seems logical as an earlier round implies that the city's projects started earlier, which is reflected in a higher project completion percentage. However, we find that Data Maturity scores are not significantly correlated with the SCM Challenge Round. This is counterintuitive. On discussion with SCM officials, it was ascertained that as the Data Smart Cities Strategy was only rolled out in 2018, by which time all the 100 smart cities had been selected, the advantage of an earlier start was limited in the case of data maturity scores (Interview G10: 12 February 2023).

It can be concluded that the ranking generated by the Data Smart Cities matrix is very significantly correlated with the overall smart city project completion ranking. Surat, Bhopal and Pune, which did well in implementing the data strategy, also did well in implementing the projects in general, although Pimpri-Chinchwad faced certain construction-related delays (Construction World, 2021). This makes sense because a smart city that has a higher project completion rate will benefit more, which shows in its ranking. Also, the overall smart city ranking and project progress are positively correlated with the SCM Challenge Round of selection, which indicates when smart city projects will begin in that city. This is also logical, as an earlier start will translate to higher progress. Finally, we see that smart city rank and the proportion of state funding have a strong correlation. However, compared to the other two factors, it is slightly lower because most of the cities have followed the SCM's policy of equal state and central funding. The exceptions were Shillong and Imphal, which both faced significant delays in the transfer of Central grants (routed through the state governments) to the smart cities.

The variations in performance between the cities analysed reflect state-level issues. [Table 2](#) shows that all four low-performing cities are in poorer states with low urbanisation. The top three cities – Surat, Pune, and Pimpri-Chinchwad – are industrial hubs in wealthy states. Bhopal is an anomaly. The urbanisation level and per capita state GDP of Madhya Pradesh (Bhopal's capital) are similar to Uttar Pradesh and below Gujarat and Maharashtra. However, Bhopal has become a major industrial centre in recent decades



**Table 5.** Correlation between project progress, Smart Cities selection challenge round and Data Smart Cities score.

Bivariate Variables	Correlation	p- value	Result*
Project Progress Percentage and SCM Challenge Round	72%	0.041	Significant at 0.05 level
Data Smart Cities Score and SCM Challenge Round	66%	0.071	Not Significant

Source: Compiled by authors.

and performed well under the SCM because of the state government's urban-centric growth policy. A senior executive of a multinational management consulting firm working with several smart cities noted,

Urban issues never received much priorities before in rural states like Bihar and Uttar Pradesh. But things are changing now, it would take time. Madhya Pradesh is placing a lot of emphasis on the urban sector – Bhopal and Indore are doing great work under SCM. (Interview C11: 5 December 2022)

Thus, the uneven performance of cities under a national programme highlights the roles of state-level factors in shaping developmental outcomes in a multilevel context. Under the SCM, smart city companies are entrusted with implementation responsibilities and not the elected municipal bodies. However, the smart city companies in all eight case study cities are headed by senior state government bureaucrats. The state governments, rather than the elected municipal bodies, thus have an enabling role in the implementation of the smart city projects.

Moreover, state governments are significant financial contributors for the SCM. They are required to provide funds equalling those contributed by the central government. However, there is a significant gap in the release of funds between the Centre and the states. As of December 2022, about 95% of the Central Government's share has already been released, whereas the corresponding share of cumulative state government funds is 82% (Centre for Policy Research, 2023). According to almost all the interview respondents, "budget constraints" and "timely release of grants" are the two most significant project implementation challenges. According to the CEO of a smart city company,

The biggest challenge is financial, or rather time scheduling. It takes time for the funds to reach us at the smart city. Ours is a poor state. The [State]Government is facing budget issues and the COVID situation made it worse. State finances had suffered. So, state grants do not reach in time. Unless matching grants are released by the state, the next cycle of Central fund is also not released. So, the delay starts spiralling up. (Interview G01: 28 November 2022)

Understandably, the budget constraints are more acute for cities in poorer states. While Madhya Pradesh has transferred 95% of the Central grants to smart city SPVs in the state, the corresponding figure for Manipur is only 80% (Centre for Policy Research, 2023). Moreover, 47 cities are yet to make any budgetary allocations (Smart Cities Mission, 2023a). Under the circumstances, it remains doubtful who will pay for digital infrastructure operations and maintenance once the SCM ends. Like all centrally sponsored schemes, SCM also has a finite deadline. Originally launched for five years, it has received three extensions and is scheduled to end in June 2024 (Economic Times, 2023). While a few financially stronger cities and more committed states may make the necessary financial commitments after that, poorer cities are likely to face difficulties.

Apart from financial difficulties, the other most common problem faced by low-performing cities is the availability of skilled human resources. Although all smart city companies have city-data officers, finding the right person for the position is challenging. It is a key leadership position requiring high techno-managerial expertise. The role involves coordination with (1) heads of different government departments and parastatal agencies for city-wide data integration; (2) ICT consultants and vendors regarding the Integrated Command Centre operations; and (3) private entrepreneurs, NGOs and community groups to build data alliances as mandated under the Data Smart Cities guidelines (Smart Cities Mission, 2021). While technical expertise is available in the private sector, people with government experience are particularly difficult to find. In Pune, staff training requirements for data officers were handled by the Tata Trusts in association with Tata Consultancy Services (Dore et al., 2019).

As a pioneering initiative, without a precedent, the office of the city-data officer in Pune faced several operational challenges. Government data are held in silos, often with a reluctance to share, even with other government organisations. Moreover, files in municipal departments are mostly in hardcopy format and digital conversion is a long-drawn process. As an executive from the Pune data office explained,

It was a big challenge. There are chief data officer positions in private companies. But there was nothing in a municipal government setting. Working systems are totally different. Many government data are still not available in digital format. So, converting them was a big task. Also, as you know, government departments work in silos. So, sharing data was another big problem. But the support from the Municipal Commissioner was crucial. (Interview G 12: 8 February, 2023)

ICT companies and technology vendors handle system integration, operations, and maintenance of the command centre. However, they also find it difficult to station skilled people in small towns and remote regions. A senior manager of an ICT company involved in setting up Intelligent Traffic Management Systems pointed out,

It is very difficult to get senior people for posting in northeastern cities like Imphal and Shillong. We manage by rotating staff from other locations on short-term basis. (Interview C-05: November 22, 2022)

There is a sharp regional divide in ICT skill availability in India. While economically better-off regions have skilled people, poorer states are deficient (National Sample Survey Office, 2023).

To sum up, the case studies bring out the challenges of digitalising cities in a country of large regional diversity through a top-down national government-driven mission and highlight the importance of state-level governance aspects. The SCM entrusted city-level project implementation responsibilities to smart city companies, which are Type II category institutions under a multilevel governance framework, instead of municipal bodies (which are Type I category), to speed up project execution. Our case study does not show that this institutional innovation resulted in any appreciable difference. Rather, it is the state-level policy priority and governance capacity that matters. Being heavily dependent upon state governments, financially and administratively, the smart city companies do not have autonomy in any real sense and are functioning as just another parastatal agency. They are financially and administratively dependent upon the state governments and depend on consultants and ICT vendors for technical matters and day-to-day functioning.

## Conclusion

India's approach to urban digitalisation is a unique developmental model. While most well-known global smart city initiatives like New York, Amsterdam, Barcelona, Sao Paulo, and Johannesburg are primarily driven by city governments, India uses a multilevel arrangement. The SCM is a central-government scheme and has expanded the role of the national state in shaping urban policies. The scheme represents an overarching nation-building agenda centred on state digitalisation and urbanisation. The vision reflects what Datta (2022) termed as "digitalisation as urbanisation". Although top-down, SCM is not a one-size-fits-all model and has space for active involvement of state and city governments. The scheme is rooted in neoliberalism and widens the space for engagement of technology companies and management consultants in urban governance.

The Data Smart Cities Strategy, a fundamental sub-component of the SCM, aims to improve the operation of municipal services through well-developed data governance structures, as well as enabling legislation, standards, and technological platforms. Our review of how the strategy is being implemented shows wide city-to-city variation in digitalisation and data readiness. While a few cities are at an advanced stage, most are at an inception stage. Cities located in poorer states and remote regions are facing delays due to financial, technological and human resource constraints.

Our study highlights the importance of state-level factors in shaping city-level outcomes. Governance capacities and administrative attention towards urban issues vary significantly from state to state. This, in turn, impacts city performances as smart cities are managed by state government officials, not by elected municipal bodies. Even though the municipal governments are shareholders in Smart City companies, the roles of their elected representatives are marginal.

Second, our review raises questions about the future of India's urban digitalisation agenda. While seed capital from the central scheme helped cities to build expensive ICT infrastructure, there are uncertainties regarding how the infrastructure will be managed once the scheme ends. Several smart city projects suffered due to delays in the release of matching grants by state governments, and 47 out of the 100 cities are yet to allocate any budget towards data smartness. How these cities would fund expenditures to maintain their digital infrastructure is uncertain. Although data monetisation is envisioned under the National Urban Digital Mission, it is too early to say how that would materialise. The ambitious national digitalisation project may perpetuate regional digital gaps between cities in rich and poor states unless dedicated revenue sources are arranged.

The overarching message from our study is that urban digitalisation is a continuous process, as technology is constantly evolving. While a large-scale, national-level scheme is useful for kickstarting the process, it is also important to build city-level capacities for the long run.

The outcome of the programme is varied. Although a few big cities in advanced industrialised states have capitalised on the opportunity and expanded their data management capacities, most cities are still at an early stage. Cities in poorer states face additional challenges due to financial and human resource constraints. It is pertinent to note here that National Urban Renewal Mission, a centrally sponsored scheme in vogue between 2005–14, applied a graded approach towards urban infrastructure funding. For big cities with higher capacities, central funding was only 35%; while for weaker cities in

the Northeast, it was as high as 90%. Deviating from this, the SCM adopted a uniform approach, where government grants were shared at a 50:50 ratio between the central government and the states for all cities. Our analysis points to the need for a more customised approach to meet the needs of cities to reduce developmental inequities.

## Notes

1. <https://www.census2011.co.in/census/city/375-pune.html>
2. <https://www.rbi.org.in/Scripts/PublicationsView.aspx?id=20675>

## Disclosure statement

No potential conflict of interest was reported by the author(s).

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