

In collaboration with the Ministry  
of Housing and Urban Affairs,  
Government of India and Deloitte



# Technology and Data Governance in Cities

## Indian Smart Cities at the Forefront of the Fight Against COVID-19

INSIGHT REPORT  
DECEMBER 2020



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# Forewords



**Durga Shanker Mishra**  
Secretary, Ministry of  
Housing and Urban Affairs,  
Government of India

The year 2020 has been challenging, to say the least. The COVID-19 crisis presented hitherto unknown challenges to our social and institutional capacities, tested our individual resilience and the efficacy of our technological deployments in dealing with prolonged emergencies. In this global effort to deal with the pandemic efficiently and minimize the social and economic impact, city governments and their collaborations with civil society and industry have been remarkable agents of crisis management.

Under the Smart Cities Mission launched by the Government of India in 2015, we are witnessing a never-before infusion of digital technology in city management. Several cities have been able to quickly develop technological capacity and tools for citizen-centric urban management and service delivery in sectors such as urban transport, utilities, sanitation, waste management, law enforcement, women's safety, air quality, disaster management and community participation in governance. These

capabilities, institutions and frontline manpower proved to be a bulwark against the COVID-19 pandemic, minimizing its negative impact.

This report by the World Economic Forum in partnership with Deloitte India is a timely analysis of the critical role India's city governments have played in managing the disastrous impact of the pandemic. Its specific thrust on the critical use of technology and data science highlights the extent of adoption of such tools by cities in their service to citizens. It is heartening to note that the global pandemic is providing opportunities for cities around the world to participate in a dialogue and exchange ideas to foster innovation and help transform cities. I hope this global analysis will inform other cities and local governments about best practices which have worked, and encourage city administrators and policy-makers to think long term in developing further capabilities in order to deal with unforeseen risks like these in the future.



**Kunal Kumar**  
Joint Secretary, Ministry of  
Housing and Urban Affairs,  
Government of India and  
Mission Director, Smart  
Cities Mission

Urban India has been the ground zero for the COVID-19 pandemic, with over 90% of reported cases in the country. Out of crises emerge new and incredible opportunities. Over the past 10 months, civic authorities have demonstrated adaptive leadership in uncertain times. They have employed new ideas and tools, in a very short time, with minimum leeway for trial and error, and have excelled at crisis management.

While responding to an unknown crisis of this scale, cities have striven to maintain the delicate balance between life and economic well-being as both ultimately meant one and the same thing – precious human lives had to be saved at all costs. There was no time to strategize in a foolproof way and innovative choices had to be made on the go. Although problems faced by individual cities look similar at the macro level, there were crucial differences in how the crisis presented itself in each context.

India's smart cities have been at the forefront in their response to challenges posed by the global pandemic. The smart infrastructure leveraged in smart cities – such as Integrated Command and Control Centers (ICCCs) with surveillance cameras, optical-fibre networks, sensor-enabled smart services, app-based governance modules, etc. – has helped states/cities to tackle numerous COVID-related challenges. The technology-based smart solutions deployed by our cities have helped them in contact tracing, testing, isolation, treatment and enforcing the lockdown to enabling innovations for information collection, crisis management, effective communication and predictive modelling.

As cities have begun to realize the enormous potential of data-driven governance, it is time to address some of the key challenges in implementing the technology and data-driven initiatives. How countries and cities handle data turns out to be a crucial part of their pandemic response. Information about people's health,

movements and interactions with others can be as important as physical quarantines and lockdowns in combating disease. This data is also highly sensitive and, in most countries, it is subject to stringent privacy controls.

This report makes an attempt to cover the above aspects while showcasing initiatives in cities across the globe. As part of the study conducted by World Economic Forum and Deloitte, three Indian smart cities (Bengaluru, Surat and Pimpri Chinchwad) and three global cities (Tel Aviv, Lisbon and New York City) were assessed in terms of their responsiveness to the pandemic, together with underlying mechanisms for technology and data governance.

Encouraging all the city governments which have embarked on their journey to become data-smart, the report emphasizes the need and urgency to institutionalize and strengthen data governance capabilities in cities focusing on aspects relating to standardization and interoperability, data security and protection, inter-agency coordination, data-management strategy, outcome focus and citizen engagement. My wish is that this document ignites hope and inspires confidence in the ability of our civic ecosystems and becomes a milestone in shaping our future engagements in the urban sector.



**Arindam Guha**  
Partner, Government and  
Public Services Leader,  
Deloitte India

COVID-19 has had a debilitating impact on the health and livelihoods of people, with governments around the world rallying to counter the impact through multipronged responses. A number of Indian cities that made investments in technology platforms under the Smart Cities Mission, 2015, have been at the forefront of this response.

The current study carried out by Deloitte, jointly with World Economic Forum and India's Ministry of Housing & Urban Affairs (MoHUA), attempts to assess the initiatives undertaken by select cities in more detail. More importantly, it identifies some common threads underlying their efficiency and effectiveness. As part of the exercise, we have endeavoured to answer a series of pertinent questions on the city-level response to COVID-19. For instance, what have been some common services and solutions offered by cities in response to the pandemic? What has been the role of technology in rolling out these services? Which government agencies and other ecosystem partners were involved and how did they coordinate?

As part of the study, we interacted with city leadership in the smart cities of Bengaluru, Surat

and Pimpri Chinchwad in India, as well as Tel Aviv, Lisbon and New York City. The study team also conducted extensive desk research on relevant initiatives and policies to analyse specific hypotheses and arrive at key findings. These findings clearly demonstrate how cities leveraged digital platforms and analytics effectively to reach out to citizens and ensure coordinated data-driven decision-making in different city-level agencies. For institutionalizing these practices in future, it is important for governments to adopt the right policies for technology standardization and interoperability and invest in building capacity for data-driven policy initiatives and service delivery to citizens.

We would like to thank the municipal commissioners and other senior city officials for taking time from their frontline roles in fighting the pandemic and providing us with valuable insights and perspectives for this exercise. We are particularly thankful to the Smart Cities Mission leadership team at MoHUA, India, for their continuous guidance and support. Finally, we would like to thank our colleagues at the World Economic Forum for another opportunity to work together.



**Anindya Mallick**  
Partner,  
Deloitte India

# Executive summary

COVID-19 has affected almost the entire world, with more than 40 million people diagnosed with the virus as of mid-October 2020. India reported about 7.4 million cases in the same period. As in other countries, the Government of India has been at the forefront of the COVID-19 response to minimize loss of lives and counter the adverse economic impact. Challenges in India, especially in its cities, were somewhat greater than many other countries due to a large population, high population density, healthcare capacity-related constraints and higher vulnerability of a section of the population to the economic shock.

The Smart Cities Mission, launched by the Government of India in 2015, played a critical role in shaping the government's response. As part of their pandemic response strategy, many Indian smart cities effectively used the Integrated Command and Control Center (ICCC), which forms the "brain and nerve centre" for smart solutions.

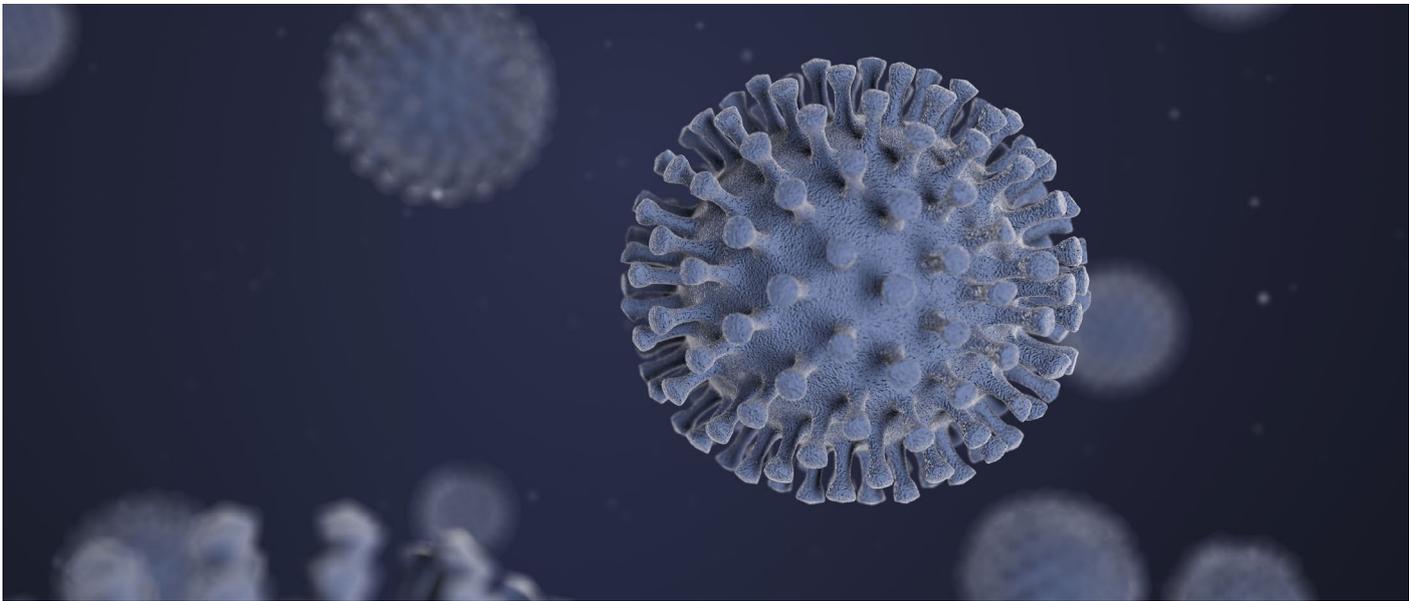
As part of the current study, three Indian smart cities (Bengaluru, Surat and Pimpri Chinchwad) and three global cities (Tel Aviv, Lisbon and New York City) were assessed in terms of their responsiveness to the pandemic, together with underlying mechanisms for technology and data governance. Most Indian cities are using their ICCCs

as "COVID-19 War Rooms" to effectively coordinate and monitor activities of various state and city agencies. Using their COVID-19 War Rooms, cities brought together civil society, local businesses and others on a single platform through their websites and mobile applications to collaborate with the city administration. Key activities included the following:

- Tracking and monitoring infected citizens and organizing their healthcare
- Managing the lockdown through ensuring supply of essential goods and services at citizens' doorstep
- Providing food to economically weaker sections of society and vulnerable citizens
- Setting up health and quarantine facilities
- Disseminating information on the pandemic to citizens
- Maintaining connection with citizens

Based on data collected manually and through various sensors, cities carried out data modelling and predictive analytics at the COVID-19 War Room using dashboards, scenario visualization and





“ To make a transformation sustainable, cities and governments need to invest in the people and processes that support innovation and technology.

simulation models to identify the virus spread and plan their response.

In the case of global cities, they tackled the pandemic in a similar manner, with city authorities effectively coordinating with various city agencies in planning and monitoring their response. The cities quickly put in place a robust mechanism using existing smart solutions to ensure healthcare measures to tackle the spread of the virus, manage the lockdown and maintain effective communication channels with citizens.

The quick adoption of technology solutions by Indian smart cities was facilitated by specific measures instituted by the Ministry of Housing and Urban Affairs (MoHUA), the nodal ministry for the Smart Cities Mission. Some key enablers include:

- The **DataSmart Cities Strategy**, which recommends a data governance system based on three key pillars: people, process and platform. The people dimension focuses on capacity-building and institutional and coordination mechanisms. Process refers to adopting required changes in the way urban services are delivered. Platform refers to the National Urban Innovation Stack (see below).
- The **National Urban Innovation Stack** comprises: an open data portal that serves as a digital repository for cities to publish their data and the single point of access to datasets available with various smart cities; the India Urban Data Exchange, where cities are able to share and leverage data from other smart cities for actionable decision-making; the India Urban Observatory, which is envisaged as the main data analytics hub for deriving key insight required for planning and evidence-based decision-making; and the National Urban Learning Platform for capacity-building of city officials and knowledge-sharing among cities.
- The **National Data Sharing and Accessibility**

**Policy**, which has the objective of ensuring standardized processes for handling, managing and sharing data.

The ministry is working with agencies, such as the Bureau of Indian Standards, to formulate smart city technology adoption standards aligned to global standards. This will enable Indian smart cities to adopt technology solutions that are interoperable, scalable and capable of connecting with other smart cities for data-sharing and other functionalities.

The study identified key challenges that Indian smart cities faced while designing and implementing their COVID-19 response together with solutions that were used to address these:

- Technical know-how and knowledge required to choose the optimum portfolio of solutions was a key challenge that city authorities faced in repurposing existing smart solutions to respond to the pandemic. This was addressed by seeking support from consultants implementing smart solutions, local industry (IT partners) and academic institutes to help adapt existing solutions.
- Capacity-building and training of personnel was required as cities had to quickly establish their COVID-19 War Rooms. This was addressed through organizing training sessions with the help of local partners and consultants supporting the city in implementing smart solutions at the time of the outbreak.
- Workforce-related constraints arose as the city authorities had to plan and implement the response to the pandemic within a short time. The city administration coordinated with other agencies to deploy personnel in the COVID-19 War Rooms and involve volunteers from local communities.
- Defining an optimum portfolio of solutions was another key challenge cities had to face, given data collection and analysis requirements.

Sharing of best practices among cities, along with development of a standard data template and standard operating procedures, helped achieve the objective.

- Existing lengthy and complex procurement processes delayed the implementation of critical solutions of the COVID-19 War Rooms. This was addressed through fast-tracking of procurement processes with requisite approvals.

While cities were able to respond to these challenges during the COVID-19 response, experience in Indian smart cities and their global counterparts suggests that, if cities are to institutionalize and strengthen these practices, the following actions need to be prioritized:

- **Ensure standardization and interoperability** through cities formulating their respective technology management policies and strategies. Indian cities should use policy advisory support and guidance provided by MoHUA, along with platforms such as an open data portal and India's Urban Data Exchange.
- **Data security and protection** through cities developing their data policy in compliance with national laws and guidelines to ensure citizens' data security and protection; and standard operating procedures addressing data collection, storage, usage and management, along with data-sharing protocols. Cities may consider establishing a dedicated department taking a cue from the New York City Mayor's Office of Information Privacy, which works with city departments and agencies to ensure adherence and compliance to data privacy and security regulations.
- **Institutional coordination among agencies** through cities establishing mechanisms for information-sharing among city and state agencies and having defined protocols for responding to incidents in line with the respective agency's mandate. The city's ICCC

can be used as a platform to coordinate and monitor agencies' activities.

- **Adequately staffed technology and data management organization** by ensuring appointment of a city data officer, data contributors and establishing/strengthening the city data cell by including professionals in areas such as data architecture, security, privacy and analytics.
- **Adopting objective indicators to monitor citizen service delivery** using assessment frameworks such as MoHUA's ICCC Maturity Assessment Framework, which enables cities to assess gaps and learn from the experience of better-performing cities.
- **Using multiple delivery channels for citizen outreach** through implementation of connectivity-related smart solutions in ICCC that include help desks and call centres, citizen portals and mobile app and variable messaging display systems.

The above measures are expected to help Indian smart cities strengthen their technology and data governance capabilities and provide them the required agility and improved resilience during a crisis or emergency. As highlighted above, MoHUA is already supporting cities with institutionalization of best practices through DataSmart Cities strategy and other initiatives. However, further support can be provided through working with international partners to develop frameworks based on global best practices. This can quickly be adopted in areas such as data governance and deployment of AI solutions by addressing critical issues such as privacy, trust, ethics, regulation and policy-sharing.

The experience of Indian cities demonstrates that innovation and technology can make a significant difference to how they manage COVID-19 and, by implication, other major crises. To make the transformation sustainable, cities and governments would need to invest in the people and processes that support innovation and technology.



1

# Introduction



## 1.1 Background

Technology adoption across cities in India and globally has been a key to providing better service delivery to citizens and enhancing the quality of life. The smart infrastructure and solutions adopted by smart cities facilitated their response to the COVID-19 pandemic using data analytics for evidence-based decision-making, including predictive modelling. However, limited information is available on how cities are framing their response while addressing technology and data governance challenges, especially those related to data handling and protection and privacy and security issues.

In this context, the World Economic Forum's Centre for the Fourth Industrial Revolution (C4IR) at the request of the Ministry of Housing and Urban Affairs (MoHUA) of India, which is the nodal ministry for India's Smart Cities Mission, has prepared this publication for sharing practical approaches that cities have adopted on the responsible use of technologies and data to respond to COVID-19. In this regard, Deloitte Touche Tohmatsu India (Deloitte) supported them to document various challenges and risks faced by select global and Indian smart cities relating to technology and data governance, including handling and management of data along with measures taken by cities to overcome such challenges/risks.

## 1.2 India's response to COVID-19

“ The pandemic has challenged governments to act in ways usually reserved for war, depression and natural disasters.

COVID-19 has affected almost the entire world with more than 40 million people infected as of mid-October 2020. In such situations, citizens look to their governments for credible information, guidance and leadership to keep them safe and healthy and avoid economic hardship. The pandemic has challenged governments to act in ways usually reserved for war, depression and natural disasters. Governments at different levels across the world are taking extreme measures to limit the loss of human life and minimize economic disruption.

The challenges in India were somewhat larger than many other countries on account of the following:

- **Large, densely populated cities:** Of 377 million urban residents comprising 31.2% of the total population (Census 2011), about 43% live in 53 urban agglomerations<sup>1</sup> with a population of more than 1 million; This results in high-density living in these cities.
- **Limited healthcare capacity:**<sup>2</sup> With 8.5 hospital beds per 10,000 citizens and one doctor for every 1,445 citizens (WHO's prescribes one doctor for every 1,000 people) and 1.7 nurses per 1,000 people (43% less than the prescribed minimum of three, according to WHO norms), health infrastructure in Indian cities is inadequate.
- **Vulnerability of population to economic shock:** The most affected group of people to economic shock in the city that affects operations of businesses and results in sudden loss of jobs are economically weaker sections.

These sections comprise informal workers and their families who are residents of the city and largely stay in slums and the 139 million<sup>3</sup> urban migrants living in cities across country.

As in other countries, in India the government has taken several measures to contain the spread of the virus. Key measures include:

- Imposing a countrywide lockdown from 25 March until 31 May 2020
- 100% screening of foreign travellers
- Tracking and contact tracing of COVID-19 patients
- Increased testing from 1,000 per day in 20 March to 1 million per day<sup>4</sup> by 20 August (number of testing labs increased from four to 1,500+)
- Facilitated developing an ecosystem to promote local manufacturing of PPE kits; now, India has become second-largest producer of PPE kits in the world, with a daily production capacity of more than 500,000 per day<sup>5</sup>
- Provided a fiscal stimulus package worth \$270 billion<sup>6</sup> to help the economically vulnerable sections of the population; businesses, with a focus on micro, small and medium-sized enterprises; and employees and entrepreneurs to revive the economy.

## 1.3 Smart cities' response to COVID-19

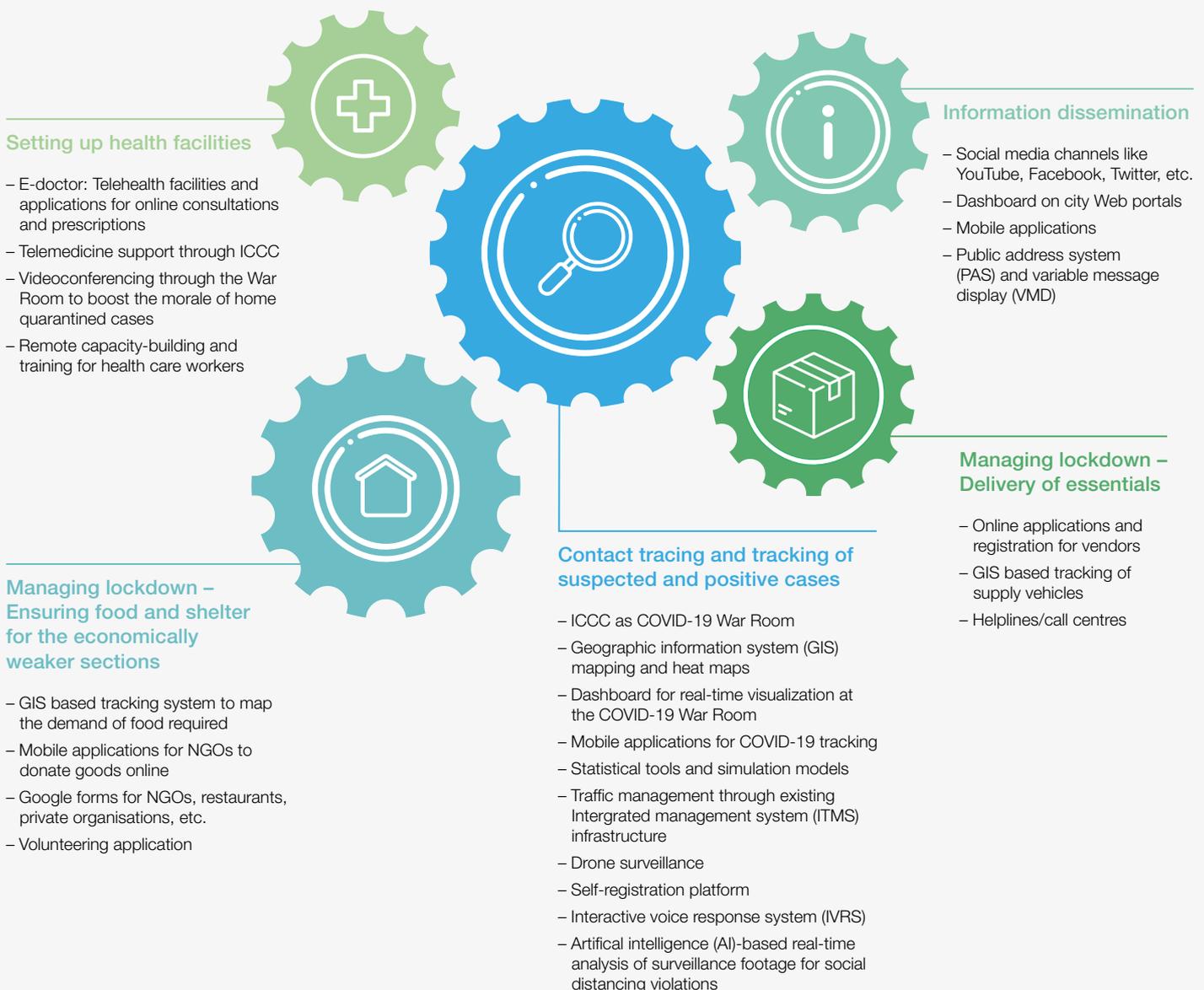
Alongside the central and state governments, the smart cities in India have also played a vital role in fighting COVID-19. These cities have used smart solutions and facilities that have been implemented as part of the Smart Cities Mission (SCM) to combat the pandemic.

About 50<sup>7</sup> cities across the country have used their Integrated Command and Control Centre (ICCC) as a COVID-19 War Room to coordinate and monitor city-level emergency response. This involved setting up data analytics and monitoring dashboards in the ICCC to manage and contain the spread of the virus. At the same time, across the majority of the cities, civil societies and corporates were brought on to a single platform through websites/mobile

applications to collaborate with the government in rendering public services. The list of technological solutions adopted by smart cities across five key thematic areas is summarized in Figure 1.

These initiatives demonstrate how smart cities in India have developed their capabilities to respond to the pandemic. However, there is need to address the technology and data governance challenges – especially those relating to data management, protection and addressing privacy and security issues – by putting together adequate policy and regulatory frameworks. This publication analyses the nature of response of some Indian and global cities in terms of regulatory aspects related to technology and data governance.

FIGURE 1 Technology solutions adopted – India smart cities



## 2 Indian Smart Cities Mission and data governance initiatives



This section briefly describes India's initiatives of developing 100 existing Indian cities as smart cities using technology solutions, to make them more inclusive and sustainable. These smart solutions

were effectively used to spearhead the fight against COVID-19 and set up COVID-19 War Rooms. The section highlights the SCM and key initiatives undertaken on technology and data governance.

## 2.1 India's Smart Cities Mission – highlights

The Government of India launched the SCM in 2015 with an objective of promoting sustainable and inclusive development in 100 cities through applying smart solutions, along with upgrading and augmenting urban infrastructure. These cities were selected through a competitive process based on the quality of proposals submitted by them. The cities selected under the mission have been indicated in the map below.

The nodal point of the city-level smart solutions is the ICCC, which functions as the city's "brain and nerve-centre" for operations and management,

enabling real-time and evidence-based decision-making by city authorities. The ICCC acts as the analytics platform for the data generated and captured by the city (both real-time and archived) using modern technological tools of machine learning, image processing and artificial intelligence. As of 30 August 2020, a total of 50 smart cities in the country have functional ICCCs. These ICCCs have been employed in coordinating actions in areas such as city surveillance, disaster management, solid waste management, traffic management and street lighting.



## 2.2 Technology and data governance framework

“ India provides guidance to help key urban stakeholders embrace a data-driven governance paradigm.

To leverage city data for the envisaged benefits in planning and governance, institutions across the world have stressed the necessity of evolving a culture of data usage in governance machinery.

Recognizing this need of encouraging a data-driven culture, India's MoHUA has launched a guidance and framework document in the form of the **DataSmart Cities Strategy**<sup>8</sup> (DSC) to enable key urban stakeholders, i.e. city authorities, citizens, academia and industry, to embrace a data-driven governance paradigm.

The strategy is built on three foundational pillars, namely people, process and platform. These act as key enablers to facilitate a data culture at the city level. These are to be addressed by formulating city data policies (CDP). These policies prescribe processes for the overall management of city data throughout their life cycles, along with mechanisms to create awareness and foster collaboration among various stakeholders in order to harness the power of city data.

Under **people**, the focus is on institutionalizing a data governance structure.

The DSC recommends that a designated city data officer (CDO) should be responsible for data governance at the city level and formulate the CDP. The CDO should be supported by a pool of data champions and coordinators in various city departments and governance agencies. The CDO is also mandated to establish a city data office/cell that functions as the city-level data analytics and management unit staffed with requisite skills in data science, ICT, network technology etc. To promote enhanced participation of non-state stakeholders (i.e. citizens, industry, academia), the strategy recommends the formation of city data alliances (CDA) to create data-led partnerships, build muscle for innovation and create collaboration on city data.

The DSC strategy also recommends a similar governance structure at the state and national levels. These structures at the three levels of government are non-hierarchical and intended to complement each other, while functioning with the desired level of autonomy to achieve their stated purpose. The mission is committed to their continuous capacity-building through hands-on data collation for assessments, online learning modules and expert support through partner networks.

The **process** component of the strategy lays down processes with respect to data standardization, categorization and classification in line with the National Data Sharing and Accessibility Policy<sup>9</sup> (NDSAP). The policy requires the city authorities to adopt a privacy-first approach while collecting, processing and sharing city data. The CDP defines how to collect, store and manage data for cities.

Under the **platform** component, the objective is to create digital infrastructure as a public good. The creation of National Urban Innovation Stack (NUIS)<sup>10</sup> (a digital infrastructure built with a deep understanding of the urban ecosystem undertaken by MoHUA) is a key step towards achieving the same.

The NUIS is envisaged as a shared digital infrastructure that will be available for use by citizens, entrepreneurs, academics, administrators, governments, NGOs and other urban actors across the country. It comprises a set of building blocks developed as a “common public good” to avoid duplication of efforts, provide equitable access and successfully achieve convergence. This is expected to accelerate and amplify solutions and innovations that are underway and enable the rapid development of diverse new solutions by cities and states.

### BOX 1

#### Key components of NUIS

a. **Core data infrastructure layer:** This layer is made up of two key components – registries and data infrastructure. Registries enable a single source of truth and manage master urban data for the nation. Data infrastructure contains data standards, specifications and data services that should be used by programmes built on top of NUIS.

b. **Core enabling services layer:** These are reusable functional services to enable the creation of urban solutions. These services consist of fundamental building blocks of reusable open APIs<sup>11</sup> and libraries. Some of the services may be seeded by NUIS as

open-source services or already available open-source components. Other services may come from different actors in the ecosystem and be adopted as open standards by NUIS. A few examples of core services are payments, authentication, localization, GIS service and entity management.

c. **Urban solutions platform:** This layer makes NUIS real for citizens and other stakeholders. It uses the first two layers of NUIS – core data infrastructure and core services – and builds functional solutions that can be assembled by urban ecosystem players to achieve goals of various programmes.

With the strategy in place, the MoHUA partnered with various ecosystem players to initiate stacking various platform layers of NUIS. This led to the creation of the following:

- Open Data Platform (ODP)
- India Urban Data Exchange (IUDX)
- India Urban Observatory (IUO)
- National Urban Learning Platform (NULP)

MoHUA launched an **ODP** (<https://smartcities.data.gov.in>) in February 2019, a digital public repository for cities to publish machine-ready data. It is designed to be a single point of access to open datasets available with various smart cities, ministries/departments, along with enhanced visualization, efficient discoverability of resources, widgets to share filtered sets of data catalogues and community participation through fora, blogs, infographics and much more.

As of December 2020, the portal has more than 3,000 data catalogues across different sectors from 100 smart cities. The CDOs are uploading datasets on the portal for their respective cities per defined frequency. The CDO from each city is responsible for managing the necessary compliance, including privacy/disclosures per NDSAP.

**India Urban Data Exchange (IUDX)**, a critical component of the NUIS, is being developed to help evolve standards, specifications, certifications, systems and tools for urban stakeholders to share data effectively for improved planning and decision-making. The IUDX is intended to enable authenticated, secure and consented data access between different organizations to ensure privacy and data security in interactions.

**India Urban Observatory (IUO)** has been established to collect and manage data from multiple sources, including individual city internet of things (IoT) data platforms, non-IoT data sources, social media, open data and other third-party sources. The platform, envisaged as the main

data analytics and management hub of MoHUA, correlates, analyses data to extract key insight and uses this intelligence for planning and evidence-based decision-making. It also measures and tracks key operational and performance metrics and enhances the accessibility of urban services.

Additionally, the **National Urban Learning Platform (NULP)** was launched to address the training and skill development needs of different ecosystem actors. The NULP team works with various stakeholders to ensure that the knowledge they possess is digitalized and made available to ecosystem actors in a streamlined manner. It also enables delivery of training programmes and certification courses in a targeted manner. Over time, the NULP is expected to host content from a large variety of stakeholders, making it the primary source for urban training and development for government employees, civil society, business and industry actors.

Both central and state-level technology and data platforms have played a key role in responding to the COVID-19 pandemic. MoHUA has also partnered with various organizations to create awareness on technological solutions adopted by Indian and global smart cities. The key initiatives are summarized below:

- Developed compendiums consisting of best practices adopted by national and international cities and shared with Indian smart cities to show how smart cities are responding to the challenges posed by the pandemic.
- Facilitated development and customization of solutions targeted at COVID-19 response and using them across cities.
- Organized several webinars/events inviting national/global cities to share their response with Indian cities.
- Created a repository of publications on COVID-19 from various sources. Details are available at <https://smartnet.niua.org/covid-19>.

## 2.3 Regulatory framework for technology and data governance

City level agencies often face significant challenges around standardization and interoperability between their individual technology solutions. To address these, international standard setting agencies such as International Organization for Standardization (ISO) and the British Standards Institution (BSI) have developed several standards to provide support to smart cities in finding solutions to address the above-mentioned challenges. Examples of such standards have been highlighted in Appendix 1.

Adoption of standards ensures that smart solutions processes and analyses derive meaningful information for the city's planning and operations. This has helped cities formulate an evidence-based response to the pandemic. Given the extensive use of citizen data in smart solutions, measures should be put in place to ensure protection of citizens' privacy in collecting, handling and managing this data.

Globally, most countries may not have data protection regulations for their cities. However, regulations such as the European General Data Protection Regulation (GDPR), are widely accepted and adopted by smart cities. These regulations remain applicable even during the pandemic unless exempted under provisions for dealing with emergency situations, such as a disaster or pandemic.

Indian cities do not have specific standards for technology solutions or regulations on citizen data protection and security. MoHUA, in close consultation with several departments/agencies – such as Bureau of Indian Standards (BIS), National Security Council Secretariat, Department of Electronics and Information Technology, Department of Science and Technology and

industry associations – are working towards providing guidance to Indian smart cities on adoption of available global technology standards developed by BSI, ISO etc. Currently, the Bureau of Indian Standards (BIS) is working in association with the SCM to develop requisite standards<sup>12</sup> for Indian smart cities.

With regard to data security, Indian cities comply with the provisions of “Information Technology (Reasonable security practices and procedures and sensitive personal data or information) Rules, 2011”, which governs management and sharing of sensitive personal data, and the National Data Sharing and Accessibility Policy (NDSAP), which governs sharing of non-sensitive data available either in digital or analogue forms by ministries/ government departments etc.

These rules provide protection to sensitive personal information and non-sensitive shareable data. However, they do not provide comprehensive protection to personal data. The Personal Data Protection Bill, 2019, is under consideration in the parliament to provide protection in the use of personal data. Please refer Appendix 2 for further details on the legal framework for data protection.

India is working to develop appropriate regulations and frameworks to bring clarity on technology and data governance management during the pandemic. Case studies of select Indian and global smart cities are presented in the next sections to provide insight into key measures taken in response to the pandemic with a focus on aspects related to technology and data governance.



### 3 COVID-19 response by Indian smart cities



This section summarizes how three Indian cities,<sup>13</sup> Bengaluru, Surat and Pimpri-Chinchwad, have adopted technology to respond to COVID-19 and managed data governance challenges.

Population

**8,443,675**

(2011 Census)

Area

**709**

sq.km

URL

[bbmp.gov.in](http://bbmp.gov.in)



### 3.1 Bengaluru, Karnataka

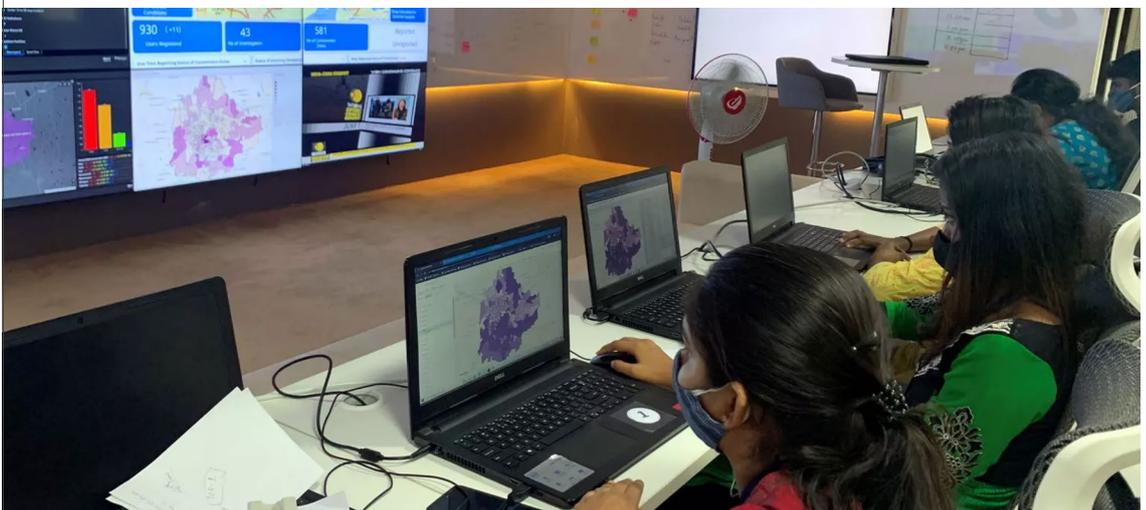
Bengaluru is India's fifth-largest city and one of Asia's fastest-growing metropolises. It has been labelled the IT Capital of India or India's Silicon Valley.

#### Technological solutions used in response to COVID-19

The Bruhat Bengaluru Mahanagara Palike (BBMP), the city municipal corporation, has used the technological expertise and capabilities of its residents to combat the pandemic. With the support of city-based IT organizations, BBMP adopted several technology solutions to set up a COVID-19 War Room, dashboards and mobile applications for contact tracing and various other services. Their highlights are as follows:

##### A. COVID-19 War Room at Bengaluru

BBMP developed a COVID-19 War Room to respond to the pandemic in March 2020. This 24x7 command-and-control centre helped to map each COVID-19 positive case in the city using GIS, track healthcare workers using the Global Positioning System (GPS) and draw up containment plans using heat-mapping technologies.



COVID-19 War Room, BBMP

The city-level planning, coordination and monitoring of the COVID-19 crisis strategies are being implemented from the War Room itself.

1. **COVID-19 dashboard:** BBMP has launched a citizen-focused COVID-19 dashboard at the COVID-19 War Room. This dashboard serves as a one-point source for COVID-19 related data that includes people under quarantine, their contacts, medical personnel, hospitals, data by zone and city. This dashboard was developed with support from the Indian Institute of Science (IISc) Bengaluru and other private-sector organizations.

The dashboard<sup>14</sup> provides real-time information related to hotspots, containment zones, healthcare facilities etc. It also enables monitoring cases at the micro level with a granular-level analysis by age, gender, source of transmission and location using statistical tools and simulation models. BBMP has also signed a memorandum of understanding with IISc for undertaking predictive modelling to study the spread of the virus and find containment solutions.

2. **Telecare:** To provide telemedicine/teleconsultation services at the ward level, a list of health volunteers has been prepared. These health

volunteers underwent virtual training sessions using the facilities at COVID-19 War Room.

## B. Monitoring of containment zones

Containment zones are monitored daily using BBMP Contain app, drones and closed-circuit televisions (CCTVs) to manage people crowding, sanitization etc.

## C. Management of quarantine centres

The BBMP IQMS app developed and deployed at quarantine centres provides data on the health of quarantined persons. It also provides information on available facilities at the centre, as well as real-time tracking of ambulances and disinfection services using GPS using surveillance technologies.

## D. Mobile apps to respond to pandemic

1. **INDEX application:** The BBMP COVID-19 War Room, in collaboration with various partners, developed this application, which has been in operation since 1 July 2020. It processes the patient data records from the ICMR portal<sup>15</sup> (<https://cvstatus.icmr.gov.in/>) and cases for action by zone in near real-time, including shifting of the patient to either hospitals or COVID care centres (CCC), based on symptoms, arranging ambulances, tracking patient life cycle etc. This has helped reduce reaction time from 24 hours to near real-time.

**BBMP INDEX APPLICATION**

SELECT AREA: [District] | SELECT DISTRICT: [ ] | Login

**SUMMARY FORM** (2020)

	Male	Female	Transgender	Not-ecogred	Total
Number of positive cases:	258	181	1	0	440
Number of cases hospitalized:	44	23	0	0	67
Number of cases shifted to Government Hospital:	8	4	0	0	12
Number of cases shifted to Private Hospital:	36	19	0	0	55
Number of cases in Covid Care Centres(CCC):	18	7	0	0	25
Number of cases sent for home isolation:	82	62	1	0	145
Number of cases discharged:	1	1	0	0	2
Number of Deaths:	4	1	0	0	5
Number of cases Not reachable:	48	29	0	0	77
Number of cases Under process:	17	26	0	0	43
Number of Unattended cases:	43	31	0	0	74

**PATIENT LINE LIST WITH DATE FILTERS & ZONE POPULATED USING GIS APPLICATION**

ICMR ID	DISTRICT P Code	Patient Name	ICMR Zone	ICMR Ward	Address
			Bangalore urban	Bangalore urban	Taluk
			BB Nagar	Jana Bharathi ward	
			South	Ganesh Mandir ward	
			East	Shantala Nagar	

**SOME SCREENSHOTS**

ICMR FEEDS: [Form with patient details]

PERSONAL HEALTH SUPERVISION: [Form with symptoms and contacts]

2. **Sahaaya Sethuve app:** Enables Bengaluru residents/NGOs to donate money and supplies to COVID-19 relief and volunteer for efforts to fight the pandemic. The technology acts as a bridge among various groups, including individuals, NGOs, doctors and BBMP officials. Government employees can assign activities, track inventory and monitor and manage the overall process. The app also provides users the location of “fever clinics” and Indira Canteens, which provide subsidized food.

3. **BBMP Contains app:** BBMP has launched a mobile application exclusively for residents living in containment zones that have been sealed due to COVID-19. The app aims to be a platform for grievance redressal and helps the authorities monitor surveillance mechanisms in these areas. It allows citizens in containment zones to raise complaints and seek help for issues, such as a health-related emergency and requirement of essential services (including drinking water, ration kits, groceries, electricity breakdown, waste collection). It provides options to upload

photographs and videos to raise complaints of lockdown violators from the area, among others. GPS tracking helps teams at the COVID-19 War Room locate the area and respond accordingly.

## E. Essential services delivery

1. **Essential services delivery to needy:** BBMP launched the Hunger Helpline to provide information about food distribution drives. Local newspapers and the city website were used to create awareness about it among citizens. The purpose of the helpline is to provide food to the poor, including migrant labourers who were rendered jobless due to the pandemic. BBMP has also reached out to local branches of

associations, such as CREDAI,<sup>16</sup> to seek details about construction sites in the city where out-of-work construction labourers may be found.

2. **Home delivery of groceries:** To ensure adherence to lockdown, BBMP, in coordination with Karnataka State Disaster Management Authority, has launched a helpline for home delivery of essential commodities to citizens. BBMP also directed shop owners to compulsorily register their shops with the helpline by using WhatsApp. BBMP also provides support of delivery partners to shop owners in case they do not have their own home delivery mechanism.

**Hunger Helpline**

9480685873

ALERT TO ALL BBMP OFFICERS ON FIELD TO CONTACT THIS NUMBER IN CASE OF URGENT REQUIREMENT OF FOOD AND WATER FOR MIGRANT LABOUR

WHATSAPP A MESSAGE ON THIS NUMBER ABOUT THE EMERGENCY AND PLEASE NOTE THAT THIS IS ONLY FOR INTERNAL COORDINATION. STRICTLY NOT TO BE SHARED WITH PUBLIC.

---

9480685888

HUNGER HELPLINE NUMBER

WHATSAPP OR CALL

IN CASE OF FOOD RELATED EMERGENCY

**BRUHAT BENGALURU MAHANAGARA PALIKE and KARNATAKA STATE DISASTER MANAGEMENT AUTHORITY**

Helpline Number for Home Delivery  
**080 6191 4960**

Appeal to Shop Owners

To ensure total success of lockdown, we are providing for home delivery of all essential commodities to citizens through the COVID-19 Home Delivery Helpline 080 6191 4960. "Shop owners are directed to compulsorily register their shops by WhatsApping us on 080 6191 4960". After the launch of this helpline, all persons in Bengaluru must procure items via home delivery only. Customers will use the same helpline number to place their order. The order will be allotted to the shop located nearest to the customer. In case your shop supports home delivery, you can deliver it yourself. In case your shop does not support home delivery, our delivery partners will deliver the order. A standard delivery fee of Rs. 20/- will be levied, to be paid to the delivery partner by the shop.

**HOW TO USE THIS HELPLINE:**

**STEP 1** WhatsApp 'Shop' to 080 6191 4960. You will be asked to send your shop name and location.

**STEP 2** You have to indicate what you sell in the shop. For example, send 'N' for fruits and vegetables, 'M' for groceries, 'C' medicines, etc.

**STEP 3** Send picture of your shop for verification.

**STEP 4** You have to indicate whether you support home delivery. Send 'Yes' if you support home delivery. Send 'No' if you do not support home delivery.

**STEP 5** You will receive a confirmation of your registration.

You may also call us on 080 6191 4960 to register your shop if you are not familiar with WhatsApp. We request your support and cooperation to make this initiative successful.

R. Ashoka, Minister for Revenue and Vice-Chairman, Karnataka State Disaster Management Authority  
M. Goutham Kumar, Mayor, BBMP  
Ramamohain Raju C.R., Deputy Mayor, BBMP  
B.H. Anil Kumar, IAS, Commissioner, BBMP

As enshrined in our Constitution 'to safeguard public property and assure justice' is the fundamental duty of every citizen of the Country.

**BRUHAT BENGALURU MAHANAGARA PALIKE and KARNATAKA STATE DISASTER MANAGEMENT AUTHORITY**

Helpline Number for Home Delivery  
**080 6191 4960**

Dear Citizens, Many are stepping out to buy groceries, medicines and vegetables during the lockdown period. All essentials will be delivered to your doorstep from now on by placing the order on the helpline. People must not step out even for the purchase of any essential commodities.

**HOW TO USE THIS HELPLINE:**

**Call**

Step 1: Call 080 6191 4960. Send to our customer care executive.

Step 2: Provide your details - Name, Phone Number, Address.

Step 3: Tell the call center executive the name of the items you want to place your order.

Step 4: Share the order.

Step 5: Delivery Partner will deliver the items at your doorstep at the designated time.

Step 6: After the order is placed, you will receive a SMS confirming your order along with a transaction ID.

Step 7: Pay for your grocery, medicines & MTC for delivery fee (to be received by the delivery partner).

**WhatsApp**

Step 1: Send 'Shop' to the number 080 6191 4960.

Step 2: Message 'N' to the number 080 6191 4960.

Step 3: Share your location / address.

Step 4: Follow the instructions given.

Step 5: Tell 'Yes' for groceries, medicines or vegetables.

Step 6: After you send 'N' to the order and give your phone number to the call center.

Step 7: Delivery Partner will deliver the items at your doorstep at the designated time.

Step 8: Pay for your grocery, medicines & MTC for delivery fee (to be received by the delivery partner).

As enshrined in our Constitution 'to safeguard public property and assure justice' is the fundamental duty of every citizen of the Country.

## F. Connect with citizens

1. **Panic/stress management:** Through social media, sentiment analysis is being carried out to reach out to a maximum number of citizens to prevent panic and ensure they get correct information about the pandemic.
2. **COVID-19 War Room bulletin:** BBMP publishes a daily news bulletin to share real-time information generated through its dashboard with citizens. This bulletin includes information on increases in COVID-19 cases (positive, recovered and deaths) at zone-wise/city level,

age and gender-wise distributions, maps showing the intensity of spread at the ward level, new cases in last 24 hours, status of containment zones, testing status etc.

3. **Information dissemination:** BBMP ensures real-time information dissemination to citizens using various modes, including dashboard, situation reports with analysis, daily bulletins, weekly bulletins, apps and platform updating, BBMP website, social media sentiment analysis and Facebook.

## Key challenges in technology adoption

1. **Technical know-how:** As Bengaluru did not have a functional ICCC, establishing the COVID-19 War Room as the command-and-control centre was a new concept for BBMP. However, being an IT and education hub, Bengaluru had the support of local Industry and academia partners and was able to quickly establish the War Room. For more details, visit: <https://covid19.bbmpgov.in/pages/about-us>.

2. **Capacity and training of COVID-19 War Room staff:** With the help of local partner organizations, BBMP has trained health workers and volunteers from NGOs to address data entry requirements for the War Room. BBMP has created a training facility to train 1,000 persons at a time through a videoconferencing facility.

## Technology and data governance assessment



### Policy

In the absence of CDP, BBMP is following data-sharing protocols per the National Data Sharing and Accessibility Policy (NDSAP) and other guidelines recommended under the DataSmart Cities strategy developed by MoHUA.



### Data gathering and analysis

#### Datasets and sources

During COVID-19, the following data is being collected through mobile applications and, in some cases, manually on spreadsheets:

- Personal data of patients.
  - Number of tests and positive patients.
  - Name, age, gender from hospitals, labs etc.
  - Information on travel history and current location through mobile apps.
- Traffic violation and overcrowding data: Surveillance systems, including CCTV cameras.
- Location tracking of health workers from mobile apps.
- Information on healthcare infrastructure, such as availability of RT PCR test kits, beds and ventilators at city/zone level, from hospitals through mobile apps.

#### Data analysis

Data analysis uses the dashboard, visualization of scenarios and simulation models to understand the spread of the pandemic. The Indian Institute of Science, Bengaluru and other private-sector organizations are supporting BBMP in data modelling and predictive analytics.



### Institutional structure

**Data team:** CDO and data contributors

**City data cell:** Not yet established

**Data alliance:** No information available



### Data governance issues

#### Privacy and transparency

As per NDSAP and Smart Cities strategy

#### Data security and resilience

- Bengaluru is using a service provider's cloud platform to store the data collected through different sources.
- The ownership of data lies with BBMP and requisite non-disclosure agreements have been signed with third-party vendors to ensure data security. Personal data is being used only after ensuring data privacy.

#### Openness and interoperability

- Data is transferred through APIs and it is ensured that there is no duplication of data entry. Seamless flow of real-time information is a key requirement for the functioning of the COVID-19 War Room.
- To ensure interoperability between the different technological solutions, BBMP has taken necessary care by clearly defining the system requirements (API compatibility) while procuring the solutions.

#### Equity, inclusivity and social impact

Bengaluru is sharing the statistical analysis and visualization of data through dashboards<sup>17</sup> and weekly newsletters/reports<sup>18</sup> with residents of the city. However, limited datasets are available for public usage.

#### Operational and financial sustainability

These initiatives are funded through the city budget. However, Bengaluru is exploring potential for future data monetization through MoHUA's India Urban Data Exchange (IUDX).

#### Population

**4,467,797**

(2011 Census)

#### Area

**326.5**

sq.km

#### URL

[suratsmartcity.com](http://suratsmartcity.com)

[suratmunicipal.org](http://suratmunicipal.org)



## 3.2 Surat, Gujarat

Surat, known as the diamond and textile hub of the country is the eighth-largest city in India in terms of population. The city accounts for nearly 90% of the world's total rough diamond cutting and polishing.

### Technological solutions used in response to COVID-19

With the pandemic significantly affecting industries and residents, Surat Municipal Corporation (SMC), with the support from Surat Smart City Development Limited (SSCDL), has adopted the rigorous strategy of Track, Test, Treat, Isolate and Quarantine (TTT-IQ) to respond to COVID-19.

#### A. Surat's integrated command and control centre

SMC has used [SMArt City \(SMAC\)](#) Centre, its integrated command and control centre, to effectively monitor and manage the fight against COVID-19. SMAC Centre facilities are used as the COVID-19 War Room, which is gathering information from the following sources:

- Self-declaration form on SMC website and SMC app
- Toll-free helpline
- Citizen reporting of travellers or suspects in their society/vicinity
- International traveller information received from Government of India (GoI)
- Details of patients received from private clinics/hospitals and urban health centres

- Door-to-door survey carried out and data collected through the employee connect app

A team of medical interns and MBBS (Bachelor of Medicine, Bachelor of Surgery) is deployed at the COVID-19 War Room to support SMC/SSCDL officials on informed decision-making.

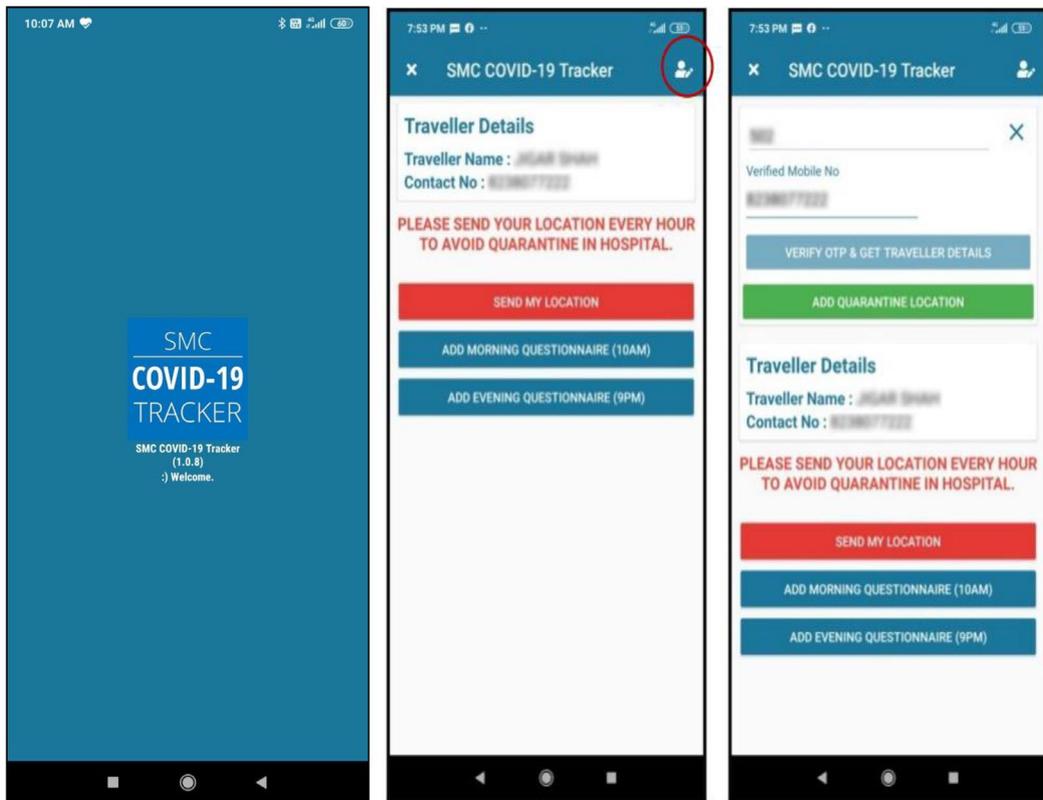
#### B. SMC COVID-19 tracker app

SMC developed SMC COVID-19 tracker app<sup>19</sup> to track the people arriving in the city with international and interstate travel history. It also tracks persons who have come into direct contact with positive COVID-19 individuals and persons reported with acute respiratory infections (ARI).

Citizens have an option for self-declaration through the app or SMC's website. The QR code of the app and link to the website are being circulated in newspapers for the uptake of self-registration.

Home quarantine violation is being monitored from the COVID-19 War Room based on the hourly location tracking of citizens under quarantine through the app (based on mobile towers).

Each COVID-19 positive case is mapped using GIS. Heat maps are generated based on various parameters such as positive cases, ARI cases and density.



COVID-19 Tracker app developed by SMC

### C. War Room at VesuUrban health centre

SMC has formed a dedicated War Room for COVID-19 management. A team of MBBS intern doctors is deployed for tracking and follow-up of suspect cases. ARI cases are detected using the following surveillance mechanisms:

- Passive surveillance: Using data from private clinic and hospitals and urban health centres
- Active surveillance: Adds suspected cases from field surveys directly into the central database

These cases are visited in the field by Rashtriya Bal Swasthya Karyakram (RBSK) AYUSH doctors. Suspects with ARI, severe acute respiratory infections (SARI) and influenza like illness (ILI) are home quarantined and monitored through the COVID-19 tracker app. Regular follow-up on citizens under quarantine is done from the COVID-19 War Room. ARI patients' data from passive surveillance (private hospital and practitioners) is being integrated with this application to ensure their monitoring.

Further, mobile text messages are sent to persons who are suspected as being positive and aged more than 50 with a co-morbid condition providing the nearest community health centres (CHC) reference with doctor name and contact number, along with a location link. Telephonic assistance or logistic support, if required, is provided to reach CHC. SMC has also displayed agility through using its existing disease control system for COVID-19 management.

### D. ITIHAS – Aarogya Setu

SMC has also deployed ITIHAS – Aarogya Setu, a hotspot forecast system to boost surveillance

and contact tracing in COVID-19 affected areas of the city. This app fetches data directly from the Government of India's Aarogya Setu app<sup>20</sup> related to exposure of different regions to COVID-19 positive patients of the past 15 days. Accordingly, it classifies city areas in four COVID-19 hotspot categories for requisite interventions by city officials:

- Pink (immediate scrutiny)
- Amber (immediate watch list)
- Deep blue (watch list)
- Light blue (observation)

## E. Information dissemination

A dedicated COVID-19 related section has been put on the SMC website<sup>21</sup> and its mobile app. It disseminates COVID-19 statistics (such as the number of positive cases, recovery, death, active cases, tests and people under quarantine); important circulars/notifications, advisories; daily update from the municipal commissioner; details of the affected area with a map view, analytics and trend of reported cases (pattern analysis); and information, education and communication (IEC) material for awareness. As soon as a positive case

is registered, citizens within that ward are notified through SMS.

SMC is extensively using social media for information dissemination and panic management among residents. The municipal commissioner's daily live briefing is done from the COVID-19 War Room through these social media platforms. The commissioner also interacts with NGOs and other stakeholders to assess the situation and identify issues. Awareness material and activity updates are posted frequently.

## Key challenges in technology adoption

1. **Technical know-how:** Surat's experience of developing a mobile app for managing municipal solid waste under the smart city project helped the city modify the app to launch SMC COVID-19 tracker app with additional features. However, launching the IOS version was a bit of a challenge due to stringent security requirements. The in-house team of SMC developed this app.

2. **Capacity and training of COVID-19 War Room staff:** With the help of local partner organizations, SMC has organized trainings for health staff, doctors and nurses to treat COVID-19 patients and protect themselves during the process.



## Technology and data governance assessment



### Policy

In the absence of its own city data policy, following data-sharing protocols per NDSAP and other guidelines recommended under DataSmart Cities strategy developed by MoHUA.



### Institutional structure

**Data team:** CDO, Data coordinators and data contributors (29 departments)

**City data cell:** Not yet established

**Data alliance:** Digital Initiative for Surat Citizens (DISC)



## Data gathering and analysis

### Datasets and sources

During COVID-19, the following data is being collected through mobile applications and, in some cases, manually on Microsoft Excel sheets:

- Personal data of patients.
  - Number of tests, positive patients.
  - Name, age, gender from hospitals, labs etc.
  - Information on travel history and current location through mobile apps.
- Self-declaration form on SMC website and SMC app.
- Traffic violation and overcrowding data: Surveillance system, including CCTV cameras.
- Citizen reporting of travellers or suspect cases in their society/vicinity.
- Location tracking of health workers from mobile apps.
- Information on healthcare infrastructure (such as availability of RT PCR test kits, beds, ventilators at city level/zone level) from hospitals through mobile apps.

### Data analysis

Data is being analysed using the dashboard, visualization of scenarios and simulation models to understand the spread of the pandemic. SMC has laid down a standard operating procedure to carry out data analysis at the city level.



## Data governance issues

### Privacy and transparency

SMC's Standing Committee, a statutory committee constituted under the municipal laws, has approved the adoption of the National Data Sharing and Accessibility Policy (NDSAP) guidelines issued by the Department of Science and Technology, Government of India, as its policy for data management.

### Data security and resilience

Surat is using its in-house data centre to store the data collected through different sources. It has also developed a user manual for employees to adhere to the hosting requirements of the server. The SMC has signed a memorandum of understanding with third parties, including private hospitals, to ensure data protection. Personal data is being used only after anonymising to ensure data privacy.

### Openness and interoperability

Openness is ensured through use of open standards and creating vendor-neutral APIs and interfaces for components. Data access is allowed through APIs. To ensure interoperability between different technological solutions, the SMC has taken necessary care by defining the system requirements (API compatibility) while procuring the solutions. For illustration, RFP<sup>22</sup> requires that “the ICCC software solution should have provision for sharing the data sets for open data platform of SMC and state/central government. Necessary APIs in this regard shall be developed/customized from time to time so that necessary datasets can be made accessible.”

### Equity, inclusivity and social impact

SMC is sharing the statistical analysis and visualization of analysed data through dashboards and reports available to the residents of the city. However, the raw data is not available for public use.

### Operational and financial sustainability

Currently, these initiatives are funded through the city budget. However, Surat is exploring potential for future data monetization through MoHUA's India Urban Data Exchange (IUDX).

Population

**17,27,692**

(2011 Census)

Area

**181**

sq.km

URL

[smartpcmc.org](http://smartpcmc.org)

[pcmcindia.gov.in](http://pcmcindia.gov.in)



### 3.3 Pimpri-Chinchwad, Maharashtra

Pimpri-Chinchwad is a key industrial hub in the state of Maharashtra and is part of the Pune Metropolitan Region.

#### Technological solutions used in response to COVID-19

With the threat of COVID-19 spreading, Pimpri-Chinchwad Municipal Corporation (PCMC) explored the possibility of using the existing smart city infrastructure and facilities to manage the response to the pandemic.

A key measure implemented was to convert the ICCC into a COVID-19 War Room. The ICCC is being used as the central control room for collection, collation, analysis and dissemination of COVID-19 related data. This has led to a significant reduction in coordination time, helping PCMC take prompt decisions based on the most recent data points.

The city administration onboarded smart city technology consultants to support their efforts to build and develop solutions for COVID-19 tracking and integrating it with the War Room. Various technology solutions were designed and installed at the War Room to facilitate better management of the COVID-19 pandemic.

##### A. Healthcare and patient tracking dashboard

The highest priority was given to contact tracing and tracking of infected patients and on prevention of the spread of the disease. A healthcare and patient tracking dashboard was developed by PCMC to provide real-time information on COVID-19-related cases, testing and healthcare arrangements.

Hospitals have been linked to the COVID-19 War Room dashboard, where hospitals update data in an online form daily. The dashboard is available to the public on the PCMC website. The key features of the dashboard are:

- Patient details are filled by each facility involved in COVID-19 support (hospitals, COVID care centres, dedicated COVID health centres, test labs etc.); these details are reflected on a real-time basis at the War Room.
- Each patient is provided with an ID number and identity is kept confidential.
- Key information is reflected in a colour-coded box form for a quick read, with additional details made available in the dropdown format under each information box.

**GIS dashboard:** PCMC is using a GIS-based information system to track containment areas. The GIS dashboard provides geotagging of home quarantined, COVID-19 positive cases, recovered cases, deaths, containment areas etc.

This information is used to generate a heatmap that helps classify areas from low to high risk. This dashboard is also used to identify epicentres of COVID-19 cases, which helps the health

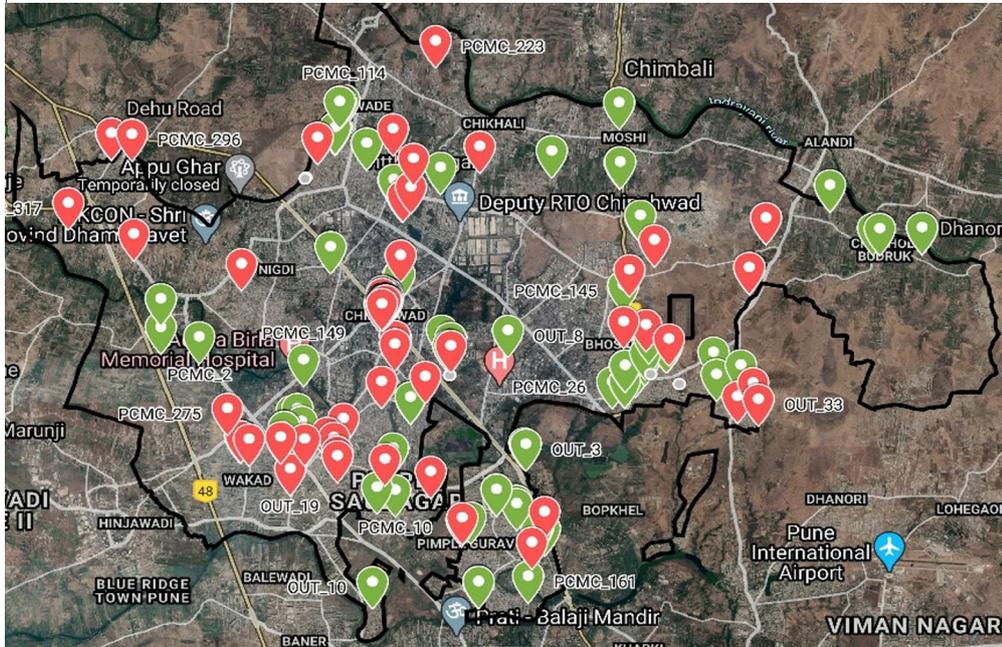
“ The city administration onboarded smart city technology consultants to support their efforts to build and develop solutions for COVID-19 tracking.

department to identify locations for immediate spraying of disinfectant.

The same information is used by the medical department to send out special task forces to carry out door-to-door campaigns and identify cases. This geographical information assists in identifying the areas for cordoning-off to contain any further spread. Please refer to the figure of the GIS dashboard (below), showing geotagged people who have been home quarantined (green colour dots on

map), last location of COVID-19 positive persons (red drop marks on map), cordoned-off area (black lines on map), lane closures etc.

Patients' activity level is monitored through the system and health officials use this data to identify locations for immediate spraying of disinfectant and deployment of the special task force for door-to-door campaigns. The COVID-19 War Room gets real-time updates on positive cases, including active (14 days) and passive (28 days) home quarantine cases.



COVID-19 GIS Dashboard

## B. Controlling COVID-19 spread – Lockdown management

**Surveillance dashboard:** A dashboard for city surveillance has been set up at the COVID-19 War Room and is being jointly monitored by a dedicated team of the PCMC and Pimpri-Chinchwad city police. A total of 298 “point-tilt-zoom” surveillance cameras, installed at 85 locations across PCMC jurisdiction, monitor activities from the ICCC. The feed from the CCTVs is used for video analytics, based on which the team can provide alerts in case of gatherings of more than three people.

PCMC has put in stringent systems and checks in place that generate alerts and notification when lockdown protocols are violated. The PCMC special task force, comprising city police, local health workers and city municipal authorities, is alerted from the COVID-19 War Room to take appropriate steps.

**Sarathi Helpline:** PCMC has set up a dedicated helpline platform called SARATHI (System of Assisting Residents and Tourists through Helpline Information) wherein citizens can request assistance for essential goods and services. The calls received are saved as audio files and tagged with respect to date and nature of request, responsible department and zone and status of request closure.

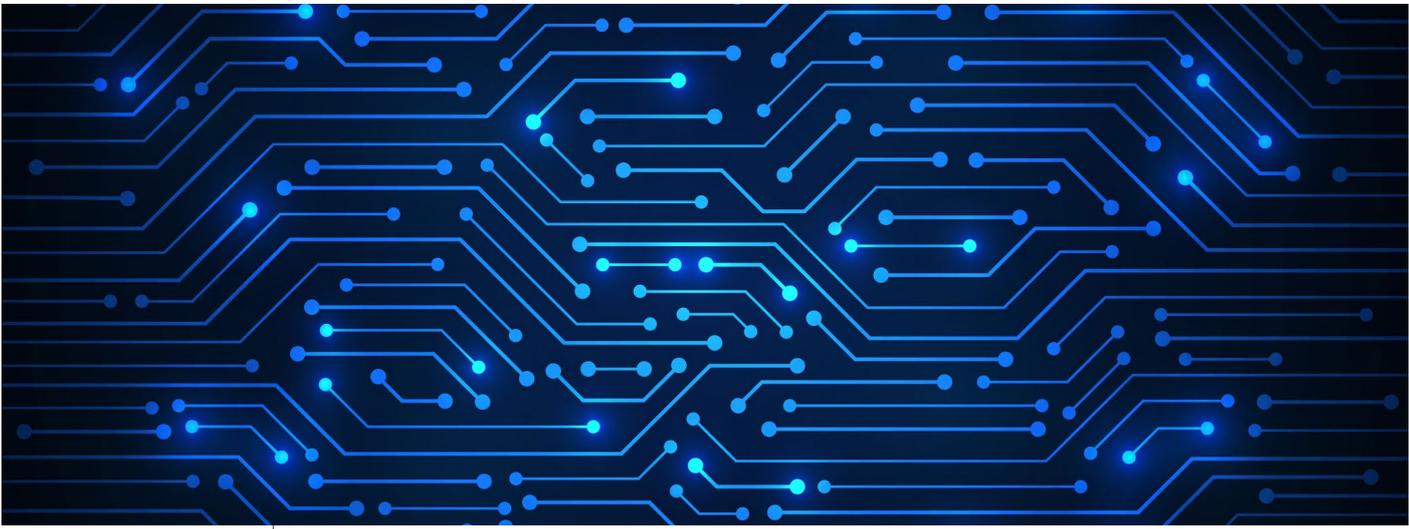
The COVID-19 War Room is being used to ensure that every question and query received through the

helpline is responded to by trained professionals. A dashboard of SARATHI has been set up at ICCC, which provides analytics on major request/complaints from citizens, request/complaint redressal status, zone-wise request/complaints etc.

**PCMC Smart Sarathi mobile application** has an online self-assessment test for citizens of the PCMC area. The data from these tests are used by the city administration for analysis; developing action plans; monitoring patients; checking quarantine movement; identifying the location of suspected patients; and mobilizing the concerned health workers of that area. Citizens can also use this application to register to volunteer their services for providing relief measures.

The data from the application is monitored from the ICCC. The app is equipped with a “Near Me” feature that lists the details of nearby COVID hospitals, fever clinics, emergency dispensaries, marketplaces, food distribution centres, home shelters and grocery stores within the city.

In addition, PCMC has integrated a tele-medicine feature with the Smart Sarathi mobile app to enable video consultations between patients and doctors. The prescription can be sent to patients over the WhatsApp messaging app for which no consultation fee is charged from patients.



### Key challenges in technology adoption

- 1. Designing solutions:** After setting up the ICCC as the COVID-19 War Room, city officials faced challenges in designing technical solutions to respond to the rapid spread of the pandemic. It took time to understand the effective deployment of technological solutions to predict the trend of the spread of the virus, areas likely to be affected, how to go about tracking fresh cases, contact tracing etc. For example, to trace those who had been in contact with patients, the city deployed location-tracking tools for individuals with the help of telecom partners, which resulted in some privacy concerns. However, after learning about various technological solutions, such as “Aarogya setu” app (which uses Bluetooth solutions to target locations), the city started tracking through mobile towers to map the spread of COVID-19.
- 2. Technical challenges:** Several technological solutions are available to address a particular requirement. Hence, it is difficult to choose the best solution to meet the requirements within a short time. In addition, understanding of IT systems is important to ensure the compatibility of new technology solutions with existing IT systems. For example, the city deployed GPS for location tracking. However, it was later found that, for better accuracy, the solution requires use of local Wi-Fi.
- 3. Administrative challenges:** This includes the following:
  - **Limited workforce:** Capacity-building of health workers, nurses, volunteers for data entry through conducting training sessions.
  - **Data sorting:** Significant volumes of data started flowing from various sources but in different formats, making it difficult to analyse. Hence, standard data templates, along with a standard operating procedure, were developed for use by data-entry operators to ensure timely availability of quality data.
  - **Procurement process:** Implementation of several initiatives at the same time required fast-tracking procurement processes, which required special permissions.

### Technology and data governance assessment



#### Policy

PCMC has drafted its city data policy. Please refer the box below for highlights.



#### Institutional structure

**Data team:** CDO and data contributors

**City data cell:** Not yet established

**Data alliance:** CDA exists; the list of members includes representation from some of the private IT companies



## Data gathering and analysis

### Datasets and sources

During COVID-19, the following data is being collected through mobile applications and in some cases, manually on Microsoft Excel sheets:

- Personal data of patients.
  - Number of tests, positive patients.
  - Name, age, gender from hospitals, labs etc.
  - Information on travel history and current location through mobile apps.
- Traffic violation and overcrowding data: surveillance system, including CCTV cameras.
- Location tracking of health workers from mobile apps.
- Information on healthcare infrastructure, such as availability of RT-PCR test kits, beds, ventilators at city/zone level from hospitals through mobile apps.

### Data analysis

PCMC is carrying out data modelling and predictive analytics through its in-house teams using the dashboard, visualization of scenarios and simulation models to understand the spread of the virus. Also, an in-house team of doctors and health functionaries with an IT background has been attached to the COVID-19 War Room to support data analysis. Additionally, PCMC is using a predictive analytical tool provided by the Ministry of Health of India.



## Data governance issues

### Privacy and transparency

PCMC has drafted its city data policy (yet to be finalized and adopted), which defines privacy procedure to be followed per NDSAP.

### Data security and resilience

It will be governed per the provisions of new data policy when approved. However, at present, PCMC is using a local cloud platform at Software Technology Parks of India (STPI) in the city to store the data collected through different sources. The ownership of data lies with PCMC and requisite NDAs have been signed with third-party vendors to ensure data security. Personal data, including sensitive information related to individuals' health and location, is being used only after anonymising to ensure data privacy. PCMC has already appointed a dedicated database administrator to ensure compliance.

### Openness and interoperability

Data is transferred through APIs. No duplication of data entry is ensured. Seamless flow of real-time information is a key requirement for operation of the COVID-19 War Room. To ensure interoperability between different technology solutions, PCMC has taken necessary care by defining the system requirements (API compatibility) while procuring solutions.

### Equity, inclusivity and social impact

At present, PCMC is sharing the statistical analysis and visualization of data through dashboards and other reports available in the public domain. However, sharing raw datasets has yet to be done. The open data transfer policy is expected to ensure better access to residents towards accessing city data online and shall help implement the city's transparency initiatives

### Operational and financial sustainability

The implementation of the open data policy of PCMC is expected to entail expenditures for both data owners and data managers for analogue to digital conversion, field revenue data refinement data storage, quality up-gradation etc. Budgetary provisions and appropriate support for data management for each department by PCMC would be necessary. The departments will also earmark the decided budget in its annual budget after going through the suggestions given by the CDO for implementation of data-related initiatives/activities.

Key highlights of the city draft policy are summarized in Box 2.

## BOX 2 PCMC data policy

PCMC has drafted a city data policy that is in the process of being finalized. Key highlights of the proposed policy are:

**Objective:** The policy provides an enabling provision and platform for proactive and open access to data generated. It is based on National Data Sharing and Accessibility Policy of the Department of Science and Technology, Government of India.

Data will be classified as “shareable data” and “non-shareable data”. A review committee chaired by the Additional Commissioner will prepare the negative list of data, which will be placed before the Commissioner for approval.

Data will be categorized as personal and non-personal. Personal data comprises information relating to an individual who can be identified from that information. Non-personal data comprise anonymous information/data that does not relate to an identified or identifiable natural person or personal data rendered anonymous in such a manner that the data subject is not identifiable.

Measures for data security in terms of securing physical premises, network security, system security, maintenance of audit trail and log, and information security governance have been covered.

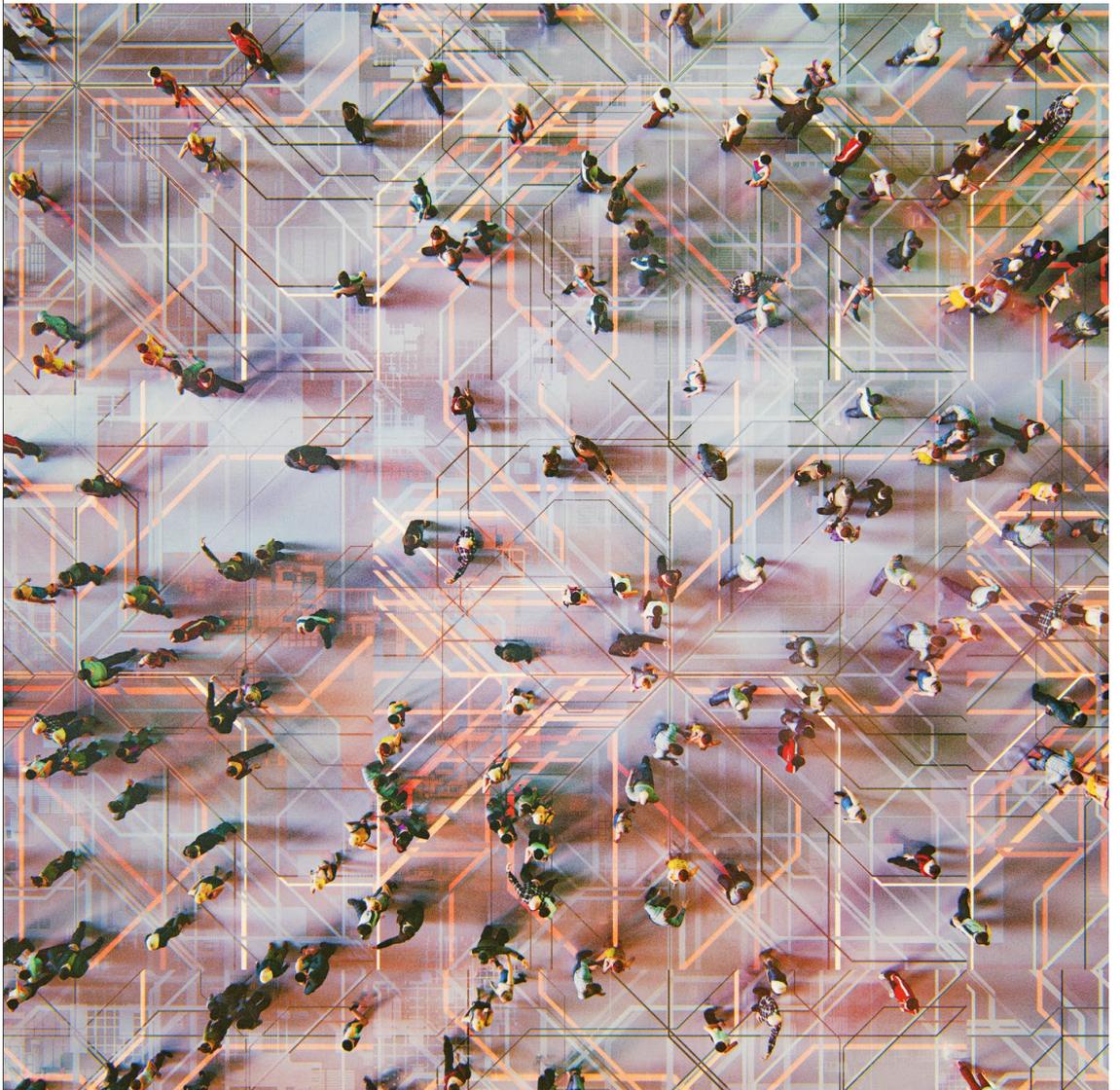
**Legal framework:** The entity/agency collecting and storing data will be responsible for data protection and security. Access to data will only be in compliance with any acts or rules of the Government of India in force.

Standard operating procedures will be defined for data collection, verification, validation and dissemination.

The policy will be implemented by establishing a City-Data Cell headed by CDO. The cell’s key responsibilities will include preparing a negative list of datasets, proposing a list of datasets to be released, monitoring and managing an open data initiative, institutionalizing processes for dataset creation and building capacity.



## 4 COVID-19 response by global cities



This section summarizes how three global cities,<sup>23</sup> Tel Aviv, Lisbon and New York, have leveraged their technological solutions to respond to COVID-19 and managed data governance challenges.

Population

**451,520**  
(2018 Census)

Area

**52**  
sq.km



## 4.1 Tel Aviv, Israel

Tel Aviv-Yafo, known as the non-stop city, is Israel's second most populous city with a population of 451,520 (2018). It is part of the Tel Aviv metropolitan area, which had a population of 3.9 million, accounting for 44% of the Israeli population (2018).

### Technology and innovation used for COVID-19 response for citizens

In November 2014, Tel Aviv-Yafo won first prize in the Smart City competition held at the Smart City Expo in Barcelona (EU, 2014), shifting the global focus to its unique approach that uses technology to improve the quality of life in the city. Tel Aviv-Yafo Municipality has taken several innovative initiatives to respond to COVID-19.

#### A. Municipal command and control centre

As part of its security and emergency structure, the municipality operates a municipal command-and-control-centre<sup>24</sup> known as Mabat that uses monitoring and security methods, including cameras, emergency call buttons and an alarm network in public spaces. The control centre is used for managing lockdown; spotting overcrowding and violation of protocols; and managing events, observations, recording and investigation.

#### B. Municipality's technology platforms

Tel Aviv-Yafo is a global hub for the development of innovative technologies. The city uses existing digital tools available from local industries and develops applications on its own to support cutting-

edge work methods. The municipality has deployed a variety of technological platforms to maintain direct and continuous contact with city residents.

At the onset of the pandemic, several dedicated functions were added to these platforms<sup>25</sup> to enable timely updating of relevant information for residents, while providing the municipality a credible, up-to-the-minute picture of the status of the city's residents and businesses.

1. **DigiTel:** This mobile app provides direct, personalized contact with city residents using a variety of digital means (its website, text messages to residents' phones and personal emails).

During the pandemic, the platform is used to deliver information on various topics to target audiences (the elderly, families, young people, residents of certain districts etc.). The communications include updates on guidelines, municipal activities and the mayor's daily message.

“ A dedicated COVID-19 dashboard helped to highlight hotspots, provide statistical analysis for districts in terms of number of elderly residents and the origin of calls to city’s COVID hotlines.

2. **106 plus call centre:** In addition to its usual role as the municipality’s 24-hour hotline for rapid reporting, the city’s call centre has added new functions to its capabilities in response to COVID-19. The functions include the following:
  - Sending urgent messages to residents
  - Receiving reports from residents regarding senior citizens who need help
  - Serving as a panic button for elderly residents
3. **Municipality’s website:** A dedicated page was set up that presents information relevant to the pandemic, such as updates, where to turn for support and assistance, community activities, education and relief for business owners. The website is accessible in both Hebrew and English.
4. **GIS mapping system:** This interactive platform shows the location of educational institutions, parking lots, pharmacies, public shelters, hotels and other categories of places throughout the city. When the pandemic broke out, the municipality built on these existing layers of information, adding a function that demarcates the extent of outdoor movement permitted to residents. During the lockdown, this helped people observe the government directive not to go any farther than 100 metres from their homes.
5. **Real-time city management:** This was a key tool to provide updated situation reports based on residents’ reports to the 106 plus municipal hotline (via telephone and application), reports

from municipal inspectors and workers and various IoT systems. During the pandemic, the city expanded its reporting system to include events that are specific to the pandemic, such as forbidden gatherings of more than two people and businesses operating in contravention of the health ministry’s directives. This allows the municipality’s management to identify an irregular event and take quick action.

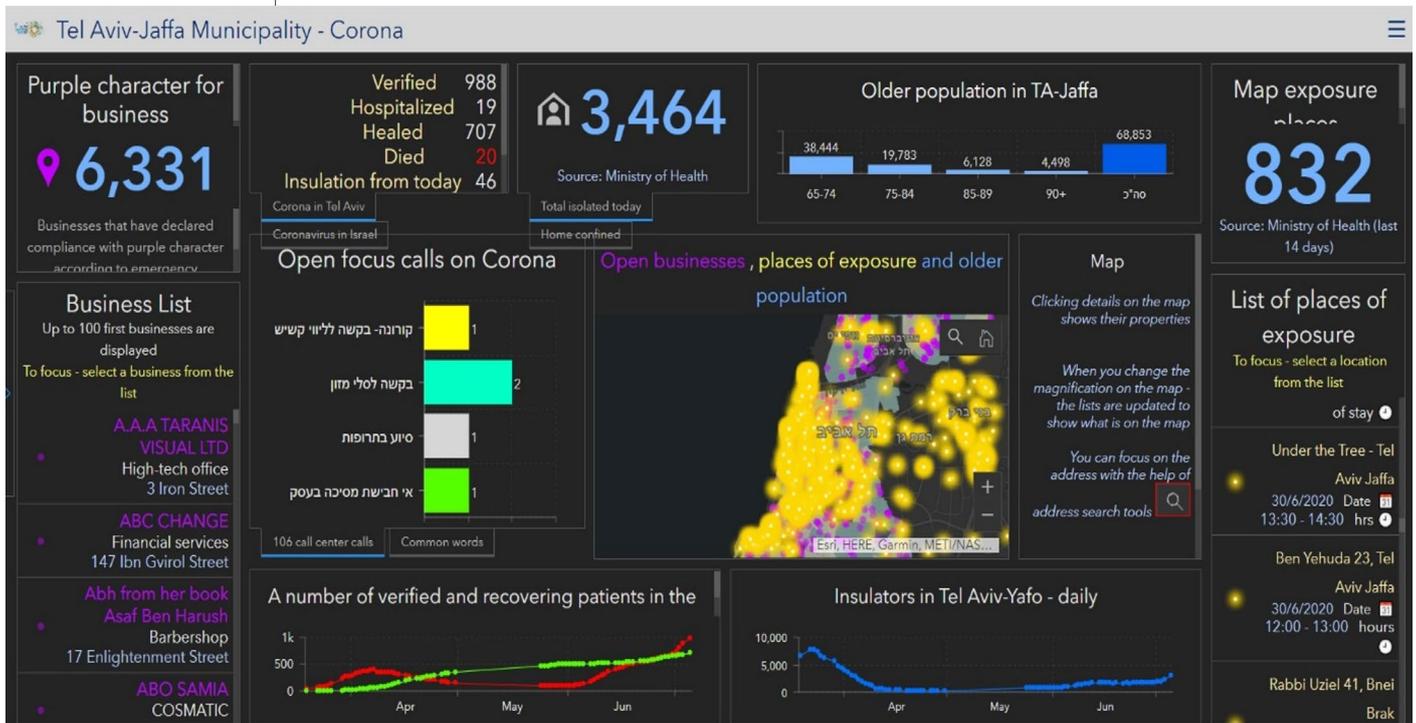
6. **Assistance to the elderly population in need:**

By using the information stored in municipal databases, the city was able to identify elderly members of its population who live alone and/or are not mobile and/or have other limitations. During the pandemic, this information enabled the city to maintain continuous contact with its older residents and extend a helping hand by regularly sending them food, assisting them in obtaining medications and other necessities.

**C. COVID-19 dashboard**

The city developed a dedicated dashboard to provide an overview of the COVID-19 situation, including the number of sick, number of critically ill, number in quarantine and number of recovered patients. The dashboard also helped to highlight hotspots, provide statistical analysis for districts in terms of number of elderly residents, origination of calls to city’s COVID hotlines etc.

This tool provides the municipal management with a situation report in real time that helps decision-makers in fields such as population, operations, public health and other relevant issues.



Corona dashboard

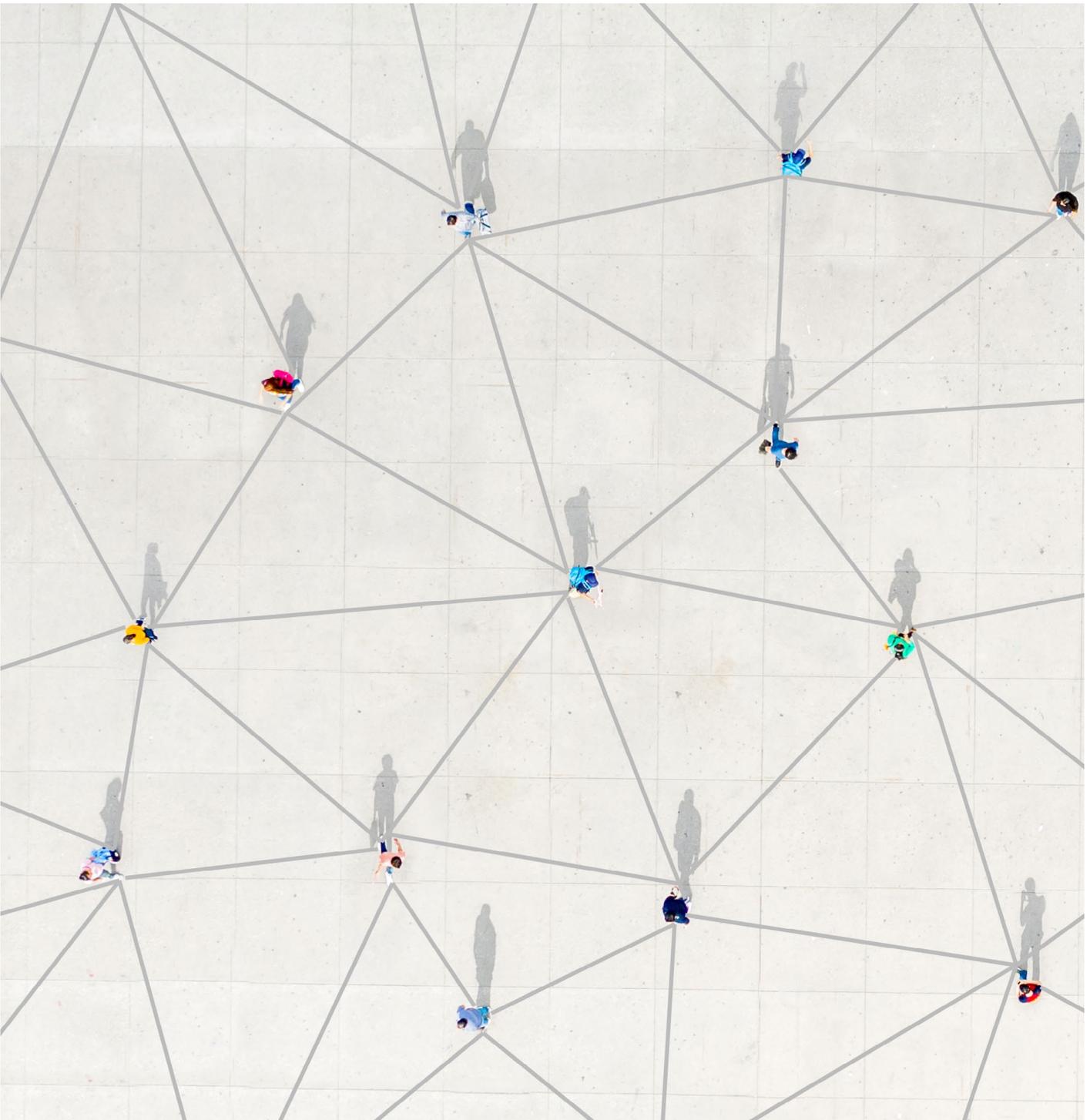
#### D. International virtual hackathon

Realizing the urgent need for innovative solutions to deal with the challenges posed by the pandemic, Tel Aviv held its first international virtual hackathon<sup>26</sup> dedicated to this mission in April 2020. The hackathon provided a platform for interested entrepreneurs and students who are confined to their homes to pitch in and help. The hackathon, which sought new ways to help businesses survive and aid communities in distress, was held in collaboration with the Global Resilient Cities Network.

#### E. Apps for managing volunteers

The municipality regularly works with the vibrant start-up community based in Tel Aviv-Yafo. During the pandemic, the city connected with them for initiatives dealing with volunteering in the community:

- **Help is on the way:** This start-up operates a platform mapping a network of volunteers to assist the elderly population. The organization specializes in occasional volunteering, i.e. people who want to volunteer but cannot commit to it on a regular basis.
- **TRIBU:**<sup>27</sup> This app enables people to volunteer in a wide variety of activities that benefit the city's residents. This non-profit app connects those who want to help to those who need help. In the app's first three days of operation, more than 600 volunteers signed up to help with various activities, including bringing medications to the elderly, distributing prepared meals and staffing telephone helplines.



## Technology and data governance assessment



### Policy

**Privacy policy defined by 'Privacy Protection Law'**



### Institutional structure

**Privacy Protection Agency:**

Privacy Protection Authority<sup>28</sup> (PPA) is responsible for regulating and enforcing data protection across sectors, both public and private.

**Tel Aviv-Yafo municipality's legal department:**

To ensure that the Tel Aviv-Yafo municipality complies with the data protection and security measures, introduction of any new initiative or service (including those for responding to the pandemic) requires clearance from its legal department, which has officials specializing in data privacy and security regulations.



### Data gathering and analysis

**Datasets and sources**

In light of the importance of ongoing updates, transparency and data integration, a data management infrastructure was established to enable the municipality's various units to record their activities. This infrastructure, which includes meeting summaries, reports, resident satisfaction surveys and public announcements, allows managers to share updates and maintain orderly documentation of municipal activities.

**Data analysis**

The data management infrastructure has been a major tool for learning and drawing conclusions about what works and what needs to be improved.



### Data governance issues

**Privacy and transparency**

PPA ensures compliance with the privacy laws' provisions on data protection in every Israeli organization, including public bodies that manage personal data. PPA has issued policy<sup>29</sup> guidelines on various aspects of data use to ensure protection, privacy and security.

To respond to COVID-19, PPA has issued guidelines on privacy aspects of COVID-19<sup>30</sup> for handling the unique situation to maintain a balance between the need to prevent the spread of the virus and potential violation of privacy per provisions of Privacy Protection Law. PPA has set up a hotline to respond to queries and concerns of citizens and organizations on data privacy issues.

**Data security and resilience**

PPA regularly reviews and revises its policies/guidelines on data protection, privacy and security in light of new technologies being adopted and is in the process of updating the guidelines to include drones, wearable cameras, improvements in automatic face recognition technologies etc.

Organizations have to comply with data privacy, protection and security under Protection of Privacy Regulations (Data Security),<sup>31</sup> PPA's enforcement mandate is enabled by its power to conduct inspections, audit, criminal investigations and computer forensics.

**Openness and interoperability**

As part of the city's policy to promote the accessibility and transparency of the information provided to the general public, the municipality allows direct access to municipal databases that deal with community affairs, culture, public health, budgets, statistical data and security.

**Equity, inclusivity and social impact**

Tel Aviv Open Data<sup>32</sup> enables the public and app developers to use information in municipal databases that are not of a confidential nature.

**Operational and financial sustainability**

Funded through budgetary allocation.

Population

**547,733**

(2011 Census)

Area

**100**

sq.km



## 4.2 Lisbon, Portugal

Lisbon is the capital and the largest city in Portugal with 547,733 inhabitants per the 2011 census. This modern and cosmopolitan city has retained its traditional heritage even as it steps up as a hotspot for smart city innovation.

### Technology and innovation used for COVID-19 response for citizens

Lisbon manages the city's activities and responses through its **Platform for Intelligent Management in Lisbon**<sup>33</sup> (PGIL). It integrates several systems that allow monitoring, analysis and management of the city more efficiently and in real time. It integrates data coming from both sensors (internal and external systems) and social networks.

The data is provided by 10 internal systems managed by Lisbon's city government and 30 external systems managed by partner organizations. The platform provides real-time data from different sources and IoT devices for the efficient management of city events. It gives a video analytics solution based on artificial intelligence and supports the municipality to automatically identify and alert potential safety hazards. The platform integrates and makes data available through open standards. The PGIL is the source of much of the information that is now available to the public in real time.

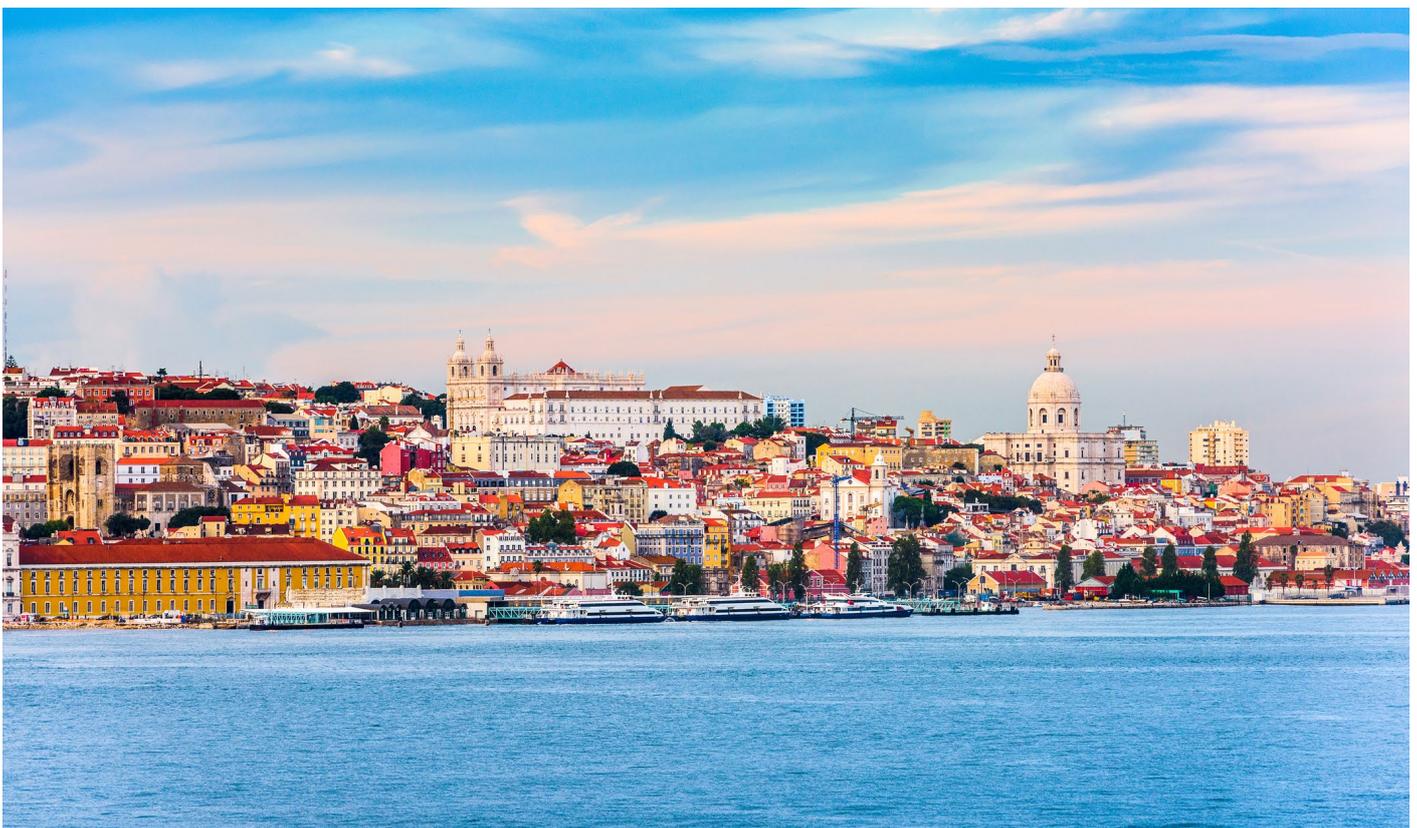
Lisbon City Council, hereinafter referred to as CML, uses PGIL to manage the response to the COVID-19 pandemic. The key initiatives undertaken by CML during the pandemic include the following:

- **Developing a common platform**<sup>34</sup> for 18 municipalities comprising the Lisbon metropolitan area to assess supply and demand for resources and ensure that municipalities collaborate and share resources so that resources such as accommodation, equipment, meals and other goods are made available to those who need it the most.
- **Supporting the central government** and various departments with data analytics capabilities related to mapping and visualizations of data received through its intelligent management platform.
- **Leveraging the open data gate** (Open Lisbon, the Lisboa Aberta portal),<sup>35</sup> a data-sharing portal of CML, the city involved partner entities of the Lisbon Open programme in responding to the pandemic. The platform had been developed to enhance citizen participation, encouraging data reuse and sharing and stimulating entrepreneurship and innovation. It provides curated datasets free of cost to citizens, companies and researchers.

“Lisbon's data-sharing portal has been developed to enhance citizen participation, encouraging data reuse and sharing and stimulating entrepreneurship and innovation.”

LISBOA.24 mobile app

- **Lisbon 24 app:**<sup>36</sup> The CML-developed mobile application provides residents with information on city activities, real-time traffic conditions, car parking locations and availability, and the city bicycle network. The app shares notifications on events that may affect residents' daily lives. During the pandemic, the app was used to provide information on open establishments in the city, along with opening hours and additional services being offered. It also provides personalized information about topics and places of interest to users.
- **Managing the call centre** to inform citizens on the measures implemented by the city and the government to respond to the pandemic.
- **Mitigating the crisis** by supporting digitalization through the following initiatives:
  - a. **Yes, we're open website:**<sup>37</sup> This platform shows which local shops are open during the pandemic to sell food, medication and other basic necessities. The aim is to prevent citizens from making unnecessary trips.
  - b. **Home delivery partnerships:** The city leveraged its technology platform to facilitate delivery services of food and medication during the pandemic by allowing bike-sharing and other mobility options that were otherwise prohibited.



## Technology and data governance assessment



### Policy

Lisbon open data policy that is compliant with European Union GDPR.

Lisbon has in place requisite regulations and guidelines for handling and managing citizen data. Compliance and adherence to these were required while responding to the pandemic.



### Institutional structure

#### Data team:

Chief data officer and director of the Lisbon Urban Management and Intelligence Centre, supported by a team of project manager, technical adviser and project management adviser.

#### City data cell:

The Lisbon Urban Management and Intelligence Centre



### Data gathering and analysis

#### Datasets and sources

PGIL receives data on 357 datasets across 18 functional areas through open data sourced from 10 internal systems managed by Lisbon's city government and 30 external systems managed by several partners.

During the COVID-19 pandemic, the datasets for accommodation, equipment, meals and other goods are being collected from 18 municipalities from the Lisbon metropolitan area to ensure meeting the demands of those who need it most by collaborating and sharing their resources.

#### Data analysis

CML has a team with data analytics capabilities related to mapping and visualization of data.



### Data governance issues

#### Privacy and transparency

Lisbon City Council follows European GDPR to ensure consistent data privacy and protection requirements of consumer and personal data.

To implement GDPR, a team has been constituted to work with each department to facilitate a uniform interpretation of the GDPR and support them in:

- Identifying what data can be shared or is sensitive
- Developing a roadmap to implement GDPR
- Defining standard operating procedures for data access related to data collection, entry and analytics

It has resulted in eliminating multiple databases lying with several stakeholders.

#### Data security and resilience

Lisbon City Council uses both cloud and on-premises data centre to store the data collected through different sources. The data from PGIL (Platform) is stored on an on-premises server. The data-sharing protocol is used to ensure data privacy during the transfer of data between public and private companies.

#### Openness and interoperability

In 2017, open data strategy was implemented through the approval of the open data plan for Lisbon, an instrument for planning and coordinating the annual initiatives that CML and its partners had undertaken to implement.

The data transfer between the open data portal and PGIL and other users takes place using APIs (CKAN API and ARCGIS REST API).

#### Equity, inclusivity and social impact

The open data strategy assumes that the information produced by municipal services, companies in the municipal universe and various actors working in the city should be available openly for the provision of better services to its citizens. In addition to free data, the Lisboa Aberta portal also provides data catalogue services to cover life cycle data.

#### Operational and financial sustainability

The monetization of data has been considered as an option but no steps have been taken so far.

Population

**8,400,000**

(2019 Census)

Area

**784**

sq.km



## 4.3 New York City, USA

New York City, home to 8.4 million<sup>38</sup> people (as of July 2019), is the largest city of United States of America. It is the business capital of the country and known as the “City That Never Sleeps”.

### Technology and innovation used for COVID-19 response for citizens

New York City Emergency Management<sup>39</sup> is responsible for coordinating citywide emergency planning and response for all types and scales of emergency. It has more than 200 dedicated professionals with diverse backgrounds and areas of expertise, including individuals assigned from other city agencies. It had been set up to help citizens before, during and after emergencies through preparedness, education and response.

The agency leads the coordination for multiagency response to emergencies and other significant incidents in New York City. These incidents include developing New York City emergency plans, collaborating with over 400 local, state, federal, non-profit and other entities and educating the public about emergency preparedness.

As part of its response to the pandemic, New York City Emergency Management established a series of task forces to work alongside the emergency support functions. Its support operations to the healthcare system include medical surge staffing, medical surge space and the procurement of critical medical supplies. Its logistics centre team managed resource requests and procurement of assets sourced from the emergency supply stockpile, city agencies and state and federal partners, as well as from open market procurements.

As the number of COVID-19 cases continued to increase, NYC Emergency Management and other city agencies coordinated the expansion of hospital operations in non-traditional medical settings.

Working with agency partners, NYC Emergency Management took the following initiatives:

- Coordinated the use of hotels to house healthcare workers, individuals from congregate settings who were symptomatic and individuals discharged from hospitals who tested positive for COVID-19 and required an isolated setting
- Minimized food access disruptions for vulnerable and newly vulnerable New Yorkers by providing home-delivered meals to people who were both food insecure and at a higher risk of catching the virus

Other programmes included the **NYC Food Delivery Assistance** programme, the Department of Education’s grab-and-go meals at over 400 sites across the city, senior meal deliveries and work with food pantries and soup kitchens in five boroughs.

Keeping the public apprised of the city’s steps to protect and support New Yorkers during this evolving incident was paramount. Public messaging

“ In New York City, a short code messaging programme (known as Nixle) was launched to ensure New Yorkers receive critical updates about the city’s response to COVID-19.

expanded beyond social media and websites during the emergency.

The agency (working with the animal planning task force) rolled out the COVID-19 pet hotline, a resource for pet owners who need assistance if they have been affected by the virus.

**Notify NYC**<sup>40</sup> is the city’s official emergency communications programme to ensure New Yorkers stay informed and connected during critical times and is an official source to be informed on important city services.

The Notify NYC team launched a short code messaging programme (known as Nixle) to ensure New Yorkers receive critical updates about the city’s response to COVID-19.

The agency issued wireless emergency messages to recruit medical personnel to volunteer in healthcare settings across the city.

Additionally, the **NYC Recovery Data Partnership**<sup>41</sup> was launched by the Mayor’s Office of Policy and Planning, the Mayor’s Office of Data Analytics and the Mayor’s Office of Operations, with counsel from the City’s Chief Privacy Officer.

**The NYC recovery data partnership** is a collaboration between community, non-profit and private organizations to support COVID-19 related social and economic recovery efforts in the city. The mandate of the partnership is to provide no-cost access to data that will help the city understand “how New Yorkers have been affected by COVID-19” and “to inform programmatic and policy decisions for an equitable recovery”. The data repository includes information and indicators that integrate real estate market metrics, employment and hiring activity, illness indicators, data on

financial need and urgency and on-foot traffic within neighbourhood. This information is being organized and analysed to help understand how COVID-19 has affected communities and neighbourhoods and help the city formulate a response.

The New York City Department of Information Technology and Telecommunications implemented the LinkNYC network with an objective of covering the critical mass of New York City’s public spaces with Wi-Fi service.

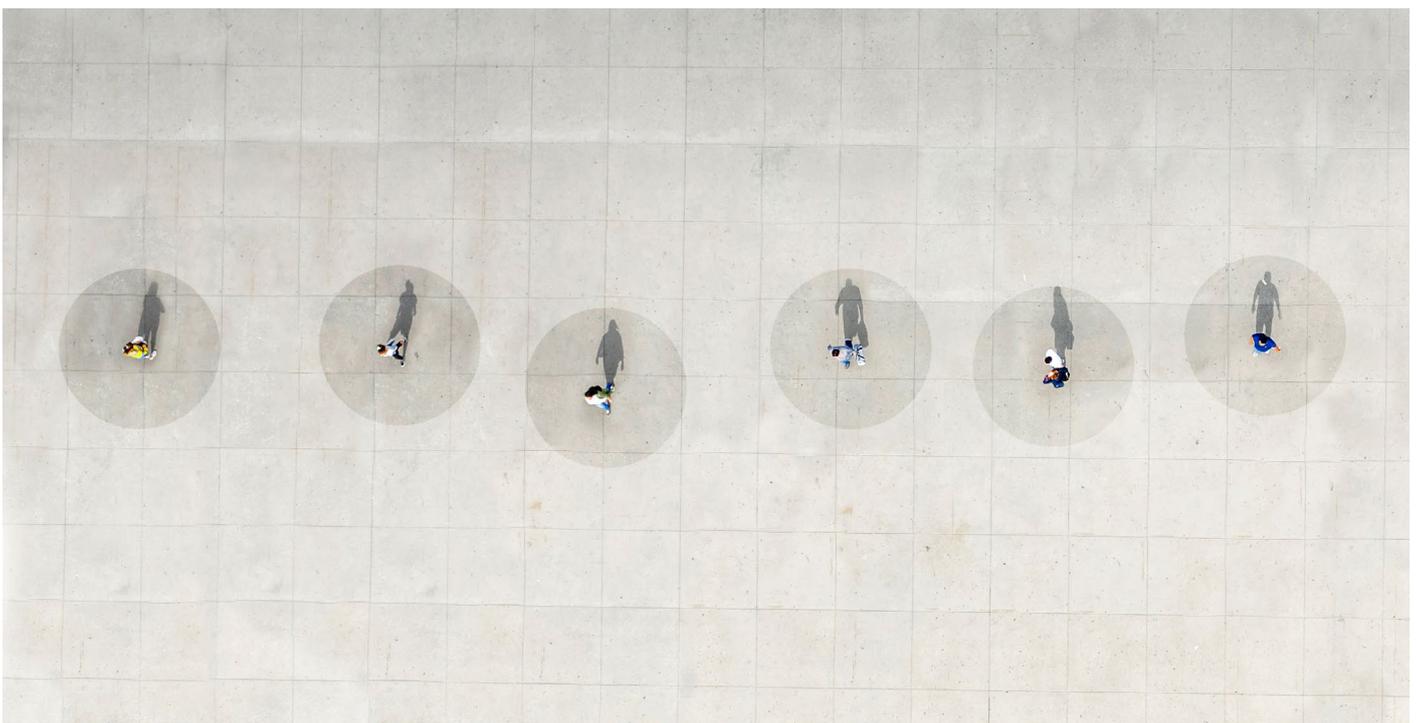
**LinkNYC:** New York City has over 2,200 links across the city. Each link provides fast, free public Wi-Fi (100 times faster than average public Wi-Fi), free phone calls anywhere in the US, device charging and a tablet for access to city services, maps and directions. It provides a digital outdoor advertising network to city and companies to reach residents and visitors.

#### Screens used for public service announcements:

During the pandemic, these screens across the city are being used to help people find the “least crowded” times to visit grocery stores and pharmacies. The same screens are being used to display public artwork related to the COVID-19 crisis to promote messages of positivity, solidarity and gratitude during a difficult and traumatic time.

Building on the lessons learned from handling emergency situations, including managing the response to the pandemic, NYC Emergency Management has outlined five reform priorities to better prepare for, respond to, recover from and mitigate the consequences of future incidents. These priorities are as follows:

1. **Optimize agency operations for mission effectiveness:** Organizational



realignment and the implementation of an integrated preparedness cycle to increase the effectiveness of NYC Emergency Management's preparedness and response operations and achieve stronger coordination across stakeholders.

2. **Modernize the emergency management governance structure:** Establishing clear governance of emergencies will aid in clarifying roles and responsibilities; NYC emergency management will lead the effort to update its guiding document – the Citywide Incident Management System (CIMS) – to ensure city agencies understand their roles, build and exercise their capabilities to effectively perform their functions and collaborate to achieve the collective mission.
3. **Connect and align strategy and budget planning:** Elevating the agency's policy development and budgeting functions through

clearly defined business processes will ensure the agency is achieving its mission through the strategic allocation of resources.

4. **Enhance the role of technology in emergency management:** Developing coordinated and integrated systems and processes that exchange data will improve the city's identification of emerging threats and risks, decision-making and overall response to emergencies; the agency will adopt and implement integrated technology solutions that perform real-time data analytics, leverage social media and collect information from mobile devices and enable the city to quickly disseminate information.
5. **Institutionalize innovation and future-thinking across the agency:** Creating a culture of innovation and creativity that is critical to solving complex problems and managing emerging threats.



## Technology and data governance assessment



### Policy

Open Data Law (also known as Local Law 11 of 2012); and citywide privacy protection protocols



### Institutional structure

#### Mayor's Office of Data Analytics:

The Mayor's Office of Data Analytics (MODA) headed by a chief analytics officer is the city's civic intelligence centre, enabling the city to aggregate and analyse data from across city agencies to more effectively address crime, public safety and quality-of-life issues.

#### Open data team:

MODA and the Department of Information Technology and Telecommunications (DoITT) partner to form the open data team.



## Data gathering and analysis

### Datasets and sources

NYC open data is free public data published by New York City agencies and other partners. This platform had a total 2,167 datasets at the end of 2019 published from 98 agencies, of which 310 datasets were automated datasets.

City agencies are data owners and have open data coordinators who serve as the primary point of contact with the open data team.

### Data analysis

Each agency has its own data team to carry out data analytics and generate visualization for evidence-based decision-making. MODA supports data analytics through:

- Collaborating with agencies to implement data-driven solutions for service delivery and resident engagement. It supports agencies through in-depth operational analytics projects. The MODA team works closely with an agency to understand the operational issue and associated data, helps in designing an applicable analytical model and delivers actionable insight to improve operations.
- Convening analytics professionals across city agencies, it runs Analytics Exchange (AnEx), a community of practice for data analysts across city agencies with more than 600 members from about 60 agencies.
- Facilitating data-sharing among city agencies and ensuring adherence to data privacy laws by contributing to technology system requirements; it is continuing to pursue improvements to the city's data-sharing platforms and tools.



## Data governance issues

### Privacy and transparency

The Mayor's Office of Information Privacy (MOIP) headed by a chief privacy officer (CPO) is responsible for developing a comprehensive information privacy protection framework in NYC. It has issued **citywide privacy protection protocols**<sup>42</sup> to govern the collection, retention and disclosure of identifying information by city agencies and certain city contractors and subcontractors, in line with the requirements of the New York City Charter and Administrative Code. It tries to balance the information privacy protection with the importance of responsible data-sharing to deliver services to individuals and families who need them. The key highlights of the protocols are:

- Well-defined privacy principles for the city.
- Share best practices and guidelines on data privacy and security; for example, it lays down requirements for data license/sharing agreements to be signed with the agency collecting the information

MOIP works with agency privacy officers to lay down agency-specific guidance, policies and protocols with respect to privacy and security protection requirements and in compliance with applicable laws and regulations affecting the agency.

### Data security and resilience

The information retained by the agency should be stored and maintained in its underlying servers and networks according to the Citywide Data Classification Standards;<sup>43</sup> applicable citywide IT policies; and citywide privacy protection policies and protocols.

DoITT, in collaboration with the CPO and MOIP, develops and implements clear privacy policies and guidelines on the responsible release of open data. It develops and updates **open data policy guidance** in the Technical Standards Manual<sup>44</sup> to better address internal data coordination, data quality standards and self-publishing processes. It has also created a new quality assurance system to check how published datasets comply with updated standards.

### Openness and interoperability

The Open Data Law mandates the NYC administration to upload the public data on a single Web portal. MODA performs citywide data analytics using open data in the community. DoITT provides support on the technical operations with city agencies and vendors, ensuring user requirements are fulfilled. Further, the CPO shares best practices for open data interoperability and access that can be incorporated when new technology systems are procured.

### Equity, inclusivity and social impact

The Open Data Law also lays down the requirements of data dictionaries and data retention, response timelines for public requests, for making it easier for residents to access city data online and anchor the city's transparency initiatives on open data.

DoITT, in collaboration with the Mayor's Office for People with Disabilities (MoPD), works to make the platform more accessible for people of disabilities. Further, it works to building internal understanding of agency leadership through education and training support for use of open data. It also creates case studies and presentations to share how open data can improve service delivery, promote equity and increase efficiency.

### Operational and financial sustainability

Operations are supported through budget allocations. To date, the city authorities have not taken any initiative to achieve financial sustainability for investments in setting up data systems. The focus has been on investing in technologies to receive more value for providing citizen services and enable faster decision-making.

5

# Conclusion



Smart cities in India have been at the forefront of the fight against COVID-19. Our analysis shows the significant investments made in implementing smart solutions (as part of SCM) have enabled many smart cities to provide robust responses to the COVID-19 pandemic.

However, Indian smart cities have faced various challenges in designing and implementing their COVID-19 responses using their existing smart solutions. The key challenges, together with solutions that were used to address them, are as follows:

- Technical know-how and knowledge required for choosing the optimum portfolio of solutions was a key challenge faced by city authorities in repurposing existing smart solutions for responding to the pandemic. This was addressed by seeking support from consultants implementing smart solutions, local industry (IT partners) and academic institutes to help adapt existing solutions.
- Capacity-building and training of COVID-19 War Room personnel was required as cities had to quickly establish their COVID-19 War Rooms. This was addressed through organizing training sessions with the help of local partners and consultants, supporting the city in implementing smart solutions at the time of the outbreak.
- Workforce-related constraints came to the fore as city authorities had to plan and implement the response to the pandemic within a short time. The city administrations coordinated with other agencies to deploy personnel in the COVID-19 War Room and involve volunteers from local communities.
- Defining an optimum portfolio of solutions was another key challenge cities had to face, given data collection and analysis requirements.

Sharing best practices among cities, along with development of a standard data template and standard operating procedures helped achieve the objective.

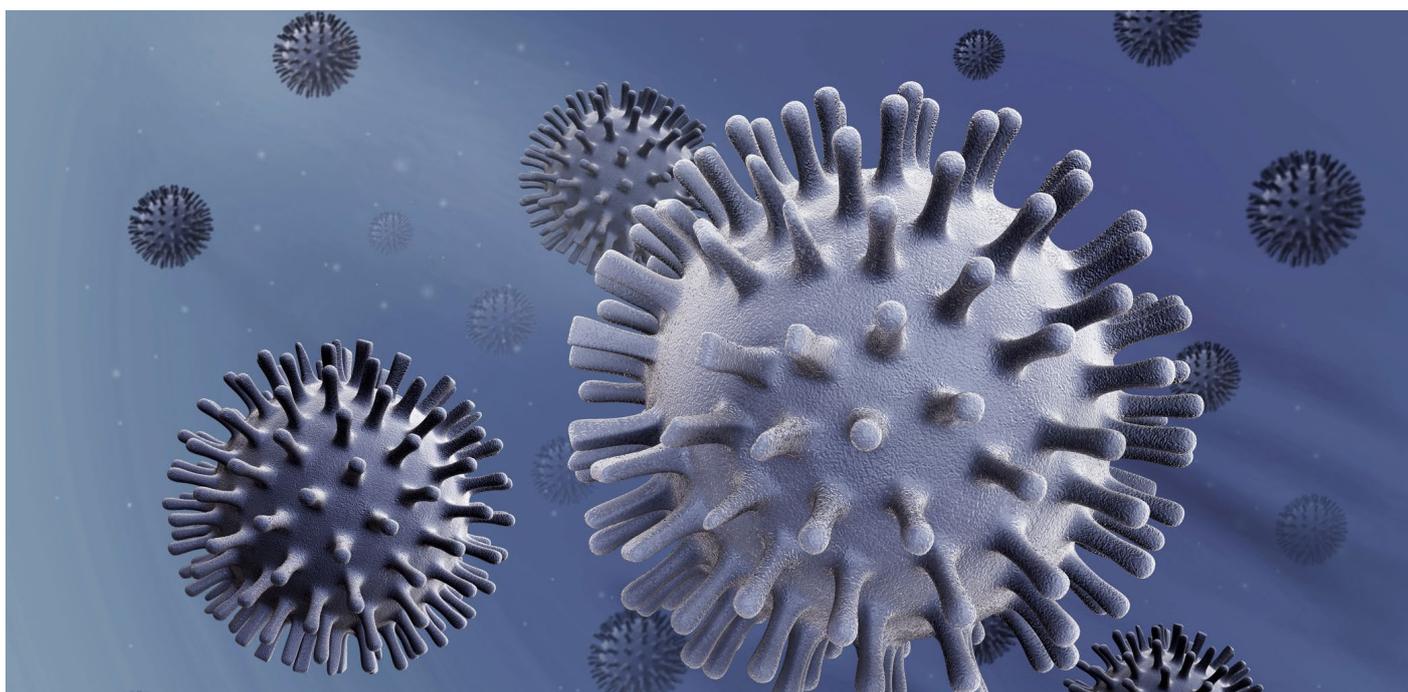
- Existing lengthy and complex procurement processes delayed the implementation of critical solutions of the COVID-19 War Room. This was addressed through fast-tracking of procurement processes with requisite approvals.

Faced with these challenges, cities were able to devise new practices that could deal with their immediate need.

Many enablers (such as National Urban Innovation Stack that includes Open Data Portal, India Urban Data Exchange, India Urban Observatory and National Urban Learning Platform) put in place by MoHUA have effectively facilitated the quick roll out of solutions for COVID-19 response and sharing of best practices and knowledge across cities.

However, experience in Indian smart cities and their global counterparts suggests that if cities are to institutionalize and strengthen these practices, the following actions need to be prioritized:

- **Ensuring standardization and interoperability** through cities formulating their respective technology management policies and strategies. Indian cities should use policy advisory support and guidance provided by MoHUA, along with platforms such as the open data portal and India Urban Data Exchange.
- **Data security and protection** through cities developing (1) their data policy in compliance with national laws and guidelines to ensure citizens' data security and protection and (2) standard operating procedures addressing data collection, storage, usage and management,



“ The experience of Indian cities demonstrates that innovation and technology can make a significant difference to how they manage COVID-19 and by implication, other major crises.

along with data-sharing protocols. Cities may consider establishing a dedicated department taking a cue from the New York City Mayor’s Office of Information Privacy (which works with city departments and agencies to ensure adherence and compliance to data privacy and security regulations).

- **Institutional coordination among agencies** through cities establishing mechanisms for information-sharing among city and state agencies and having defined protocols for responding to incidents in line with the respective agency’s mandate. The city’s ICCC can be used as the platform for coordinating and monitoring agencies’ activities.
- **Adequately staffed technology and data management organization** by ensuring appointment of a city data officer and data contributors and establishing/ strengthening the city data cell by including professionals in areas such as data architecture, security, privacy and analytics.
- **Adopting objective indicators for monitoring citizen service delivery** using assessment frameworks such as MoHUA’s ICCC Maturity Assessment Framework. This enables cities to assess gaps and learn from the experiences of better performing cities.

- **Using multiple delivery channels for citizen outreach** through implementation of connectivity-related smart solutions in ICCC, such as helpdesks and call centres, citizen portal and mobile app, variable messaging display systems, and others.

These measures are expected to help Indian smart cities strengthen their technology and data governance capabilities and provide them the required agility and improved resilience during a crisis or emergency.

As highlighted above, MoHUA is supporting cities with institutionalization of best practices through the DataSmart Cities strategy and other initiatives. However, further support can be provided through working with international partners to develop frameworks, based on global best practices, which can quickly be adopted in areas including data governance and deployment of AI solutions by addressing critical issues such as privacy, trust, ethics, regulation and policy-sharing.

The experience of Indian cities demonstrates that innovation and technology can make a significant difference to how they manage COVID-19 and by implication, other major crises. To make the transformation sustainable, cities and governments would also need to invest in the people and processes that support innovation and technology.



# Appendix 1: Technology standards

Cities across the globe are working towards providing a good quality of life for their citizens, a clean and sustainable environment through the application of smart solutions using ICT tools and solutions, to improve the quality of infrastructure and citizen services.

However, the rapid pace of changing technological trends, lack of standardized ICT framework and architecture, and the interoperability of systems across city agencies often make it difficult for a city to adopt technological solutions.

To address the above, international standard-setting agencies such as International Organization for Standardization (ISO) and British Standards Institution (BSI) have developed several standards to provide support to smart cities in finding solutions to address the above-mentioned challenges.

## A. Global technology standards

This section summarizes the list of standards available with cities to overcome the challenges related to the following five aspects of technology governance while implementing ICT solutions.

1. Privacy and transparency
2. Security and resilience
3. Openness and interoperability
4. Equity, inclusivity and social impact
5. Operational and financial sustainability

TABLE 1 Global technology standards

	Aspects of technology governance	Standards	Brief description
1	Privacy and transparency	ISO 37156:2020: Smart community infrastructures – Guidelines on data exchange and sharing for smart community infrastructure	The standard provides guidelines on principles and the framework to use for data exchange and sharing for entities having the authority to develop and operate community infrastructure. The specific practices of data exchange and sharing of community infrastructures will depend on the characteristics of each community.
2	Data security and resilience	ISO/IEC 27001:2013(en). Information technology – Security techniques – Information security management systems – Requirements	This specifies the requirements for establishing, implementing, maintaining and continually improving an information security management system within the context of the organization. This International Standard also includes requirements for the assessment and treatment of information security risks tailored to the needs of the organization.
		ISO/IEC 27002:2013(en). Information technology – Security techniques – Code of practice for information security controls	This standard provides guidelines for organizational information security standards and information security management practices, including the selection, implementation and management of controls taking into consideration the organization's information security risk environment(s).

	<p>ISO/IEC 27017:2015(en). Information technology – Security techniques – Code of practice for information security controls based on ISO/IEC 27002 for cloud services</p>	<p>This standard provides guidelines for information security controls applicable to the provision and use of cloud services. It gives controls and implementation guidance for both cloud service providers and cloud service customers.</p>
	<p>BS 10012 Personal Information Management System</p>	<p>This provides a framework for a personal information management system that is aligned to the principles of the European General Data Protection Regulation (EU GDPR).</p>
	<p>ISO 37100:2016(en) Sustainable cities and communities – Vocabulary</p>	<p>It defines terms as follows:</p> <p><b>Sustainability:</b> State of the global system, including environmental, social and economic aspects, in which the needs of the present are met without compromising the ability of future generations to meet their own needs. The environmental, social and economic aspects interact, are interdependent and often referred to as the three dimensions of sustainability.</p> <p><b>Resilience:</b> Resilience is the ability of an organization to resist being affected by an event or the ability to return to an acceptable level of performance in an acceptable period of time after being affected by an event. Smartness is embedded in the process of sustainable development, i.e. sustainable development is the overarching process, while smartness is a characteristic. It implies a holistic approach, including good governance and adequate organization, processes and behaviours and appropriate innovative use of techniques, technologies and natural resources.</p>
	<p>ISO 37101:2016(en). Sustainable development in communities – Management system for sustainable development</p>	<p>This standard adopts a holistic approach to the establishment of the requirements of a management system for sustainable development in communities, including cities.</p>
	<p>ISO 37120:2018(en). Sustainable cities and communities – Indicators for city services and quality of life</p>	<p>This standard provides guidelines for information security controls applicable to the provision and use of cloud services. It gives controls and implementation guidance for both cloud service providers and cloud service customers.</p>
	<p>ISO 37122:2019 - Sustainable cities and communities – Indicators for smart cities</p>	<p>This standard complements ISO 37120 and establishes indicators with definitions and methodologies to measure and consider aspects and practices that dramatically increase the pace at which cities improve their social, economic and environmental sustainability outcomes.</p>

2 (cont.)

ISO 37123:2019 - Sustainable cities and communities – Indicators for resilient cities

It provides a set of indicators on resilience by which cities can measure where they stand. It complements other standards in the series on smart cities indicators that includes ISO 37120 (Sustainable cities and communities – Indicators for city services and quality of life) and ISO 37122 (Sustainable cities and communities – Indicators for smart cities).

3 Openness and interoperability

PAS 181:2014. Smart city framework – Guide to establishing strategies for smart cities and communities

The smart city framework (SCF) is a guide intended for use by leaders, across levels and sectors, of smart city programmes. It provides practical, “how-to” advice, reflecting current good practice as identified by a broad range of public, private and voluntary sector practitioners engaged in facilitating UK smart cities. It has been produced by the British Standards Institute.

PAS 182:2014. Smart city concept model – Guide to establishing a model for data interoperability

This PAS is intended to facilitate discussions between decision-makers from each sector and the specialists who build and design the systems and services that enable the city to function. The components of the smart city concept model could form the basis of these discussions, by aligning ontologies to discover where data from different sectors is about the same thing or is related in a useful way.

European Interoperability Framework (EIF)

The EIF gives guidance to public administrations on how to improve governance of their interoperability activities, establish cross-organizational relationships, streamline processes supporting end-to-end digital services and ensure that existing and new legislation do not compromise interoperability efforts.

4 Equity, inclusivity and social impact

BS ISO 37106:2018 - Sustainable cities and communities

This provides guidance on establishing smart city operating models for sustainable communities. Parameters include an open, collaborative, citizen-centric and digitally enabled operating model for the city that puts its vision for a sustainable future into operation.

United Nations Sustainable Development Goals – Goal 11 – Make cities and human settlements inclusive, safe, resilient and sustainable

The Sustainable Development Goals (SDGs) – Goal 11 links both the quality of life in cities and how cities draw on and manage the natural resources available to them. For each goal, there are targets and indicators.

5 Operational and financial sustainability

ISO 37122:2019 - Sustainable cities and communities – Indicators for smart cities

This document establishes indicators with definitions and methodologies to measure and consider aspects and practices that dramatically increase the pace at which cities improve their social, economic and environmental sustainability outcomes.

### **Technology standards in India**

In the absence of common quality standards in India related to the Information and Communication Technologies (ICT) domain, MoHUA, in close consultation with several departments/agencies (such as Bureau of Indian Standards, National Security Council Secretariat, Department of Electronics and Information Technology, Department of Science and Technology and industry associations) is working to providing guidance to Indian smart cities on adoption of available global technology standards developed by the British Standards Institution (BSI), International Organization for Standardization (ISO) etc.

It has recommended that the entire Information Technology (IT) infrastructure deployed as part of a smart city should follow standards such as: ISO 27001, ISO 22301, ISO 37120, ISO 37122, ISO 27017, ISO 27018, BSI PAS 180, BSI PAS 181, BSI PAS182, for Wi-Fi access – PEAP (Protected Extensible Authentication Protocol), 3rd Generation Partnership Project (3GPP) etc., as appropriate.

However, to find a long-term solution, the Bureau of Indian Standards (BIS) has been entrusted with the responsibility to develop requisite Indian standards for ICT and engaging actively with industry organizations for wider consultation and acceptance. BIS is working in close association with SCM and has formed focused working committees to drive efforts.

Some of these standards with applications in smart cities projects are being finalized while others are undergoing wider industry consultations. They are expected to be released shortly. These standards shall bring much-required homogenization to the heterogeneous infrastructures and applications in the smart cities.

While developing standards, consideration is being given to factor backward compatibility into the existing system to make the best use of the investments already made.

# Appendix 2: Legal framework for data protection

## A. Global regulation

### European Union General Data Protection

**Regulation (GDPR):** GDPR requirements are applicable to each member state of the European Union, aiming to create more consistent protection of consumer and personal data across EU nations. The key privacy and data protection requirements of the GDPR include the following:

- Requiring the consent of subjects for processing personal data
- Anonymizing collected data to protect privacy
- Providing data breach notifications
- Safely handling the transfer of data across borders
- Requiring certain companies to appoint a data protection officer to oversee GDPR compliance

It mandates a baseline set of standards for companies that manage EU citizens' data to better safeguard the processing and movement of citizens' personal data.

Currently, the US does not have federal data privacy legislation. However, many states have instituted laws of their own.

### Regulations in India

At present, the principal legislation governing sensitive personal data (e.g. password, financial information, medical records and biometric information) is "Information Technology (reasonable security practices and procedures and sensitive personal data or information) Rules, 2011". The key highlights of the rules in the context of data governance are:

- Every organization should obtain consent in writing while collecting sensitive personal data.
- Sensitive personal data should be collected to the extent necessary and such data can be retained only until the time necessary for the purpose.
- An organization can share sensitive personal data with a third party only when prior permission has been taken from the provider of such data.
- Sensitive personal data can be shared without prior consent when requested by government

agencies, or when necessary under a legal obligation or order.

While the Information Technology (Reasonable security practices and procedures and sensitive personal data or information) Rules, 2011, provides for the protection of sensitive personal information, India does not have a comprehensive act on the protection of personal data.

The Personal Data Protection Bill, 2019, has been drafted and is being discussed in the parliament. This bill includes provisions to protect personal data as an essential facet of information privacy. It provides guidelines on data processing grounds, rights of the data principal, penalties and exemptions, among other areas. It aims to protect the autonomy of individuals from data privacy violations by the state and private entities. Once enforced, the bill will influence how smart city information systems store and process personal/sensitive data.

Further, many features in the bill are in alignment with provisions of the European GDPR. The key highlights of the bill in the context of data governance include:

- Every person or organization processing personal data should process it fairly and reasonably in a manner to ensure the privacy of the citizen.
- Personal data should be collected only to the extent that is necessary for processing.
- Personal data to be processed only when free, informed, specific and clear consent has been obtained from the citizen at the commencement of its processing.

The bill provides for data processing without the consent of the citizen in the following cases: performance of any function of the state authorized by law; responding to any medical emergency; and ensuring safety, or providing assistance or services, during any disaster or breakdown of the public order.

**Enforcement authority:** The bill provides for the establishment of the Data Protection Authority of India with a wide range of powers to protect the interests of citizens, prevent misuse of personal data, ensure compliance with the provisions of the bill and promote awareness about data protection.

# Contributors

## Deloitte

### Lead Authors

#### Arindam Guha

Partner, Government and Public Services Leader, India

#### Miguel Eiras Antunes

Global Smart Cities Leader, Portugal

#### Anindya Mallick

Partner, India

#### Debashish Biswas

Partner, India

## Cities

#### Chaitanya Y. Bhatt

Director and Chief Executive Officer, Surat Smart City Development, India

#### David Cunha

Assessor and Adviser, Lisbon's City Lead – Sharing Cities Programme, Lisbon Municipality, Portugal

#### Shravan Hardikar

Director and Chief Executive Officer, Pimpri Chinchwad Smart City, India

#### Kelly Jin

Chief Analytics Officer and Director, Mayor's Office of Data Analytics, City of New York, USA

#### Hepsiba Rani Korlapati

Managing Director, Bengaluru Smart City, India

#### Jigar Patel

City Data Officer, Surat Smart City Development, India

#### Nilkantha Poman

Chief Information and Technology Officer and Joint Chief Executive Officer, Pimpri Chinchwad Smart City, India

#### Liora Shechter

Chief Information Officer (2011-September 2020), Tel-Aviv-Yafo Municipality, Israel

## Ministry of Housing and Urban Affairs, Government of India

#### Kunal Kumar

Joint Secretary and Mission Director, Smart Cities Mission

#### Rahul Kapoor

Director, Smart Cities Mission

#### Jeenal Sawla

Principal Consultant and Project Manager, Data Analytics & Management Unit

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**World Economic Forum**  
91–93 route de la Capite  
CH-1223 Cologny/Geneva  
Switzerland

Tel.: +41 (0) 22 869 1212  
Fax: +41 (0) 22 786 2744  
[contact@weforum.org](mailto:contact@weforum.org)  
[www.weforum.org](http://www.weforum.org)