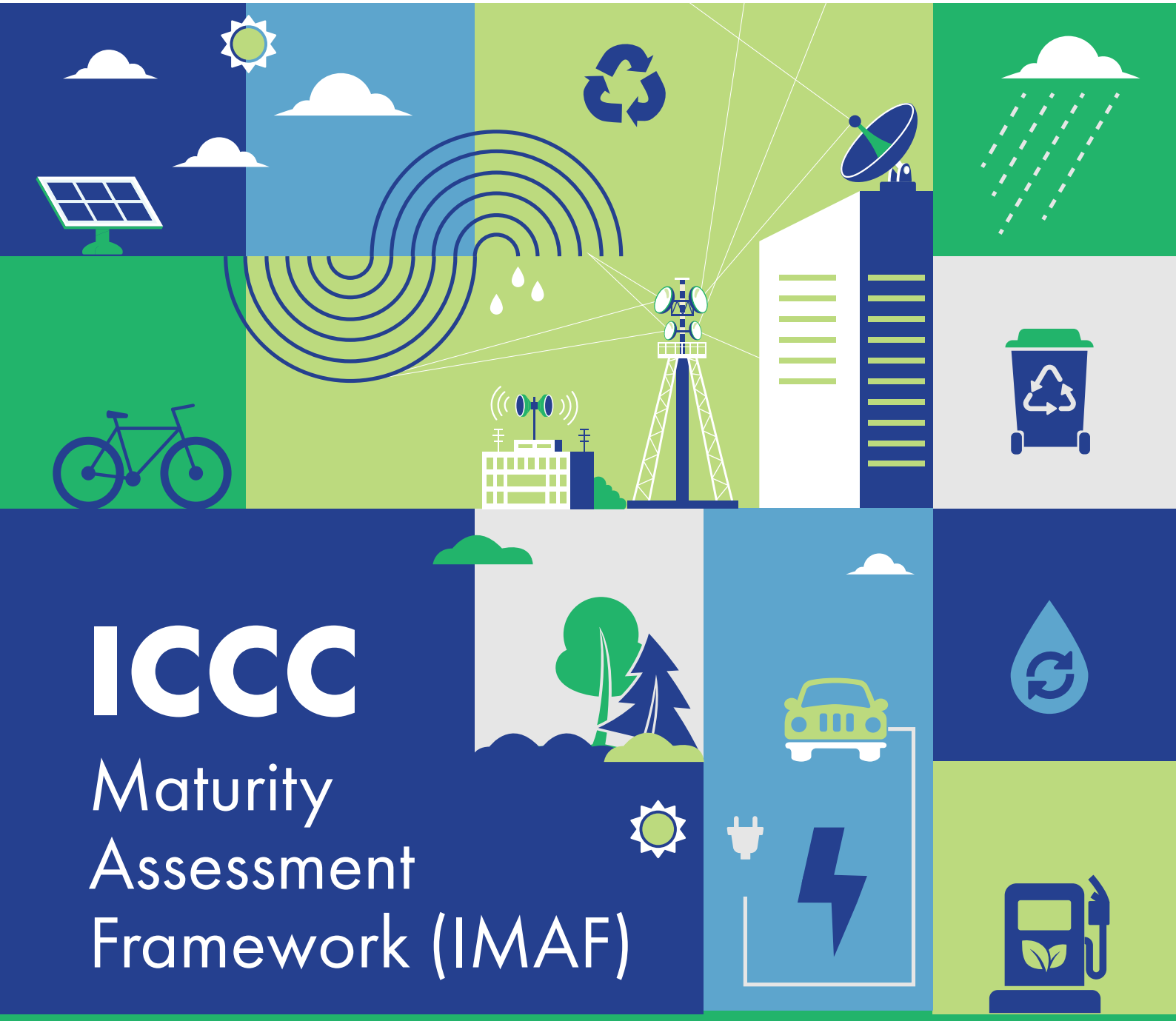
Smart City
MISSION TRANSFORM NATION

सत्यमेव जयते

Ministry of Housing and Urban Affairs
Government of India

स्वच्छ भारत
एक कदम स्वच्छता की ओर



ICCC Maturity Assessment Framework (IMAF)

A Toolkit for Technology Assessment in Smart Cities

DAY-NULM
Deendayal Antyodaya Yojana-National Urban Livelihoods Mission

प्रधान मंत्री आवास योजना-शहरी
Pradhan Mantri Awas Yojana-Urban

अमृत
Atal Mission for Rejuvenation and Urban Transformation

CONTENTS

Foreword

Durga Shankar Mishra
Secretary, MoHUA

Across the world, city administrations are riddled with multiple governance challenges. They have to continuously focus on improving the quality of life of citizens while managing day-to-day challenges, cost constraints, and crises like the current Covid-19 pandemic. Data science and technology are helping solve some of these challenges bridging the capacity gap of limited resources on one hand and growing complexity of needs on the other. For instance, by using data on traffic divergence, flow, and congestion, cities can conduct real-time traffic analysis and manage its flow more dynamically. They can build heat maps with origin and destination points at different times, enable city transport operators to manage fleets and improve their mobility strategy. Incident alert systems can provide instant updates regarding accidents or roadblocks making it easy to choose the right transportation route.

Integrated Command and Control Centers (ICCCs) are increasingly finding relevance in a large number of cities to manage such operations in a coordinated and efficient manner. These centers receive real-time data from different departments/sensors/social media and other sources. This information is then processed and analyzed to build situational awareness and decide on any necessary action if needed to be taken. All decisions are then communicated to the relevant frontline departments, entities or to the public. ICCCs thus, act as the brain and nervous system for the cities.

India's Smart Cities, guided by the Ministry of Housing and Urban Affairs, have already set-up 53 such ICCCs (as of January 2021). Most of these were successfully repurposed into Covid-19 War-Rooms to manage the pandemic. The country will potentially see all the 100 Smart Cities under the Mission with an ICCC each, making this the most ambitious public roll out of this kind of infrastructure in the world. The ICCC Maturity Assessment Framework (IMAF) is an attempt to deconstruct the why, what, and how in developing, sustaining & improving benefits from ICCCs.

I am thankful to the Smart Cities Mission team, the Bureau of Indian Standards (BIS) and the leading industry association NASSCOM for partnering to create this useful document.

Foreword

Pramod Kumar Tiwari
Director General, BIS

In today's fast changing world, standardization brings credibility to innovation and helps it to scale. As the National Standards Body of India, Bureau of Indian Standards (BIS) has been providing traceable and tangible benefits to the national economy in a number of ways through standardization, certification and testing.

The Smart Cities Mission is rapidly growing, and so is the adoption of digital technologies by cities. A crucial step undertaken by MoHUA in this direction is the release of the ICCC Maturity Assessment Framework (IMAF), which assesses the ICCC maturity covering various facets of technology and governance. The document has been effectively and extensively crafted to cover the gamut of technologies utilised in Smart Cities, that will guide SPVs/SIs when approaching both basic and advanced capabilities in Smart City Digital Infrastructure. I understand that this important step in assessing ICCC maturity will set the foundation for strengthening ICCC capabilities in becoming powerful decision support systems.

Strategic roadmap is needed to help ensure that the investment in the technology infrastructure market is aligned to the goals and context of respective Smart Cities. This assessment exercise shall work as a catalyst in such situations and will foster economic growth, social mobility, inclusiveness, and sustainability, providing a huge opportunity for good governance.

I trust it will help Smart Cities meet their potential and address issues at different levels of decision making. I believe that our on-going collaboration with the Smart Cities Mission on digital frameworks and standards will help develop high quality, efficient and secure urban services envisioned and will set the stage for redefining the standards.

I wish MoHUA and Smart Cities Mission continued success in their endeavors.

Foreword

Debjani Ghosh
President, NASSCOM

Recognizing that IT will be a key catalyst for effective governance and offers massive business opportunities to the Indian IT industry, the Smart Cities Mission has initiated extensive work on technology in cities to help them be better placed to provide efficient and effective services to citizens. We are happy to note that the IT industry has been actively participating in the execution and promotion of the Smart Cities initiatives, which also include development of Integrated Command & Control Centers (ICCCs) in various cities.

The ICCC Maturity Assessment framework (IMAF), being released by MoHUA is a step in the right direction and correctly encapsulates the Functional, Technological, Operational and Engagement dimensions of an ICCC to assess the Smart City Maturity level. It provides a common framework reducing information asymmetry for technology companies and cities to collaborate.

Taking cue from MeitY's underlying push, India has the ability to create up to $1 trillion of economic value from the digital economy by 2025, with half of the opportunity originating in new digital ecosystems that can spring up in diverse sectors of the economy. The IMAF not only enhances the outlook for businesses in cities, but fosters a virtuous ecosystem of services which would aid our cities in adopting the next wave of technology innovation in IoT, Blockchain and AI.

We are excited about the potential of the IMAF beyond just an assessment framework, to support the design and subsequent deployment of a host of digital services, platforms, applications, content, and solutions for Smart Cities.

As the representative and spearhead of the IT industry, we are happy to be associated with the Smart Cities Mission for synthesizing the immense progress on bottom-up partnership between cities and technology companies.

We look forward to witnessing meaningful adoption of IMAF by the Smart Cities to build resilient and citizen centric cities.

Message from Mission Director

Kunal Kumar

Joint Secretary & Mission Director (Smart Cities Mission), MoHUA

India is urbanizing exponentially with the expected influx of 200 million people over the next decade. This rapid urbanization presents an excellent opportunity for India to leapfrog stages of development, and at the same time, address the country's chronic urban challenges. Integrated Command and Control Centres (ICCCs) are among such initiatives being undertaken by cities to do more with less by graduating to real-time data-driven decision/policy making. It allows them to develop better situational awareness as compared to the traditional, inefficient silo-ed departmental approaches. ICCCs reduce the complexity of dealing with multiple technology systems/applications by integrating them into a common platform to leverage real-time intelligence for making informed decisions.

As various Smart Cities are moving steadily on establishing ICCCs, it is now an appropriate time to roll-out a maturity framework which allows for structured assessment, unambiguous benchmarking and clear goal setting. Since the Smart Cities are in early stages of operationalizing ICCCs, the first version/iteration of IMAF has given higher focus to the foundational building blocks of systematic readiness of ICCCs. Envisioned to empower cities to continuously evaluate their ICCCs, the future versions/iterations of IMAF will have more granular assessment criteria across all dimensions of IMAF.

I look forward to all the Smart Cities making the best out of this tool-kit to evaluate their ICCCs to identify improvement areas. Cities are also encouraged to learn from peer cities who are performing better on the Assessment, in all or any of the indicators.

I hope and wish that the 100 Smart Cities continue to harness technology effectively to serve their citizens better.

01

TECHNOLOGY IN SMART CITIES

1.1 ROLE OF TECHNOLOGY

Cities in India are growing at a rapid pace and so are challenges faced by them, which have multiplied since their limited resources are under tremendous stress. They are trying to meet citizens' aspirations and expectations with available resources, assets, finances and manpower. They are leveraging technologies to do more with less and to address challenges in service delivery, civic operations and deal with complex situations in real-time.

Today we are witnessing a technology revolution commonly referred to as the fourth Industrial Revolution which is driven by data and technology, including emerging technologies like AI, ML, Blockchain, Drones, Cloud, and advanced materials. These technologies are disruptive in nature and will have a significant impact on the way we live, way we move and way we operate our businesses. These emerging technologies will help cities in managing complex situation by collecting, processing, analyzing data at breakneck speed in real-time which was not possible earlier. Due to recent advancement in computing and storage capabilities these technologies and solutions are affordable and accessible. Next generation of urban enterprises will have significant dependence on digital technologies, data sciences and will adopt new ways of managing resources and doing business.

We are witnessing the manifestation of this technology revolution in various cities under the aegis of Smart Cities Mission. 100 Smart Cities in India have taken a quantum leap to embrace, adopt & adapt technology to reimagine the way cities deliver citizen services, manage their infrastructure and core civic operations with the objective to deliver quality of life to its citizens and local businesses. These cities have started embracing technology solutions in a planned and structured manner. More than USD 2 Bn/ INR 15,000 Crores are being invested in setting up Integrated Command and Control Centers (ICCCs) in Smart Cities. Connectivity infrastructure is being planned by various Smart Cities to cater to future bandwidth requirements.

Improved access to information

Making cities safer

Improved traffic management

Improved energy efficiency

Encouraging greater collaboration

Improved disaster resilience

Efficient resource management

Efficient citizen service delivery

Efficient project management

Technology has been leveraged by cities exceedingly well in handling Covid-19 crises. ICCCs were converted into Covid-19 War Rooms, supported by many solutions developed in an agile manner. Industry too has been supportive in such a challenging time towards such efforts.

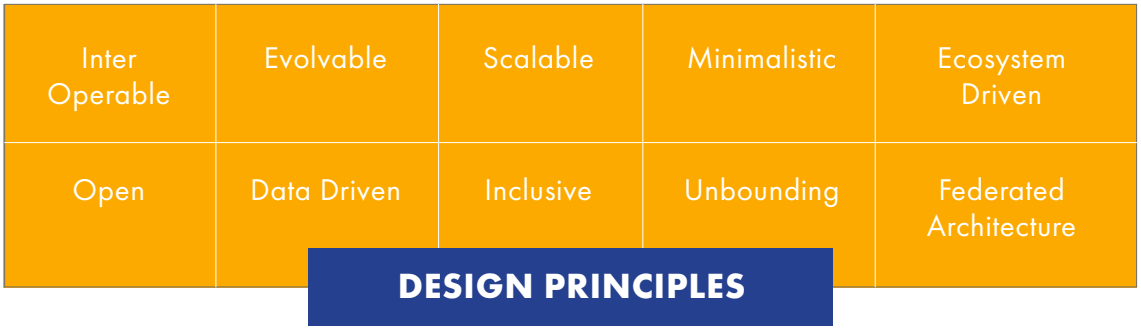
Like clean drinking water and healthcare, we must ensure that technology is perceived and leveraged as a public good in Smart Cities. Technology is to be treated as the means to achieve the end outcomes i.e., quality of life, economic ability and sustainability. We must also ensure public participation during design and implementation of technology projects in Smart Cities. Thus, there is a greater need today to discuss, debate and deliberate on how cities should conceptualize, design and implement our technology projects.

1.2 DESIGN PRINCIPLES

Design Principles are the foundation on which good products are built. While implementing technology solutions in our cities, it is important to lay down the considerations on which such products or solutions are built. In light of this, the Ministry of Housing and Urban Affairs (MoHUA) conceptualized the National Urban Innovation Stack (NUIS)- a digital infrastructure with a deep understanding of the urban ecosystem and its needs. The NUIS is being envisaged as a shared digital infrastructure that will be available for use by all citizens, entrepreneurs, academics, administrators, governments, NGOs and other urban actors across the country. The NUIS, a set of building blocks, would be "built as a common public good" to avoid duplication of efforts, provide equitable access and successfully achieve convergence. This will accelerate innovations that are underway, and act as an enabler for the rapid development of diverse new solutions by cities and states.

Guiding design principles of NUIS should be imbibed in spirit in all technology projects to promote the adoption of the stack approach at all levels.

For more details, please refer: https://smartnet.niua.org/sites/default/files/resources/national_urban_innovation_stack_web_version.pdf



Adherence to the design principles and the standards, specifications and certification processes, ensures increased access and lowers barriers to participation. Thereby, the approach allows all the actors across the whole ecosystem to collaborate and to solve urban challenges at scale and with speed while ensuring the quality of outcomes by working toward achieving clearly established benchmarks.

The key guiding principles for the NUIS are:

1. Ecosystem Driven

The NUIS will foster a vibrant ecosystem of urban actors and respond to their needs by enabling effective collaboration for the purpose of devising solutions that are relevant to the contexts of each urban challenge.

2. Interoperability through Open APIs and Open Standards

Interoperability is essential for NUIS to be able to support a large number of diverse use cases. NUIS must be built using open standards and avoid dependence on specific platforms or software frameworks that become a barrier to the participation of any actor in the ecosystem. In addition, the components of the stack would be loosely coupled using open interfaces (APIs). Adoption of open and vendor-neutral APIs and open standards and, wherever appropriate, choosing open source frameworks and components over proprietary ones, will help achieve the goal of interoperability. NUIS will integrate with all relevant open platforms of the government including Aadhaar, GSTN, UPI, BBPS, and BharatQR.

3. Inclusive

The design is aimed at ensuring that all segments of citizens can benefit from NUIS. Different instances of NUIS should be able to configure, extend or customize applications to cater to their specific needs. In addition, it can be leveraged across multiple channels - both digital and physical to engage and serve citizens effectively.

4. Minimalistic

The goal of the stack is to enable relevant solutions; hence it is important that the stack remains minimal and allows innovative solutions to emerge rather than forcing a particular type of solution. It may provide reference implementations to seed the imagination of the ecosystem, but should remain minimalistic to allow actors to respond to context and complexity.

5. Privacy and Security by Design

Managing security and privacy of data is crucial to building and maintaining trust between ecosystem participants and thus will be a critical design principle. All data access must be through API calls to ensure appropriate security controls. NUIS will provide standards and certification for data privacy and security. Except for open data, direct access to data will be prohibited and use of APIs will be mandated. NUIS will ensure privacy, data encryption and data integrity and will disseminate data only to authenticated and authorized stakeholders (both internal and external) through data fiduciaries.

6. Unbundling

Platforms achieve scale and flexibility by unbundling complex challenges into micro solutions and services and subsequently allowing their re-bundling in specific contexts. These layers rise from context-neutral bottom layers to more context-sensitive layers — similar to LEGO© building blocks. Unbundling promotes reusability, lowers the barrier for new solutions and enhances participation by abstracting complexity under simple interfaces.

7. Designing for Evolvability and Scale

The NUIS will need to keep pace with India's urban challenges as they evolve over the years. It will have an architecture that can easily accommodate new capabilities that will be needed as the ecosystem evolves and to incorporate new technologies as they emerge. The stack will be able to scale horizontally to hundreds of millions of users in the urban ecosystem and to handle trillions of data records. All components, including computer, network and storage resources, must be capable of scaling horizontally. Being cloudready and using commodity hardware will ensure that capital investments on the stack will be minimal. This will also give a choice of infrastructure to the actors and users and enable systems to evolve heterogeneously.

8. Transparency and Accountability through Data

The verified registry of all the entities and the non-repudiable transaction trails shall lead to higher trust and stronger accountability. NUIS will be data-driven and will use data generated through transactions for reporting and analysis. Public Open Data shall be made available via APIs for transparency. The access to open data will ensure high-quality analytics, accurate fraud detection, shorter cycles for system improvement and, most importantly, high responsiveness to user needs.

9. Non-Repudiable

The stack would enable the verifiability of data and its provenance and thereby ensure trust and accountability within the ecosystem. All data would be non-repudiable and verifiable in order to energize the ecosystem for collaboration and interaction between actors.

10. Domain Modeling

Since NUIS must balance between abstraction, for wider adaptability, and context-specific solutions, the data specifications would remain generic without making concrete assumptions about the purpose for which the data is used. The data specifications would be extensible, allowing programs to model their own domain by adding new data attributes on top of available specifications.

11. Federated Architecture

To resolve for scale and ensure agency, the ability to solve must be distributed, empowering stakeholders to overcome the challenges they face. Hence the NUIS will have a federated architecture enabling actors to retain agency and choice in solutions.

12. Ensuring extensibility through the use of layered design

The design of NUIS will be modular, with clear separation of data storage, software services and APIs. Components will be minimalistic, independently replaceable and extensible. This will allow different components to be loosely coupled when building applications, thereby enabling application diversity. Different instances of the stack will be able to customize and create contextual solutions to serve their specific purpose.

13. Multi-Channel Access

With the rapid growth of net connectivity and the variety of electronic devices available in the market, it is important that the end user's access points and access interfaces are kept in mind while enabling access channels — Citizen Service Centres, PCs, Tablets, Smartphones, local kiosks and doorstep delivery — and ensuring an engaging user experience on all of these channels to enable rapid adoption and ease of operation by the end users. This will enable cities to effectively respond to the needs of all citizens including digitally excluded sections of the society.

Design considerations that Smart Cities need to adopt while finalizing the technology interventions & their implementation are outlined below:

Leverage Technology to Solve Complex Societal Problems

- Digital divide, digital inequality
- Information asymmetry (internal as well as external stakeholders)
- Siloed functioning of different departments
- Redundant processes/lack of citizen centricity

Focus on Outcomes

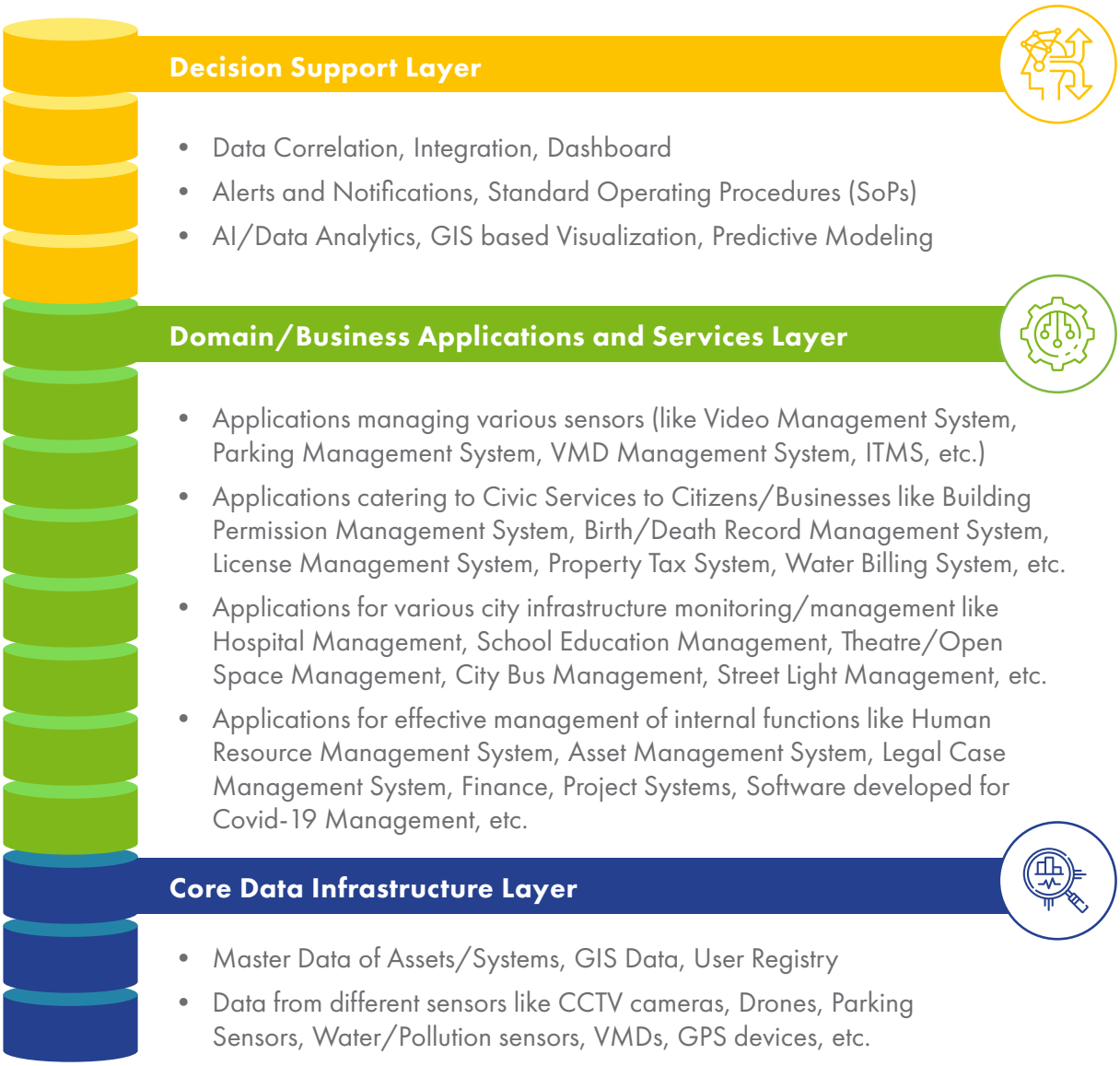
- **People:** It's important to study (& address) needs of citizens and communities. Equally important is how we design the system to empower internal stakeholders to deliver quality services to citizens & businesses.
- **Process:** Technology is just a facilitator. Cities should use these interventions to carry out business process re-engineering to bring convergence across different departments/city level organizations.
- **Platforms:** Technology infusion needs to be planned to create a decision support system and deliver a better quality of life. Cities have to adopt platform thinking, and avoid siloed solution approaches.

Sustenance by Design

- **Capacity Building:** Continuous training & Capacity Building programmes are being carried out by Smart Cities Mission to develop capacities at City Level to drive various initiatives in a sustainable manner. National Urban Learning Platform (NULP) has also been launched for the same.
- Smart Cities are advised to develop **evolvable, scalable & interoperable** solutions to avoid any bottlenecks, integrations with other systems or challenges in future expansions.
- Smart Cities are also advised to follow **Open Standards**, with due considerations to **Privacy & IT Security.**

1.3 TECHNOLOGY STACK FOR SMART CITIES

While different cities have implemented/are implementing various solutions, the central theme being adopted is to move towards data-driven governance and create a data ecosystem. A typical technology stack to drive this Data Driven Governance involves following 3 layers:



The 3 technology layers mentioned above are required to be supported by fusion/ integration of multiple initiatives to deliver effective outcomes to all the stakeholders. Integration with all the relevant external systems is key to bringing convergence and avoidance of duplicity. What is also equally important is the IT Security provisions at all levels.

Technology ecosystem is constantly evolving & Smart Cities have been experimenting/implementing with cutting edge initiatives.

Following is the list of few of such cutting edge initiatives already undertaken/being undertaken by various Smart Cities in India:

- AI, ML
- Video Analytics
- Blockchain
- Digital Twin
- Virtual Reality
- Software as a Service (SaaS)
- Infrastructure as a Service (IaaS) such as DC on Cloud

A model blueprint for the complete technology ecosystem in Smart Cities is given below, which can be used by cities as a reference functional architecture.

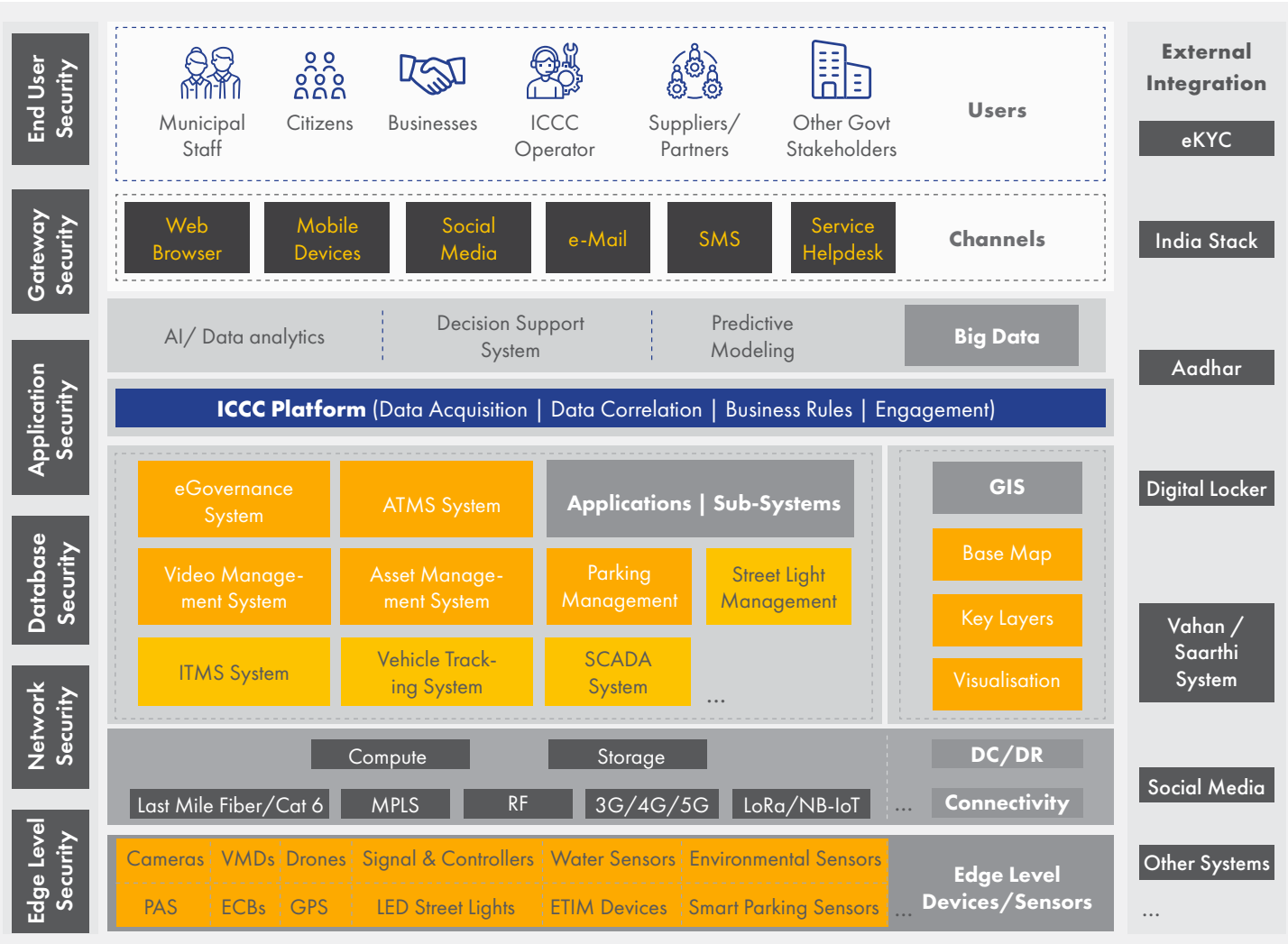


Figure 1: A model blueprint for technology ecosystem in Smart Cities

Smart Cities technology blueprint is an indicative blueprint which provides 360-degree perspective to Smart Cities stakeholders. It will guide decision makers at the city level to plan and formulate their enterprise level digital strategy, policies, processes, project budgets and resourcing.

02

ICCCs @ SMART CITIES IN INDIA

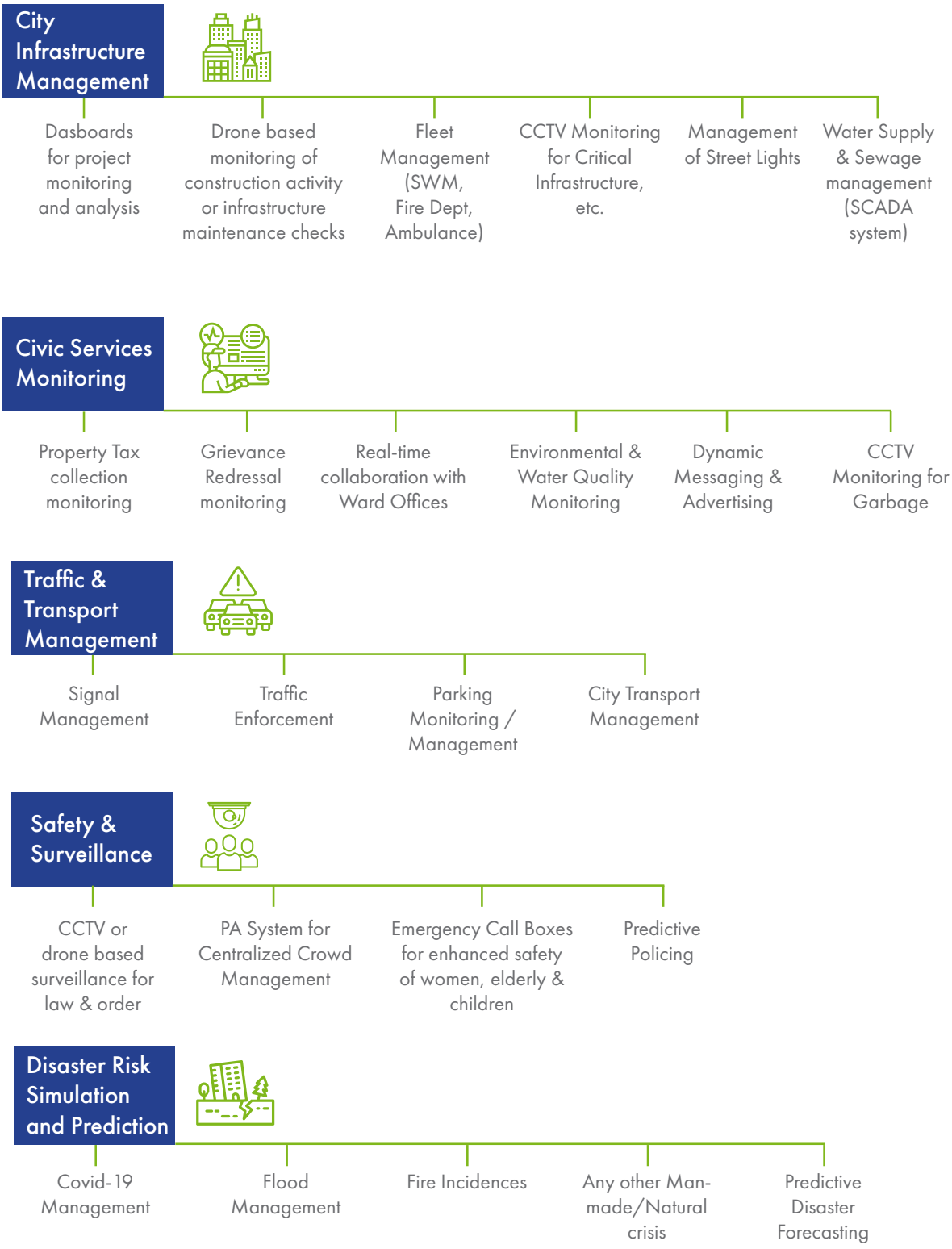
India's Smart Cities have increasingly become spaces for social and cultural evolution, apart from becoming key avenues for economic development. These multitude of aspirations put tremendous pressure on the nature and degree of evolution in a city, which requires a steady stream of support in day-to-day civic operations and early warning systems to ensure that the city is inclusive and sustainable in serving the aspirations of its residents.

A giant leap to effectively tap the enormous data available to city administrations & create actionable intelligence has been the deployment of state-of-the-art Integrated Command and Control Centres (ICCCs). Experiences from the Covid-19 pandemic and other efficiencies unlocked through ICCCs have shown us how effective a tool the well-developed ICCC system can be, in the hands of city administrators.

Similarly, the city can utilize the ICCCs to effectively monitor various operations of city administration and use its advanced analytical capabilities to plan for any future challenges. ICCCs are a great opportunity for cities to leverage technology and drive inclusion, efficiency and innovation. These ICCCs shall become strategic assets for cities and are envisaged to be the brain for city operations, handling day-to-day operations as well as exceptional scenarios and disaster/crisis management. The sensors and edge devices will capture and generate real-time data from various utilities such as water, waste management, energy, mobility, built environment, education, healthcare and safety. ICCC as a platform through its different layers and components will act as a Decision Support System (DSS) for city administration to respond to real-time events by consuming data feeds from different data sources and by processing information out of data sets.

Integrated Command and Control Centre, Bhubaneshwar

Indicative municipal and non-municipal services which can be supported well by ICCCs are as depicted below:



2.1 KEY OBJECTIVES OF ICCCs

ICCC are intended to be the brain and nervous system of the city for monitoring & managing various key functions. Core objectives to be attained through a well-designed ICCC are listed below:

- Monitoring and management of various city infrastructure/utilities like water, street lights, solid waste management, roads development, etc.
- Continuous analysis of data, preparation of dashboards for effective decision making by department heads, city leadership, creating simulations
- Increasing the situational awareness within city by providing insights using data across urban functions
- Faster response to the incidents, crisis situations; enhancing disaster resilience
- Enhancing collaboration across multiple departments within and outside urban local bodies and other government bodies
- Enhanced communication across different stakeholders in the city, including citizens, in day-to-day matters as well as during crisis situations
- Real-time Urban Planning

Please refer to **Annexure II** for an indicative list of use cases cities should target to get accomplished through the ICCC.

2.2 FUNCTIONAL MODULES OF AN ICCC PLATFORM

While ICCC is a functional unit, for its effective operationalization, a software platform (or set of applications) is needed to acquire data from various sub-systems, which can orchestrate a coordinated response and create a decision support system. Hence, the ICCC platform can aptly be called as a system of systems. An indicative functional scope (divided into various indicative modules) for such an ICCC platform is shown below:

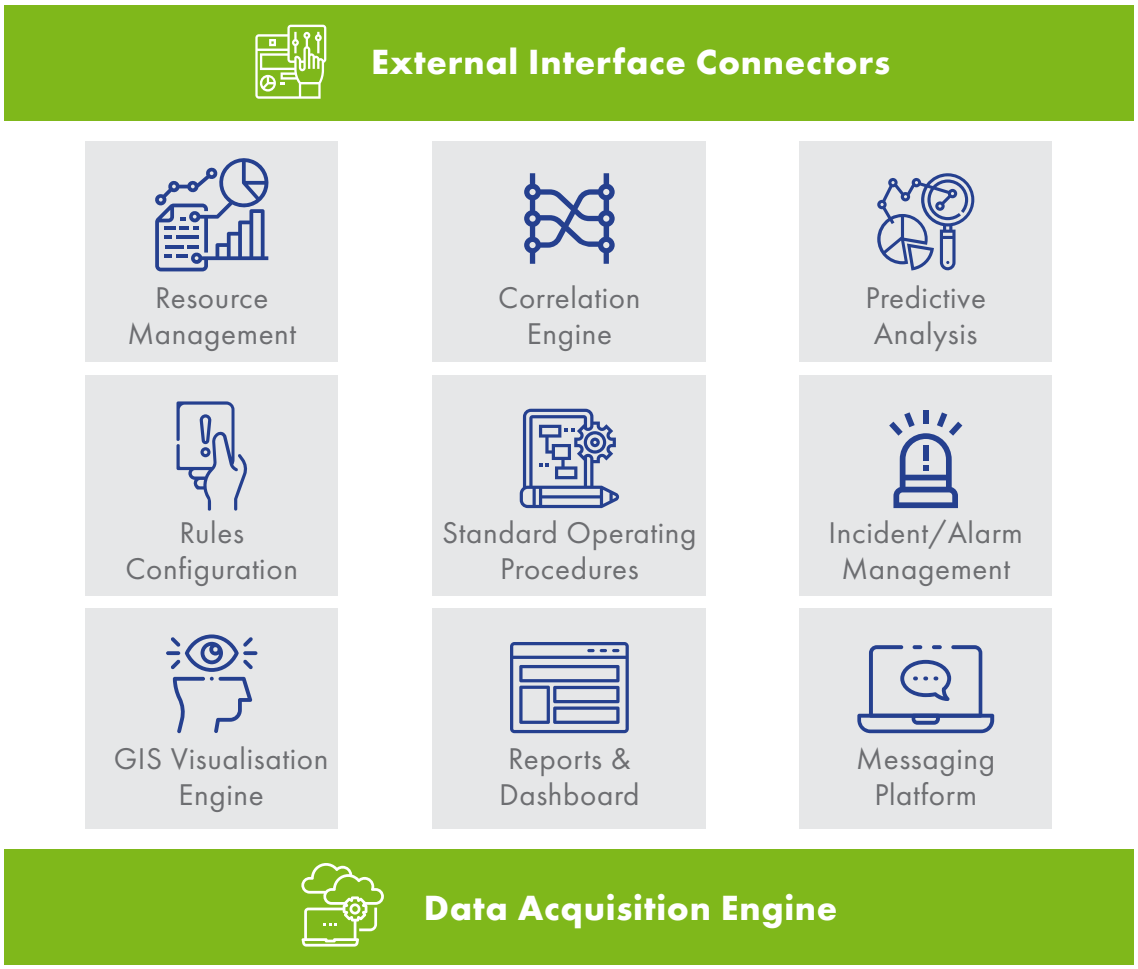


Figure 2: Indicative Functional Modules of an ICCC Platform

Please refer to **Annexure I** to explore functional and technical details of the ICCC platform, divided into 4 core engines/layers as listed below:

- **Data acquisition engine:** to ingest data from different edge devices (sensors, devices, actuators), various sub-systems, open APIs and systems
- **Data correlation & analytics engine:** to analyze the multidimensional data and create patterns, trends, correlation and forecasting for decision making purposes in real-time. The engine also facilitates the analysis in different visual formats
- **Business rules engine:** to configure or automate processes to handle events in different scenarios
- **Communication engine:** to connect with edge devices, mobile assets and resources to enable the communication or facilitate the management of different systems

2.3 KEY DESIGN CONSIDERATIONS FOR AN ICCC PLATFORM

Cities should keep in mind the following design considerations during the implementation stage of ICCC platform.

ICCC to be designed as a system-of-systems	Various sub-systems should talk to the ICCC, thereby providing common operating picture on city operations to ICCC supervisors and Smart City/ULB leadership - in normal circumstances as well as during emergency or crisis
Focus to be on outcomes	ICCC implementation to be driven by use cases to deliver specific outcomes for various departments and stakeholders of the city. Refer to **Annexure II** for indicative use cases that can be implemented through the ICCC
Adhere to open standards & IndEA Framework	ICCC platform should follow open standards, and should not be developed using proprietary algorithms, to avoid vendor-lock-ins. Also adhere to the IndEA framework released by MeitY, Govt of India
Scalable and Interoperable Architecture	IT usage within cities is going to increase in years to come and thus productive use of ICCC is expected to improve only with the passage of time. Scalable architecture can support integration of additional sub-systems in future, without additional/substantial investment of time & money.
Robust IT Security Systems & Policies	ICCC is expected to become the brain and nervous system for city operations, with access to a lot of valuable data & systems. It is thus, essential that a robust IT Security system be designed & implemented to safeguard the data & systems from internal/external threats
Address data privacy concerns	ICCC shall have access to various data sets - video, audio & text data, both through field level systems like CCTV cameras or through social media or grievances received. It's essential to have right access controls and usage guidelines to address privacy concerns.
Compliance with PPP-MII provisions	DPIIT has notified orders to promote manufacturing and procurement of locally manufactured products and services under the Make in India initiative. Smart City SPVs are required to comply with the same.

2.4 INDICATIVE SCENARIOS FOR ICCC OPERATIONS

This section outlines three indicative scenarios to explain how ICCC can assist and empower city administration and various stakeholders in effective city management.

Scenario 1

How ICCC can aid disaster management in a flood-prone city?

Context Setting: The city is subjected to water logging (even flooding in some areas) during heavy rains in the monsoon season, leading to safety concerns in certain pockets in the city, traffic congestion, electricity outages, risks of fire hazards, etc. Moreover, water logging gives rise to many water and mosquito borne diseases. The city thus grapples with a range of issues from disaster response/management to resource mobilization, spanning across sectors like transportation and mobility, healthcare and emergency services.

The inability to harvest relevant data, gather detailed insights and predict the incidence and frequency of a disaster further impede timely and efficient decision making and response.

Solution: A city with authorities connected through ICCC can salvage valuable time in a flood crisis to proactively & efficiently manage typical threats due to heavy rains in the following manner:

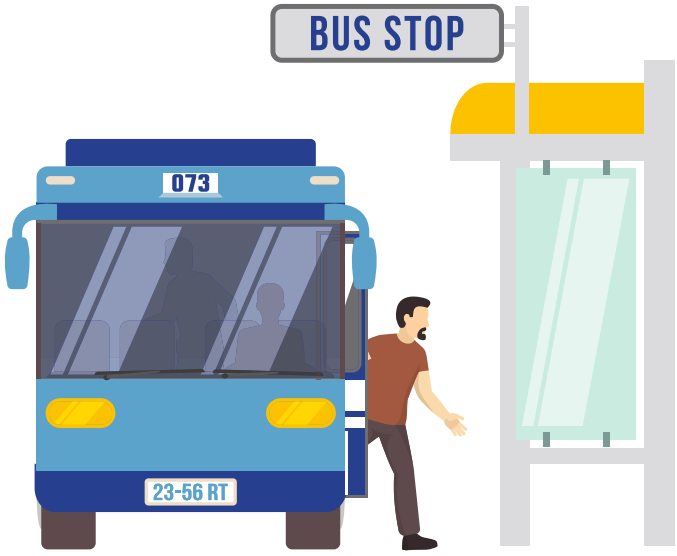
- Informed decision making with multiple authorities coordinating on a single digital source of truth for entire city
- GIS analysis can help identify functionaries best suited to respond to emergency for faster response
- Integration with city app and mobile services can provide reliable and critical communication to affected citizens

Table 1: Functions that can be performed by an ICCC in this scenario

ICCC Layers	Key functions to be performed at ICCC
Data Acquisition: To collect contextual data	• Locate all CCTV cameras, schools, hospitals, police stations, etc. on the city GIS • Sentiment/incident tracking from the internet, mobile app and social media • Online viewing of CCTV footages, video analytics on water logging • Data from water sensors across the city • Deluge maps of flood prone areas on the city map based on past incidences and patterns of water-logging • Data from meteorological department on rain forecast; Data on high tides (in case of cities with coastline)
Data Correlation and Analytics Engine: To allow better situational analysis	• Dynamic GIS maps of the city to continuously show possible affected areas in the city in the next 24 – 72 hours • Identification of public spaces (like schools) for the movement of citizens to safer locations • Location wise analysis of the impact on possible transport congestion, mosquito breeding hotspots • Identification of volunteers for possible support during an emergency
Business Rules Engine: For effective response	• Dynamic monitoring of the situation & effective decision making from ICCC • Plan traffic diversions, put in place safe zones & crowd management • Use drones for remote monitoring • Trigger SOPs for co-ordinated response involving municipal staff, rapid action force, volunteers
Communication Engine: For timely communication with all the stakeholders	• Public Address System to disseminate warnings, build awareness • Two-way communication for effective deployment of emergency response services, citizen volunteers, NGOs and private sector • Coordination with dam authorities (if applicable) for water release in most optimum way • Constant communication on social media & mass communication on mobile phones

Scenario 2

How can ICCC support management and improvement of public transit in cities?



Context Setting: Citizens use public transport system for their daily commute, switching between multiple modes of public transport - bus, train and NMT to reach their destination. They have no easy method to view availability and timings across different modes of transport to plan their journey. As a result, they often encounter delays or take a less comfortable journey than expected, incurring undue hardship and leading to low usage of

public transport. Further, on routes having inadequate lighting there are incidents reported of harassment from passers-by and co-passengers on public transport in certain sections of the city after dark.

Solution: ICCC supported seamless connectivity can help citizens identify the best time-efficient route prior to the journey. Integration with a digital women's safety platform can help them access real-time safety information on routes, provide feedback and quickly access help in times of distress.

- The city mobile application integrated with the ICCC can help citizens get real-time information on the arrival and departure of various modes of public transport
- The app can highlight the next available mode of transport based on the latest schedules and timetable, helping them plan the commute and reducing waiting time
- Throughout the commute, access to public Wi-Fi at public hotspots and public transport can be made available, which are continuously monitored through ICCC for uptime & usage tracking
- To improve safety, ICCC analyzes hotspots where commuters report harassment in the city mobility app
- The app sends live updates to users and has an inbuilt panic button that helps them reach out to relevant public authorities and emergency contacts at the earliest

Table 2: Functions that can be performed by an ICCC in this scenario

ICCC Layers	Key functions to be performed at ICCC
Data Acquisition: To collect contextual data	• Aggregate mobility based data from all nodal points like bus transport, metro, taxi, rail, etc. on real-time basis • Parking availability data from Parking Lots across the city • Dynamic data on traffic situations across the city from Google maps (or any other system) • Dynamic data on traffic signaling system at various traffic signals • Data from police on the possible movement of VIPs
Data Correlation and Analytics Engine: To allow informed decision making	• Analyze the data from different sensors, GPS devices and cameras; visualise the flow of transport/transit • Integrate all mobility related sub-systems with the mobility platform • Carry out predictive analysis for peak time analysis across the city hot-spots
Business Rules Engine: For improved outcome	• Create green corridors through the adaptive signaling system • Dynamic decision making by bus/metro railways to cater to surge/slump in the demand • E-challans to traffic rule violators, monitoring collection of the same • Real-time monitoring of footpaths & cycle tracks to identify violators, through CCTV cameras, social media, volunteers • Deploy additional security personnel in areas where safety scores fall • Regular inputs to the city planners for improving the mobility within the city
Communication Engine: For timely communication with all the stakeholders	• Regular updates to registered citizens on the city traffic situation • Dynamic reporting on traffic diversions • Timely communication with traffic police for effective management of traffic in the city

Scenario 3

How ICCC can help save energy, yet improve lighting conditions and improve sense of security within a city?

Context Setting: Every city aspires to have the best lighting conditions at public places. However, it is often faced with citizen grievances around quality & availability of street lighting. This is despite significant amount of expenditure and investments into LED street-lighting across the city

Solution: ICCC provides an excellent opportunity to effectively plan, monitor & manage street lights in a city.

- Scientific identification of hot-spots requiring street light/higher illumination requirements in the city
- Real-time monitoring of the street light functioning
- Remote management of illumination, switching ON/OFF of the street lights, thereby having substantial savings of energy bills

Table 3: Functions that can be performed by an ICCC in this scenario

ICCC Layers	Key functions to be performed at ICCC
Data Acquisition: To collect contextual data	• GIS mapping of LED street lights • Integration of grievances from grievance redressal system & social media • Data on day-night timings, for aligning ON/OFF of street lights with setting sun or the rising sun • Data on crime-hot spots, requirements coming from various citizen forums
Data Correlation and Analytics Engine: To allow better analysis	• Mapping of crime hot-spots on the GIS map & its correlation with lighting availability within the city • Correlation with some historic significance at certain places within the city • Correlation with Incidents (like accidents, fire, mob gathering, etc.) or crisis
Business Rules Engine: For effective decision making	• Effective planning for future expansion, illumination levels • Timely resolution of grievances related to faults, illumination levels • Near real-time decisions on increase of illumination in areas experiencing certain incidents, crisis situation • Daily monitoring of energy usage, identification of patterns for improved decision making
Communication Engine: For timely communication with all the stakeholders	• Real-time communication to field engineers to rectify faults • Daily dashboard to head of department, with specific suggestions on improvements

Note: Indicative ICCC use cases are provided under **Annexure II** of this document.

03

ICCC MATURITY ASSESSMENT FRAMEWORK (IMAF) - ASSESSING THE MATURITY OF ICCCs

3.1 IMAF OVERVIEW

The key objective of IMAF is to provide cities with a self-assessment toolkit to assess the maturity and effectiveness of ICCCs in civic operations management, day-to-day exception handling, disaster management, planning and policy making. IMAF has been broadly conceptualized to achieve following objectives:

- **Maturity Assessment of ICCC:** To periodically assess maturity of ICCC platform capabilities across Functional, Technological, Operational and engagement dimensions.
- **Knowledge Exchange:** To enable peer to peer learning and allow cities to replicate success, use learnings of others.
- **Standard frame of reference through Benchmarking:** To help in developing common understanding and standardization on ICCC solutions, architecture, and components among various stakeholders viz. equipment manufacturers, system integrators, startups, domain experts, consultants, and city administration.
- **Gap Assessment:** To help Smart Cities identify gaps in capabilities across functional, technological, operational and engagement dimensions.
- **Catalyze Scalable Model:** To help in replicating the successes and avoiding implementation pitfalls to scale ICCCs across Smart Cities. It will also act as a launch pad for the cities which are yet to commence their solution design, system integration and monitor city operations.

This document has been designed to help Smart Cities find answers to following questions through assessment activities:

1	**Functional Capability Assessment**	**Assess ability of ICCC to monitor and manage city utilities and services**
		Utilizing the ICCC, is the city effectively managing: • Civic functions/Utilities • Mobility • Citizens/Properties • Emergencies through
2	**Technological Capability Assessment**	**Assess technological capability, scalability, security provisions, etc.**
		Utilizing the ICCC, is the city effectively: • Ensuring convergence of applications/systems/databases • Leveraging all available components of ICCC platform/product • Putting functionality-to-use for managing city operations • Customizing the platform as per city requirements
3	**Operational Capability Assessment**	**Assess the utility of ICCCs in day-to-day management of city operations**
		Does the city have: • An operation-centric SOP framework for civic functions • The required manpower to handle ICCC operations in real-time • A responsibility matrix in place • A Business Continuity Plan in place to deal with disruptions
4	**Engagement Capability Assessment**	**Assess the nature and level of engagement with citizens and other urban stakeholders**
		Is the city able to: • Engage with the citizens frequently and improve outreach via ICCC • Utilise ICCC in effectively communicating with various urban stakeholders • Collect feedback and suggestions from citizens, urban stakeholders on inputs towards policy design and implementation • Effectively use ICCC to create awareness about urban challenges and drive behavioural change

3.2 IMAF EXPLAINED

Overall, IMAF combines the scores of the following two assessment frameworks:

I. ICCC Maturity Assessment
II. Data Maturity Assessment

ICCC MATURITY ASSESSMENT

The various components and key parameters under the 4 dimensions are explained below in detail:

Functional Capability Assessment

The Functional Capability should be assessed over following four components:

- **Data Acquisition:** Ability to demonstrate ICCC solution capability to collect data from different sources and visualize in a desired manner for decision making in real-time.
- **Data Analytics and Correlation:** Ability to demonstrate ICCC solution capability to apply data analytics for decision making in real-time.
- **Command & Control:** Ability to demonstrate ICCC solution capability to command field staffs etc. and control response in real-time.
- **Communication:** Ability to demonstrate ICCC solution capability to communicate effectively in real-time with various stakeholders.

KEY PARAMETERS/SECTORS

- **Civic Utilities**
  a) Water
  b) Solid waste
  c) Sewerage & drainage
  d) Roads
  e) Street light
  f) e-governance services e.g. property tax, license etc.

- **Mobility Services:** Ability to manage any of the following mobility services end to end through ICCCs:
  a) Public transport
  b) Traffic
  c) Public parking
  d) Public cycle sharing

- **Safety and Surveillance:** Ability to manage safety and surveillance related services end to end through ICCCs

- **Emergency and Crisis Management:** Ability to manage emergency and crises/disaster management related services end to end through ICCCs

- **Convergence:** Ability to demonstrate end to end convergence through ICCCs leveraging the following systems:
  a) ERP
  b) GIS
  c) Call center
  d) Notification gateway
  e) Mobile apps & Websites
  f) Messaging display & Public address system

Refer Functional Capability Assessment under **Annexure III** for definition and scope of each sub-indicator.

Technological Capability Assessment

The Technological Capability should be assessed over following four capabilities:

- **Data Acquisition and Visualization:** Ability to demonstrate ICCC solution capability to collect data from different sources and visualize in a desired manner for decision making in real-time.
- **Configuration:** Ability of the ICCC to configure events, triggers, user access controls and data feed handling.
- **Data Analytics and Correlation:** Ability to demonstrate ICCC solution capability to apply data analytics for decision making in real-time.
- **Command & Control:** Ability to demonstrate ICCC solution capability to command field staffs etc. and control response in real-time.

KEY PARAMETERS

- **Sensor Integration for data acquisition & aggregation from edge networks in the city.**
- **Network layer**
- **Data center layer**
- **Application layer**
- **Data analytics and correlation layer**
- **Command and Control layer**
- **Service delivery layer**
- **Security layer**

Refer Technological Capability Assessment under **Annexure III** for definition and scope of each sub-indicator.

Operational Capability Assessment

The operational capability should be assessed over the following components:

- **Governance framework:** Adoption of requisite governance policies in the ICCC for operational management.

- **Field force management:** Incorporation of sound organisational management in ICCC operations.
- **Decision making framework:** Information and situational representation at the ICCC for supporting decision making.
- **Knowledge management:** Applications and services for managing knowledge repositories and citizen-user interactions for institutional memory
- **Cyber security:** Cyber security policy and its implementation to ensure security of ICCC and linked infrastructure.

KEY PARAMETERS

- **ICCC governance coverage**
- **Resourcing and staffing**
- **Field force management**
- **Decision making framework**

Refer Operational Capability Assessment under **Annexure III** for definition and scope of each sub-indicator.

Engagement Capability Assessment

The engagement capability is to be assessed over the following components to understand ability of the ICCC to provide bilateral engagement with users and citizens in support of city governance

KEY PARAMETERS

- **Percentage (%) of unique citizens engaged**
- **Percentage (%) of city corporation employees engaged**
- **City ability to do sentiment analysis at citizen level**

Refer Engagement Capability Assessment under **Annexure III** for definition and scope of each sub-indicator.

DATA MATURITY ASSESSMENT

In 2019, the Ministry launched the DataSmart Cities Strategy and the Data Maturity Assessment Framework to gauge data maturity of cities. DMAF assesses city readiness on data across 5 Components of People, Process, Platform, Technology and Outcomes. The cities are eventually scored on a scale of 0 to 100.

Methodology:

Parameter	Component
DMAF Score	Only latest score should be considered

3.3 IMAF SCORING

The IMAF should combine of the scores of following two assessment frameworks

Framework	Weightage	Objective
ICCC Maturity Assessment Score(IMAF)	80%	To assess the maturity of ICCC on various dimensions viz. Functional, Technological, Operational and Engagement capabilities
Data Maturity Assessment Score (DMAF)	20%	To assess the data maturity of the city

IMAF Score = (0.80 * ICCC Maturity Assessment Score) + (0.20 * Data Maturity Assessment Score)

In the IMAF, the following weightages will be applicable:

Dimensions	Weightage	Component	Indicators
Functional Capability Assessment	35% (27 indicators)	Data Acquisition	7
		Data Analytics and Correlation	7
		Command and Control	6
		Communication	7
Technological Capability Assessment	25% (23 indicators)	Data Acquisition and Visualization	4
		Configuration	7
		Data Analytics and Correlation	6
		Command and Control	7
Operational Capability Assessment	25% (21 indicators)	Governance Framework	6
		Field Force Management	5
		Decision Making Framework	4
		Knowledge Management	3
		Cyber Security	4
Engagement Capability Assessment	15% (3 indicators)	Citizens Engagement	1
		Employee Engagement	1
		Sentiment Analysis	1

ICCC Assessment Score = (0.35 * Functional Capability Assessment Score) + (0.25 * Technological Capability Assessment Score) + (0.25 * Operational Capability Assessment Score) + (0.15 * Engagement Capability Assessment Score)

ICCC Maturity Assessment Framework Self-assessment should be done as outlined below:

- For Functional Capability Assessment, each indicator needs to be mapped with the following response viz.: Yes/No. For each "Yes " response, 1 (One) mark should be allotted and for each "No " response, 0 (zero) mark should be allotted.

- For Technological and Operational Capability Assessments, each indicator shall be mapped with following responses -Yes, No, or NA (Not Applicable). For each "Yes " response, 1 (One) mark should be allotted and for each "No " response, 0 (Zero) mark should be allotted. For NA response, mapped indicator should not be considered for assessment. If 30% or more of responses are NA, then the city should assess low maturity for respective component

- For Engagement Capability Assessment, each indicator needs to be mapped against selected criteria for assessment. Depending on the criteria, the city may score between 0-5 marks for each indicator.

Indicators	Score
Percentage (%) of unique citizens interacting with ICCC with reference to overall city population?	
i. 0	0
ii. >0 but <1%	1
iii.1-5%	2
iv.5-10%	3
v. 10--15 %	4
vi.15 % and above	5
Percentage (%) of city corporation employees connected with ICCC with reference to overall strength using ICCC mobile app/website etc?	
i. 0-10%	0
ii. 10-20%	1
iii. 20-30%	2
iv. 30-40%	3
v. 40-50%	4
vi. 50% and above	5
City ability to carry out feedback/sentiment analysis at the citizen level through ICCC?	
Percentage (%) of feedback received from citizens interacting with ICCC?	
i. 0-10% (In case not available please choose zero)	0
ii. 10-20%	1
iii. 20-30%	2
iv. 30-40%	3
v. 40-50%	4
vi. 50% and above	5

For each of the dimension, maximum possible marks for all questions (excluding N/As) are to be mapped to a score of 100, which is then multiplied by the weightage to get the Score for each dimension. Any decimal scores are rounded off to the nearest integer.

The IMAF outcome should categorize the ICCC into the following categories:

ICCC Maturity Level Classification

ICCC	Classification	Description
< 40	ICCC - L4	ICCC is at an evolving stage of development for stakeholders (city administration/department officials/on-field employees/citizens). The ICCC infrastructure is basic and stakeholders are unable to make use of ICCC for decision-making and governance, thereby rendering the utility and impact (social, economic, environmental) of ICCC low.
40 - 60	ICCC – L3	ICCC is at a 'progressive' stage of development for stakeholders (city administration/department officials/on-field employees/citizens). The ICCC infrastructure is established and stakeholders are beginning to make use of ICCC for decision-making and governance, although the utility and impact (social, economic, environmental) of the ICCC is not fully known.
>60 - 80	ICCC – L2	ICCC is at an 'advanced ' stage of functioning for stakeholders (city administration/department officials/on-field employees/citizens). The ICCC infrastructure is fully deployed and stakeholders are extensively using the ICCC for day to day operations and management. The city is also using ICCC for decision-making and the utility & impact (social, economic, environmental) of the ICCC is being realized.
>80 - 100	ICCC – L1	ICCC is a 'lighthouse' for all stakeholders (city administration/department officials/on-field employees/citizens) within the ecosystem. It is a role-model for functionality and urban governance. Stakeholders are fully using the ICCC for decision-making and governance and the utility & impact (social, economic, environmental) of the ICCC is high.

Scoring Simulation

Illustrative calculation: Post self-assessment, the City X may obtain following scores against each dimension

Dimension	Total Indicators	Total Marks	Marks Obtained	City Score (out of 100)
Functional Capability Assessment	27	27	15	56 (100/27*15)
Technological Capability Assessment	23	23 (All questions were Yes/No)	23	100 (100/23*23)
Operational Capability Assessment	21	18 (3 questions were NA)	15	83 (100/18*15)
Engagement Capability Assessment	3	15	9	60 (100/15*9)

ICCC Assessment Score = (0.35 x 56) + (0.25 x 100) + (0.25 x 83) + (0.15 x 60) = 80.35
DMAF Score = 65
IMAF Score = (0.80 x 80.35) + (0.20 x 65) = 77.28
Thus City X falls under ICCC – L2.

Illustrative Calculation: Under functional maturity assessment, the city's overall score should be calculated based on the average of all components score. For example, a city undertaking Functional Capability assessment against three use cases in the domains such as Water, Environment and Mobility achieves 50% maturity score for Water domain, 60% maturity score for Environment domain and 70% maturity score for Mobility domain, then the overall functional assessment score would be (50%+60%+70%)/3 i.e. 60% at a Functional Capability level "Medium" category.

3.4 MATURITY ASSESSMENT PROCESS

ICCC maturity assessment process comprises of four stages:

Stage I: Self-assessment

- Cities undertake ICCC maturity self-assessment
- Duration: 45 days

Stage II: City level validation

- Set up Evaluation Committee at the city level
- Validate and generate the score and ICCC maturity level
- Duration: 30 days from completing self-assessment

Stage III: Gap Assessment

Identify gaps under Functional, Technological, Operational and Engagement Dimensions

- Formulate action plan to rectify gaps in time bound manner
- Identify stakeholders responsibilities

Stage IV: Gap Closure and Documentation

- Validate the status of identified gaps as per the action plan
- Evaluation committee to review and validate the status of gaps
- Mark closure of iteration and document the best practices, use cases and outcomes with evidence
- Get ready for next self-assessment and undertake next iteration to improve the score.
- Timelines - 30 days from completion of action plan submission

04

ICCC MATURITY SELF-ASSESSMENT TOOLKIT

In the Self-Assessment stage, the cities should be able to assess themselves across following dimensions:

a) Functional Capability
b) Technological Capability
c) Operational Capability
d) Engagement Capability

The Assessment criteria are explained below:

4.1 FUNCTIONAL CAPABILITY ASSESSMENT

The first component of the framework is assessing functional capability of the ICCC i.e. the civic utilities or services being monitored by either the system or the people deployed at the facility. This shall include services which are planned to be integrated with the ICCC and covers primary services that are being provided by the city administration.

1. **City Utilities and Civic Services:** These primarily include civic services provided by the urban local body (ULB) to cater to the daily needs of citizens in general. The framework considers that an ICCC must integrate and monitor these services at its facility as any disruption in the services and lack of timely response could lead to poor service delivery. Few basic utilities managed by ULBs are as follow:
   a. Water Supply and Waste-Water Management: The water supply and its quality treatment is done by ULBs. Waste-water treatment operations are also managed by ULBs.
   b. Solid Waste Management: This includes services like residential garbage collection, construction and debris collection, recycling of waste collected and disposal on a daily basis.
   c. Smart Street Lighting Management: This refers to the management of a network of street-lights installed across city limits to ensure safe streets.
   d. Environment: This refers to the various sensors installed across the city to monitor data from sensors like pollution sensors, noise sensors, light sensors, etc.

2. **City Mobility:** These services refer to connectivity services provided by the city for citizens to travel from one point to another. It includes the provision of connectivity, accessibility and public space for parking of vehicles. The three broad domains can be listed as below:
   a. Transit Management (connectivity):

This refers to management of public transport vehicles like buses, taxis, and trains etc. which assist the citizens in connecting to various parts of the city.

b. Traffic Management (accessibility): This refers to the planning & control of transport services across the city to manage the traffic flow within the city.
c. City Parking Solutions: It refers to the management of public parking spaces in terms of usage as well as revenue collection.

3. **Safety and Security:** Primarily the function of police, these refer to operations to enhance the safety of the public and provide necessary surveillance information to Police for both reactive and predictive policing. CCTV surveillance has been an important component across multiple cities with increasing usage of video analytics to provide police with timely alerts for an action.

4. **Crisis Management:** These services address major disaster-related events which may occur in a city affecting the city as a whole (e.g. floods) or a part of the city (e.g. fire accident). The Crisis Management operations in a city include medical services, fire brigade and police which may need to respond either together or in tandem based upon the type of exigency. Being an important aspect of ICCC, it is imperative that a crisis management plan should be in place and properly implemented covering all possible events which may disrupt either part of or the complete city.

5. **Convergence:** There are certain enterprise systems/applications used by city governments to support city operations. Services like Geographical Information System (GIS) for the city tags all the important functions of a Smart City/ ULB on a map, providing them a holistic view of the city. Services like Enterprise Resource Planning (ERP) are essentially integrated management of core processes across various services providing real-time, digitized information about the system. Such services cut across the length and breadth of the core services and thus must be addressed in the city ICCC as they assist city administrators in visualizing information at pan-service and pan-city level, with functionality to drill-down on a specific part of the city or specific service if required.

These services can be assessed in detail based on respective functional use case configured with ICCC platform. In the first stage, cities should self-assess maturity of specific domain as per its readiness at ICCC. Smart City Functional Assessment is comprised of following components for each use case mentioned above:

a) Data Acquisition
b) Data Analytics and Correlation
c) Command and Control
d) Communication

Scores should be assigned based on maturity of specific use case on above four components.

Example:
The cities which have installed water sensors/ IoT devices for monitoring of water quality system with integration of water SCADA system at ICCC should put their response as "Yes". If it is not implemented, they should fill their response as "No"

The total score should be calculated based on the aggregated score under each category.

I.
Functional Capability Assessment Toolkit

Component 1: Data Acquisition Maturity

Data Acquisition Assessment		Response
1.1	Have sensor devices and activators been deployed as a part of field infrastructure?	Yes/No
1.2	Are the sensors deployed on the field geo-referenced?	Yes/No
1.3	Do the sensors provide real-time data?	Yes/No
1.4	Is the sensor data available at ICCC?	Yes/No
1.5	Is domain-specific data available at ICCC?	Yes/No
1.6	Is the sensor data available in a geo-referenced manner at ICCC?	Yes/No
1.7	Is the data from respective domain application/smart solution available in a geo-referenced manner at ICCC?	Yes/No
Data Acquisition Maturity Assessment Level: (Low/Medium/High)		

Note: Refer Functional Capability Assessment under **Annexure III** for definition and scope of each sub-indicator.

Component 2: Data Analytics and Correlation Maturity

Data Analytics and Correlation Assessment		Response
1.8	Does the sensor data generate exceptions based on pre-defined SLA thresholds?	Yes/No
1.9	Are the thresholds automatically refreshed based on ground conditions?	Yes/No
1.10	Is the data from sensors/systems analyzed with data from other sensors/applications based on time of event?	Yes/No
1.11	Is the data from sensors/systems correlated with data from other sensors based on location of event?	Yes/No
1.12	Does the correlation from multiple sensors/systems result in generation of alerts/exceptions?	Yes/No
1.13	Does the correlation offer diagnostic analysis of events?	Yes/No
1.14	Does the correlation offer prescriptive actions from the event?	Yes/No
Data Analytics and Correlation Maturity Assessment Level: (High/Medium/Low)		

Note: Refer Functional Capability Assessment under **Annexure III** for definition and scope of each sub-indicator.

Component 3: Command and Control Maturity

Command & Control Assessment	Response
1.15 Does the system offer Standard Operating Procedures (SOPs) based on alerts?	Yes/No
1.16 Does the system provide real-time view in terms of video, geo-location post generation of alert?	Yes/No
1.17 Are the SOPs defined to include point of contact responsible?	Yes/No
1.18 Are the SOPs defined to include action for the person responsible?	Yes/No
1.19 Are the SOPs defined to include pre-requisites?	Yes/No
1.20 Are the SOPs defined to include procedures?	Yes/No
1.21 Are the SOPs defined to include on-field/premise assets?	Yes/No
Command and Control Maturity Assessment Level: (High/Medium/Low)	

Note: Refer Functional Capability Assessment under **Annexure III** for definition and scope of each sub-indicator.

Component 4: Communication Maturity

Communication Maturity Assessment	Response
1.22 Is the communication protocol (mode, contact details, alternates) included in the SOP?	Yes/No
1.23 Does the system provide for audio communication over multiple channels to the first responder?	Yes/No
1.24 Does the system provide for audio communication over multiple channels to all responders?	Yes/No
1.25 Does the system provide for video communication to the first responder?	Yes/No
1.26 Does the system provide for video communication to all responders?	Yes/No
1.27 Does the communication channel provide for recording and playback?	Yes/No
Communication Maturity Assessment Level: (High/Medium/Low)	

Note: Refer Functional Capability Assessment under **Annexure III** for definition and scope of each sub-indicator.

Below table shows an illustration of the Functional Capability Assessment for a sample city:

Functional Capability	Low	Medium	High
Score	< 50	50 - 80	>80

The city should be able to assess the gaps under functional capability based on self-assessment for a specific domain. City administration should bring majority of its operations from various domains under ICCC and assess the maturity of functional components, to assess if ICCC platform can manage multiple and complex events on a day-to-day basis. ICCC readiness should further be assessed over horizontal dimensions like technological, operational and engagement. These dimensions are explained in detail in the following sections.

4.2 TECHNOLOGICAL CAPABILITY ASSESSMENT

The technological assessment score should be assigned based on maturity assessment of individual technological components of the ICCC platform. This should help gauge ICCC capability to support the functional requirements of city administration

a) Data Acquisition and Visualization Layer includes components for data acquisition and collection from various devices/systems/applications in different formats

c) Data Analytics and Correlation Layer includes components to aggregate and process the data for analysis on different dimensions in order to derive intelligence out of information collected through different sources.

b) Configuration Layer includes components involved in defining and configuring multiple and complex events and its automated response.

d) Command and Control Layer includes components to manage responses, assets, devices, on-field users and resources to address civic issues.

II.
Technological Capability Assessment Toolkit

Component 1: Data Acquisition and Visualization Maturity

	Data Acquisition and Visualization Assessment	Response
2.1	Integration with Sensors/Sensor Applications- Ability to collect and aggregate data in real-time generated from field sensors/edge infrastructure like bin sensors, water sensors, environment sensors, access sensors and actuator sensors.	Yes/No/ NA
2.2	ETL Capability (Extract, Transform, Load)- Ability of ICCC platform to consume raw data feeds from different data sources and ability to prepare information for downstream use. E.g. Ability to process data coming through online systems, mobile apps, social media, edge sensors, third party applications and tools, data files (microsoft excel, GIS etc.) and different databases for effective interpretation.	Yes/No/ NA
2.3	Integration with Video Feeds- Ability to consume video feeds generated from various applications capturing videos like surveillance, parking, traffic etc.	Yes/No/ NA
2.4	Integration with Data Feeds and Publishing Data Feeds- Ability to consume real-time data feeds from various systems/applications using APIs.	Yes/No/ NA
	Data Acquisition and Visualization Maturity Assessment Level: (High/ Medium/Low)	

Component 2: Configuration Maturity

	Configuration Maturity Assessment	Response
2.5	Configuration of SOP, Alerts- Ability to configure Standard Operating Procedures in ICCC platform using data feeds from different systems/ applications converging at ICCC.	Yes/No/ NA
2.6	Configuration of GIS- Ability of ICCC platform to configure and use GIS application/Open Street Maps for GIS analysis of domain specific use cases.	Yes/No/ NA
2.7	Configuration of SLAs- Ability to view SLA compliance/non-compliance of various projects and applications using ICCC.	Yes/No/ NA
2.8	Configuration of Data Security Features- Ability to configure user access and authorization control to provide specific set of information/ data/application control to designated or authorized set of users.	Yes/No/ NA
2.9	Configuration of Network Control- Ability to manage and monitor network performance through ICCC platform using NMS application or third-party application.	Yes/No/ NA

	Configuration Maturity Assessment	Response
2.10	Configuration of User Access Control- Ability to configure and manage user access for different applications/facilities through ICCC.	Yes/No/ NA
2.11	Configuration of Notification Control- Ability to configure and manage user notification as per configured protocol.	Yes/No/ NA
	Configuration Maturity Assessment Level: (High/Medium/Low)	

Component 3: Data Analytics and Correlation Maturity

	Data Analytics and Correlation Maturity Assessment	Response
2.12	Sentiment Analytics- Ability to provide sentiment analytics of configured keywords/accounts through internet crawling using ICCC platform. Ability to categorize key issues/topics/words in real-time on social media platforms (Twitter, Facebook, Google+, Website Discussion Forums, News Articles) which have negative/positive perception among citizens.	Yes/No/ NA
2.13	Predictive Analytics- Ability to make predictions about future events using past data. Predictive analytics uses many techniques from data mining, statistics and modelling to analyze data and make predictions about the future.	Yes/No/ NA
2.14	Prescriptive Analytics- Ability to propose best course of action for any given situation/scenario based on analytics.	Yes/No/ NA
2.15	Diagnostics Analytics- Ability to undertake root cause analysis using data slicing, data aggregation, data mining, data discovery and correlation techniques using ICCC platform.	Yes/No/ NA
2.16	Descriptive Analytics- Ability to view insights from historical data for a given data set.	Yes/No/ NA
2.17	Video Analytics- Ability to automatically analyze video to detect and determine temporal and spatial events.	Yes/No/ NA
	Data Analytics and Correlation Maturity Assessment Level: (High/ Medium/Low)	

Component 4: Command and Control Maturity

	Command and Control Maturity Assessment	Response
2.18	Operation/Process - Ability to aid city operation in various civic domains namely water, drainage, solid waste, fire etc.	Yes/No/ NA
2.19	SOP Control- Ability to manage the SOP lifecycles configured in ICCC platform.	Yes/No/ NA
2.20	Access Control- Ability to provide or restrict access to the users/user groups for any facility or applications in real-time.	Yes/No/ NA
2.21	Device Control- Ability to provide or restrict access to the users/user group for any actuators/devices like water supply sensors or edge devices on network in real-time.	Yes/No/ NA

	Command and Control Maturity Assessment	Response
2.22	Sensor Control- Ability to access controls like reboot and control any network sensors in real-time through ICCC platform.	Yes/No/ NA
2.23	Field Force Control- Ability to assist field force of city administration by providing requested information and support in real-time to manage civic operations.	Yes/No/ NA
2.24	Asset Control- Ability to control access to field assets through ICCC platform.	Yes/No/ NA
	Command and Control Maturity Assessment Level: (High/Medium/ Low)	

Note: Refer Technological Capability Assessment under **Annexure III** for definition and scope of each sub-indicator.

Below table shows an illustration of the Technological Capability Assessment for a sample city:

Technological Capability	Low	Medium	High
Score	< 50	50 -80	>80

Technological Capability Assessment should enable cities to assess and identify which components are extensively utilized and which are yet to be utilized to enhance the effectiveness of an ICCC.

Technological Capability Assessment should motivate cities to explore the potential of various components of ICCC platform to manage its civic operations.

4.3 OPERATIONAL CAPABILITY ASSESSMENT

An ICCC will not be able to function to its full potential if it does not have a proper governance framework covering people, processes and policy dimensions to support ICCC operations and its sustenance.

a) Governance framework: This essentially refers to the presence of governance policies as guidelines for ICCC manpower in terms of non-disclosure agreements, privacy policies, knowledge repositories, employment policies etc.

b) Field force management: This includes, but not limited to, design & implementation of workforce management plan with well-defined organizational hierarchy, manpower forecasting as well as escalation matrix for the concerned authorities to use and respond to situations in real-time.

c) Decision making framework : This refers to the ability of an ICCC to display information at an aggregated level for city-level management, so that such dashboards can be regularly utilized by concerned officials for their day-to-day or crisis situations.

d) Knowledge management: This includes applications/services for capacity building modules, case studies, data repository, ICCC system documents including SLA, FAQ, local knowledge and solutions. This also includes the capability to manage citizen feedback & responses with proper classification/cataloguing, and updation for improved operations and transition management.

e) Cyber Security: The city should have a cyber security policy in place to manage, protect and monitor various assets, system applications and networks including ICCC infrastructure itself.

III.
Operational Capability Assessment Toolkit

Component 1: Governance Framework Maturity

	Governance Framework Maturity Assessment	Response
3.1	Is the approved data governance policy in place?	Yes/No/NA
3.2	Is the approved ICCC management structure in place?	Yes/No/NA
3.3	Is the approved ICCC resourcing policy in place?	Yes/No/NA
3.4	Is 100% ICCC seat occupancy SLA monitoring in place?	Yes/No/NA
3.5	Is intern on-boarding policy in place?	Yes/No/NA
3.6	Is the ICCC training and capacity building annual budget in place?	Yes/No/NA
	Governance Framework Maturity Assessment Level: (High/ Medium/Low)	

Component 2: Field Force Management Maturity

	Field Force Management Maturity Assessment	Response
3.7	Does the field force use a mobile app connected with ICCC?	Yes/No/NA
3.8	Does the field force use ICCC Geospatial Information System (GIS) services for day-to-day operations?	Yes/No/NA

	Field Force Management Maturity Assessment	Response
3.9	Is there two-way communication between field force and the ICCC?	Yes/No/NA
3.10	Is the field force SLA monitoring in place?	Yes/No/NA
3.11	Is scientific work/area allocation undergoing analysis through the ICCC?	Yes/No/NA
	Field Force Management Maturity Assessment Level: (High/ Medium/Low)	

Component 3: Decision Making Framework Maturity

	Decision Making Framework Maturity Assessment	Response
3.12	Is the city leadership making decisions on a weekly or daily basis using ICCC analytics?	Yes/No/NA
3.13	Are city officers able to make decisions on a weekly and daily basis using ICCC analytics?	Yes/No/NA
3.14	Have area wise/department wise KPIs been configured in the ICCC?	Yes/No/NA
3.15	Can city leadership assess the performance of its officers/employees through KPI compliance using ICCC?	Yes/No/NA
	Decision Making Framework Maturity Assessment Level: (High/ Medium/Low)	

Component 4: Knowledge Management Maturity

	Knowledge Management Maturity Assessment	Response
3.16	Are knowledge management applications/services operational for improved management?	Yes/No/NA
3.17	Can stakeholders update any piece of information or intelligence in the knowledge base using ICCC interface?	Yes/No/NA
3.18	Are FAQs for services, processes and utilities made available to citizens?	Yes/No/NA
	Knowledge Management Maturity Assessment Level: (High/ Medium/Low)	

Component 5: Cyber Security Maturity

	Cyber Security Maturity Assessment	Response
3.19	Have cyber security policy, data privacy policy, security procedures and minimum baseline security guidelines been designed to protect edge devices, network and applications integrated with ICCC from different cyber-attacks?	Yes/No/NA
3.20	Are periodic assessments done for cyber security of ICCC?	Yes/No/NA

	Cyber Security Maturity Assessment	Response
3.21	Are regular training programs being conducted for creating awareness about cyber security amongst stakeholders managing ICCC?	Yes/No/NA
	Cyber Security Maturity Assessment Level: (High/Medium/Low)	

Note: Refer Operational Capability Assessment under **Annexure III** for definition and scope of each sub-indicator.

Scoring Assessment: Below table shows an illustration of the Operational Capability Assessment for a sample city

Operational Capability	Low	Medium	High
Score	< 50	50 -80	>80

Operational Capability Assessment should help cities to assess its readiness from the perspectives of people, processes, and governance policies to manage the ICCC.

4.4 ENGAGEMENT CAPABILITY ASSESSMENT

Engagement Capability Assessment should be carried out by the cities based on the following parameters:

S. No.	Indicators
1	Percentage (%) of unique citizens interacting with ICCC with reference to overall city population?
	i. 0%
	ii. >0 but <1 %
	iii. 1-5%
	iiv. 5-10%
	v. 10-15%
	vi. 15 % and above
2	Percentage (%) of city corporation employees connected with ICCC with reference to overall strength using ICCC mobile app/website etc ?
	i. 0-10%
	ii. 10-20%
	iii. 20-30%
	iv. 30-40%
	v. 40-50%
	vi. 50% and above

S. No.	Indicators
3	City ability to carry out feedback/sentiment analysis at the citizen level through ICCC?
	Percentage (%) of feedback received from citizens interacting with ICCC?
	i. 0-10% (In case not available please choose zero)
	ii. 10-20%
	iii. 20-30%
	iv. 30-40%
	v. 40-50%
	vi. 50% and above

Note: Refer Engagement Capability Assessment under **Annexure III** for definition and scope of each sub-indicator.

Below table shows an illustration of the Engagement Capability Assessment for a sample city:

Engagement Capability	Low	Medium	High
Score	< 50	50 -80	>80

Engagement Capability Assessment should help cities to assess the ability of the ICCC to engage with various stakeholders, including citizens and communities.

95

ANNEXURE I

ICCC PLATFORM EXPLAINED

The ICCC Platform plays a key role in delivering the core purpose of the overall ICCC facility. ICCC is a general terminology and can be referred to as Command and Control Centers or Smart City Center. The 4 core functionalities required in a standard ICCC Platform are explained below:

A. Data Acquisition Engine

The data acquisition engine aggregates static and real-time data feeds from different sensors/IoT devices like cameras, metering devices, telematics devices, applications, departmental databases, etc. This includes, for example, data on air and water quality, ambient luminosity, disasters, traffic, solid waste, etc. This enables other functional layers of ICCC to aggregate, process and consume the data for deriving information.

Surveillance

Camera Feed

- Fixed camera
- PTZ Camera
- Perimeter Fencing
- Private Camera Feeds

Safety & Security

- Emergency Kiosk
- Panic Button
- Data Feed from Social Media

Transit

- GPS Tracking
- RFID Tags Readers
- Sensors (induction loops, microwave, radars, laser, detection, etc.)
- Variable Messaging display
- Ticketing Data
- Automated Fare Collection System

Traffic

- Traffic Camera Feed
- Speed Detection Camera
- ANPR
- Red Light Violation Detection
- Parking Violation Detection
- Toll Management
- Congestion Detection
- Road Accident

Emergency

- Road Accident
- Fire Sensors
- Flood Sensors
- Flow Detection
- Leakage Detection: Water/Gas
- Air Quality Detection
- Hospitals in-patient data feed

Others

Data Feed:

- Disaster Response Cell
- Solid Waste Department
- Health
- Street Light
- Hospitals, Labs
- Weather Department
- Property Tax

B. Data Correlation & Analytics Engine

The data correlation and analytics engine analyzes information to show trends, patterns and insights, in visualized forms that guide towards prompt decisions. It comprises components for extraction and transformation of data from different systems, data sources and data formats. For e.g., health records are captured from Integrated Hospital Management System, traffic information is captured from Adaptive Traffic Management System and the ambulance can be tracked using Vehicle Tracking System in different formats. ICCC Data Aggregation and Analysis Engine can process the information to allow users to use information from different systems as per requirements.

This engine has data aggregation, normalization and data models with the following capabilities:

- Collect and integrate sensor/IoT devices data from multiple sources
- Normalize the aggregated data to a common data model to make comparisons more meaningful so that city administration can construct working digital models of their communities
- Expose APIs through which application developers and vendors can plug in to the city management infrastructure and provide public service capabilities.

The application developers/vendors can use the platform APIs and build applications on top of platform consuming the data model exposed as part of these APIs.

Data Analytics components are used to perform data churning to derive intelligence from different datasets across the domain. This intelligence can then be used for exception handling and visualization in different scenarios through various analysis using ICCC components or third-party tools/applications, such as:

a) Predictive Analytics
b) Diagnostic Analytics
c) Prescriptive Analytics
d) Sentiment Analytics
e) Video Analytics

This engine enables ICCC to derive intelligence from the information collected from Data Acquisition and Visualization Engine.

C. Business Rules Engine

The Business Rules Engine helps correlate the information, configure Standard Operating Procedures (SOPs), manage external and internal triggers, policy implementation, and handling of complex events. This engine enables ICCC to handle the events to make real-time decisions as per the configured protocol.

Operational Logic: Rule Engine

Access Rule Base & Engine

Configuration Management

Policy Management

Complex Event Processing

It helps in configuring or automating the operations in different scenarios, for e.g.:

a) Defining and configuring an event
b) Defining and configuring external/internal trigger
c) Defining and configuring event response
d) Defining and configuring responsibility matrix
e) Defining and configuring incidents and change requests
f) Defining and configuring user access and authorization
g) Defining and configuring access policy of field assets

This engine at ICCC allows to communicate with different systems. Few examples are mentioned below:

i) Configuring Events and Responses for Water Supply operations:

a. Configuring alerts and notifications using smart metering for water usage/consumption
b. Configuring events and triggers over data emanating through SCADA system for managing water operations
c. Configuring response protocols in case of leakage detection
d. Configuring response protocols in case of effluent detection etc.

ii) Event and Response Management for waste-water Treatment

a. Configuring alerts and notification using SCADA for waste-water treatment systems for its on-field employees
b. Configuring alerts and notification using for level detections at treatment plant
c. Configuring events and trigger for managing energy consumptions of pumping control systems for storm water management

D. Communication Engine

The Communication Engine will house the action-oriented SOPs, incident response dispatches and management systems (rules engines, diagnostics systems, control systems, messaging system, events handling system), and reporting/dashboard system to provide actionable information to city administrators and citizens. While this engine will exist in most ICCCs from inception, it will be flexible to accept inputs from various downstream applications and sensors as and when they get introduced in the city.

It will be responsible for managing:

a) Communication with Stakeholders
b) Device Control (asset, access and authorization)
c) User Interface and Visualization
d) Complex Real-time Event Handling
e) Service Management

User Interface & Visualization

- Reports
- Dashboard
- Scorecard
- Simulation

Device Control & Monitoring

- Remote configuration & control
- Event Processing
- Device Diagnosis

Data Management

- Data Transformation
- Data Metering
- Data Visualization
- Data Control

Service Management

- Control Bus
- API Management
- Services Management
- Policy Management

User Management

- User Life Cycle Management
- Access Management
- Authorization Management

ANNEXURE II

INDICATIVE USE CASES

Cities are advised to give utmost attention to identify an exhaustive list of Use Cases and gauge their details to derive the best/maximum outcomes from the ICCCs. The following table provides an indicative list of Use Cases, which are detailed in the sequent sub-sections.

#	Category
A 	**Safety and Surveillance**
	Make citizens feel safe in the City
	How to ensure safety of citizens during emergency/disaster situations
	How to predict crime in a City using Data Analytics, Artificial intelligence
B 	**Solid Waste Management**
	How to improve cleanliness at public places
	How to improve public toilet facility monitoring and servicing
	How to manage on demand Waste Collection in City
	How to manage Solid Waste Management Operations effectively
C 	**Water Supply**
	How to ensure reliable and quality water supply in city
	Reduction of potable water wastage in the city
D 	**Emergency and Disaster Management**
	How to reduce the damage to property/life in case of fire event in a busy area of city
	How to reduce the damage to property/life in case of Disaster/Emergency event in a busy area of city
E 	**Service Delivery**
	How to monitor and manage civic complaints effectively
	How to gauge Citizen Satisfaction to citizens to improve service delivery
F 	**Civic Health Use Cases**
	How to reduce victim transit time from accident location to Hospital
	How to effectively tackle mosquito borne diseases in city
	How to strengthen Civic Health Care delivery in the City using Data Analytics
	How to predict Stray Dog menace in the City
G 	**Street-Light**
	How to monitor and maintain street lighting networks remotely
H 	**Transit and Mobility Use Cases**
	How to effectively manage City Bus Operations
	How to do City Traffic Planning using Data Analytics
	How to identify open parking spots in City
	How to monitor entry of vehicles to restricted Zones
I 	**Roads Management**
	How to reduce citizen inconvenience during road maintenance
	How to effectively tackle potholes problems in City

J		**Waste-Water Management**
		How to control affluent disposal into city river water
		How to ensure the storm water network readiness before rains
K		**Environment**
		How to increase the green cover of the City
		How to address air and noise pollution in city using environmental Sensors

(A) SAFETY AND SURVEILLANCE

Linked Indicators: Ease of Living Index Framework

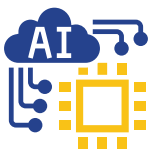
- Number of CCTV cameras installed in the city per unit of road length
- Number of recorded crimes per lakh population
- Extent of crimes recorded against women, children and elderly per year
- Transport-related fatality per lakh population

Use Case 1: How to make city a safer place to live?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Feed from CCTV cameras (installed by city administration, Police), Streetlight system • Video feeds from private CCTV camera networks in the city (e.g. collaboration with schools, commercial establishments, housing societies etc) • Location of the Beat Marshals and Rapid action teams on city map • Marking pre-identified areas as 'Critical' and collection of crime related data for the same • Data/feed from Social Media, mobile apps and other city level systems (e.g. Emergency call boxes) • Details of relevant incidences (e.g. accident, theft etc) • Grievances logged by citizens	• Classification of Crimes/accidents as per their types • Extent of crimes recorded against women, children and elderly per year • Location wise analysis of crimes. • Correlating multiple datasets from various sub-systems • Sentiment analysis by analysing citizens feedback regarding safety issues in the city (ensuring anonymity of the contributor) • Integration of GPS for optimized route tracking for Emergency Response • Integration of face detection with CCTNS system.	• Access to CCTV Network across the city providing regular video feeds • Trigger the SOP, staring with Instantaneous event reporting to respective authorities (e.g. Police. City administration) • Control of streetlights illumination • Use of Field level warning systems (e.g. Sirens, Public address systems, VMD, etc) to discourage defaulter • Creation of Green/ Emergency corridors by traffic signal management for quick response and better location management • Drones for better situational awareness and triggering appropriate action.	• Automated messaging to citizens for regular updates through Social Media/WhatsApp/ SMS • Automated Messaging to the Rapid Action Teams and other action taking team as per SOP • Awareness campaigns by authorities with citizens at large

Use Case 2:
How to ensure safety of citizens during emergency/ disaster situations?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Location of all CCTV cameras, emergency call box, Public Address System, police stations, Beat Marshals and Rapid action teams visible on the city map with feeds from CCTV • Data inputs from Dial 100/Dial 112, Smart City Helpline etc. • Data inputs from weather department, emergency fire services, hospitals, other related government agencies • Marking few areas as 'Critical' for safety • Monitor the entire city by collaboration with private establishments to gather video feeds from private CCTV camera networks • View the heat maps of fire/flood prone areas on the city map based on past incidences and patterns • Data/feed from Social Media, Mobile Apps and other city level systems	• Location wise analysis of crimes/ fires/riots/ epidemics in the city • Crowd detections using analytics on CCTV Cameras • Analyse citizen feedback about various safety issues in the city • Integration of GPS for optimized route tracking with Emergency Response teams • Integration of face detection with CCTNS system • Sentiment analysis by analysing citizens feedback regarding safety issues in the city	• Trigger SOPs, starting with instantaneous event reporting to respective authorities • Asset and Resource mobilization and allocation in real time • GIS plot with Safe zones indicators • Signal Management for Traffic diversions • Crowd management and Security Breach handling • Control of streetlights illumination • Use of Field level warning systems (e.g. Sirens, Public address systems, VMD, etc) to discourage defaulter • Creation of Green/ Emergency corridors by traffic signal management for quick response and better location management • Use of drones for for better situational awareness	• Two-way Communication with Ambulance services/ Fire Dept vehicles for effective deployment • Automated messaging to citizens for regular updates through Social Media/WhatsApp/ SMS • Automated Messaging to the Rapid Action Teams, Women Protection Teams • Use of Public Address System, VMDs to effective communication on the ground



Use Case 3:
How to predict crime in a City using Data Analytics and AI?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• View designated unsafe streets on city map (Marked by police/city administration/citizens)	• Generate Heat-map of crimes	• Notifications to the citizens about crime in sensitive areas	• Two-way communication with field response team to assist them in rescue or mitigation operation

• View Real time video streaming of camera feed and video analytics • View heat-map based on street light complaints from different areas • Citizen feedback along with photographs and coordinates • Specific gestures include Distress, violation of traffic rules, detection of crowd gathering • View objects for tracking and monitoring: Missing Car, Missing Person, etc • Inputs from CCTNS system on crime hot-spots in the city, info in recent trends • Input from ITMS on signal violation & patterns • Location of all CCTV cameras, emergency call box, Public Address System, police stations, Beat Marshals and Rapid action teams visible on the city map with feeds from CCTV • Data inputs from Dial 112, Smart City Helpline etc.	• Apply Predictive Analytics over crime date over different dimensions. • Map High potential areas of crime: Crime Type, Crime Severity, Crime Location • Analyze Social Media to get further insights on crime in the city • Location wise analysis of crimes/ fires/riots in the city • Co-relate info on crowd detection, crime hotspots, speedy vehicles, Gunshot detection, etc. • Integration of GPS for optimized route tracking with Emergency Response teams	• Deployment of Protection and Surveillance team in sensitive areas • Send alerts to Police on likely incidences; Invoke concerned SOPs • Traffic diversions using ITMS • Asset and Resource mobilization and allocation in real time • Crowd management and Security Breach and crowd movement and crowd behaviour handling • Access to CCTV Network across the city providing regular video feeds • Control of streetlights illumination at places of incidences • Use of Field level warning systems (e.g. Sirens, Public address systems, VMD, etc) to discourage defaulter(s)	• Use of Public Address System, VMDs to communicate messages on real-time basis • Feedback/awareness - Civic Services • Two-way Communication with Ambulatory services for effective deployment • Information to Women safety, Patrol Services for quick response • Automated messaging to citizens for regular updates through Social Media/WhatsApp/ SMS

(B) SOLID WASTE MANAGEMENT

Linked Indicators: Ease of Living Index Framework

- Household level coverage of municipal solid waste collection
- Efficiency of collection of municipal solid waste
- Extent of municipal solid waste recovered through reuse

Use Case 4:
How to improve cleanliness at public places?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Data Feeds from IoT sensors including bin level sensors, CCTV cameras, etc. • Grievances received from City Help Line Number, City Mobile App, Web Portal and Social Media • GPS location feeds from SWM Vehicle • Schedules of Sanitation workers • CCTV feeds from areas and places with high foot falls, hawker zones, areas having pan shops and food stalls, etc.	• Data Correlation across feeds from various aggregation sources such as bin level sensors, CCTV cameras, GPS location of vehicles, QR Code scans etc. • Designing shortest route for garbage collection vehicle to aggregation point • Route optimization, traffic simulation and congestion management for allocating appropriate vehicle • Areas (Zone/Ward) wise analysis of waste or garbage on timelines • Sentiment Analytics and response with respect to event • Sanitation worker attendance analysis	• Trigger SOPs for grievances received, track the action taken through CCTV System & other field level interventions • Proper routing of vehicles in real times and assistance during vehicle breakdown • Vehicle & workers tracking in real time • Daily checks with Sanitary Inspectors on the cleanliness of city • Monitoring of CCTV Cameras at dumping ground • Implement mechanism to carry out effective monitoring & management of Dry & Wet waste segregation (at source as well as at disposal sites)	• Automated messaging to citizens for regular updates through Social Media/WhatsApp/ SMS • Communication over VMD, PAS and Social Media for educating citizens • Two-way communication with field force: Sanitation Inspectors, Health Department Officers, and Vehicle drivers • Bulk SMS/ Notifications to the citizen in locality • City Cleanliness dashboard to be presented to Commissioner & Mayor on daily basis

Use Case 5:
How to improve Public Toilet facility?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Data Feeds from QR Codes, IoT based Toilet monitoring sensors, Toilet Feedback System devices, feedback photographs etc. • Grievances received from City Help Line Number, City Mobile App, Web Portal, Social Media, etc.	• Data Correlation across feeds from various aggregation sources such as IoT based Toilet monitoring sensors, Toilet Feedback System devices, GPS location of Mobile toilets, QR Code scans etc.	• Trigger the SOP, staring with Instantaneous event reporting to respective authorities • Communicate complaints and feedback with contractors, area officer and department heads responsible for maintenance of public toilet.	• Send alert on receiving poor feedback or complaint w.r.t to public toilets. • Provide information to citizens about public toilets & their cleanliness through Mobile App/SMS/ WhatsApp/Social Media

• View all public toilets on city map along with meta data (toilet type, water supply, cleanliness etc.) • View the cleanliness schedule of public toilets with meta data (contractor details, time etc.) • GPS location of Mobile Public Toilets • SLA benchmarks of Toilet Cleaning contractors	• Resource assignment and work allocation to contractors pertaining to public toilets cleaning • View the trend of public toilets usage • Track the area-wise issues pattern (Water leakage, unclean toilets etc.) with respect to public toilets. • Conduct usage/revenue analysis (if chargeable) of public toilets • Sentiment Analytics and response with respect to event • Sanitation worker attendance analysis	• Escalation and SLAs monitoring • Use VMDs to update citizens about public toilets in given locality and its rating • Send complaint status to citizens with respect to public toilets • Monitoring of Heath status of assets • Vehicle & workers tracking in real time	• Two-way communication with field force: Sanitation Inspectors, Health Department Officers, and Vehicle drivers. • Awareness campaigns by authorities with citizens at large • Cleanliness dashboard to be presented to concerned officials on daily basis

Use Case 6: How to manage on-demand waste collection in the city?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Data Feeds from IoT sensors including bin level sensors, AI based Video Analytics etc. • Inputs from Grievances Redressal Systems including Smart City Help Line Number, MC Helpline, City Mobile Apps, Web portal and Social Media • GPS location feeds from Vehicle Tracking Systems installed in Municipal Vehicles • View the garbage pick-up vehicle schedule and transfer station real time feeds • View and track the sanitation officer's attendance and movement	• Data Correlation across feeds from various aggregation sources such as bin level sensors, AI based Video Analytics, GPS location of vehicles etc. • Designing shortest route for garbage collection vehicle to aggregation point • Route optimization, traffic simulation and congestion management for allocating appropriate vehicle • Areas (Zone/Ward) wise analysis of on-demand waste or garbage collection • Resource assignment analysis and optimization • Sentiment Analytics and response with respect to event • Sanitation worker attendance analysis • Advance analytics on aggregated datasets	• Trigger the SOP, starting with instantaneous event reporting to respective authorities • Asset and Resource mobilization and allocation in real time • PTZ Camera Control at select places for validation • Proper routing of vehicles in real times and assistance during vehicle breakdown • Vehicle & workers tracking in real time • Informed and data driven decision making • Visuals and Dashboard	• Automated messaging to citizens for regular updates through Social Media/WhatsApp/ SMS • Communication over VMDs, PAS and Social Media for educating citizens • Two-way communication with field force: Sanitation Inspectors, Health Department Officers, and Vehicle drivers. • Awareness campaigns by authorities with citizens at large • Event Summary report for future trend analysis

Use Case 7:
How to carry out Solid Waste Management Operations effectively?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Ability to receive the complaint of on demand garbage collection through various channels and quantity of waste collected at processing plant/landfill site • Ability to schedule the waste collection as per waste type (medical Waste, Hazardous Waste or e-Waste) • View area wise request and pick up schedule • View the request allocation to specific officer and vehicle as per request.	• View the shortest route to respond the on-demand request • Ability to predict the waste complaints based on past trends of on demand waste collection requests • Ability to predict the cost and effort to calculate the cost with respect to size of request as per business rules. • Ability to predict ETA etc. • Resource assignment analysis and optimization • Sanitation worker attendance analysis • Advance analytics on aggregated datasets	• Trigger the SOP, starting with instantaneous event reporting to respective authorities • Asset and Resource mobilization and allocation in real time • CCTV Camera Control at select places for validation • Proper routing of vehicles in real times and assistance during vehicle breakdown • Vehicle & workers tracking in real time • Informed and data driven decision making • Visuals and Dashboard • Ability to communicate with on field staff/contractor/ vehicle driver and citizen • View and update the status of on demand request through call, SMS and WhatsApp • Ability to communicate the real time status of vehicle to gauge the ETA etc.	• Automated messaging to citizens for regular updates through Social Media/WhatsApp/SMS • Communication over VMDs, PAS and Social Media for educating citizens • Two-way communication with field force: Sanitation Inspectors, Health Department Officers, and Vehicle drivers. • Awareness campaigns by authorities with citizens at large • Event Summary report for future trend analysis • Ability to allocate the request to an officer/ contractor/processing plant etc. • View the SLA compliance and levy penalty on contractor etc.

(C) WATER SUPPLY

Linked Indicators: Ease of Living Index Framework

- Household level coverage of direct water supply connections
- Per capita supply of water
- Quality of water supplied
- Level of Non-Revenue Water (NRW)
- Percentage of water connections covered through meters
- Percentage of plots with rainwater harvesting facility

Use Case 8:
How to ensure reliable and quality water supply in the city?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Input from Project Management System on the maintenance work being undertaken • Real time Inputs on water quality parameters (Turbidity, Chlorine levels etc.) from water treatment plants, ESR/GSR, pumping stations • Grievances received from citizens (through Social Media, Mobile App, Portal, CFCs, etc.)	• Correlation and analysis of water quality parameters data received from water treatment plan, ESR/GSR, pumping stations • Analysing water quality parameters from source to destination • Validation of grievances by the ICCC Operator from ICCC based on water quality parameters data received.	• Visualisation/ Dashboard of water quality parameters from water treatment plants and reservoirs • Alerts in case of breach in water quality paraments • Close monitoring of Social Media & Grievance redressal system • Identifying maintenance requirement between Source to destination of water supply channels	• To water department officers, treatment plan, reservoirs vendors/ officers • Communicate with citizens of specific area about contamination of water • Alert and alert the concerned personnel in case of threshold breach (water surpasses the threshold.) • Identify the city areas on GIS map that would require planning of sewer lines and the pumping station

Use Case 9:
How to reduce potable water wastage in the city?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Input from Project Management System on the maintenance work being undertaken • Real time water pressure levels from water treatment plants, ESR/GSR, pumping stations • Grievances received from citizens (through Social Media, Mobile App, Portal, CFCs, etc.) • Data from water distribution network • Ability to record and view the water quality reports	• Correlation and analysis of water pressure level data received from water treatment plant, ESR/ GSR, pumping stations • Analyse amount of water collected from source to destination • Analyse water consumption patterns based on historical data • Analysis of water consumption patterns throughout the day and rationing of quantum based on that • Analysis of water quality at source	• Visualisation/ Dashboard of water quality parameters from water treatment plants and reservoirs • Alerts in case of breach in water pressure levels • Close monitoring of Social Media & Grievance redressal system • Identifying maintenance requirement between Source to destination of water supply channels	• To water department officers, treatment plan, reservoirs vendors/officers • Communication to maintenance team • Controlling and monitoring of supply from pumping stations in case of wastage • Alerts in case of water theft through pipeline and change in pressure

(D) EMERGENCY & DISASTER MANAGEMENT

Use Case 10:
How to reduce the damage to property/life in case of fire event in a busy area of city?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Feed from various CCTV cameras of the city including feed from private camera feeds of (societies, large establishments, shops, etc.) • Data from state emergency and disaster management systems • Data from fire sensors in the city • Live traffic data from ATCS and other traffic cameras of the city • Navigation map of the city with all the layers (police stations, fire stations, emergency forces, water reservoirs, important warehouse etc.) • Data/feed from Social Media, mobile apps and other city level systems (e.g. Emergency call boxes) • Electrical and circuit diagrams of major establishments, offices of the city • Hospital details with their specialty and bed status • Data on the Wind Flow in the affected area	• Historical, analysis of various incidents and predicting events for future considering parameters like Festival times, Sporting events, Rainy seasons, Density of population, etc. • Correlate data of seismic sensors to identify possibility of fire in congested areas • Identify and tabulate all the vulnerable property/area details area wise considering possibility of fire incidents • Identify and highlight the potential aftereffects of previous fire incident by analysing the previous incidents • Correlate the nearest water sources for the fire tenderers, in case they need to quickly refill.	• Access to CCTV Network across the city providing regular video feeds and provide real-time updates to the concerned stakeholders during a fire incident. • Trigger the SOP, staring with Instantaneous event reporting to respective authorities (e.g. Police. City administration) • Route traffic analysis and provide the shortest route available to the emergency vehicles to reach to the incident location. • Co-ordination and communication with multiple stake holders of various emergency services they all reach on time (like ambulance, fire tenders. etc) • Identify and plan the relief materials required on the ground and ensure that it reaches in the shortest possible time • Do traffic analysis and plan Creation of Green/ Emergency corridors by traffic signal management for quick response and better location management • Drones for better situational awareness • Use of Field level warning systems (e.g. Sirens, Public address systems, VMDs, etc) to dispatch the information to the citizens	• Automated messaging to citizens for regular updates through Social Media/ WhatsApp/SMS • Automated Messaging to the all the concerned departments (fire department, health department, hospitals) with real time update. • Awareness campaigns by authorities with citizens at large • Use VMDs, PA systems to update people • Communicate with various NGO's to come and help for any incident (like food donation, volunteering, etc.) • Communicate the property details to the fire department and to the respective property owners reminding them to get the fire safety survey completed

Use Case 11:
How to reduce the damage to property/life in case of Disaster/ Emergency event in a busy area of the city?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Feed from various CCTV cameras of the city including feed from private camera feeds of (societies, offices etc.) • Data from state emergency and disaster management systems • Data from sensors like seismic, flood, fire, smoke, water, environmental sensors • Flooding, fire, seismic hotspots of the city on map. • Live traffic data from ATCS and other traffic cameras of the city. • Topographical maps of the city mentioning along with maps for the underground utilities • Navigation map of the city with all the layers (police stations, fire stations, emergency forces, water reservoirs, important warehouse etc) • Data/feed from Social Media, mobile apps and other city level systems (e.g. Emergency call boxes) • Electrical and circuit diagrams of major establishments, offices of the city • Details of all the properties like schools, which are earmarked for people evacuation/ temporary shelters • Realtime traffic information from the ITMS system • Hospital details with their specialty and bed status.	• Historical, analysis of various incidents and predicting events for future considering following parameters 1) Festival times 2) Sporting events 3) Rainy seasons 4) Density of population etc. • Correlate data of seismic sensors with water level sensors to identify possibility of flooding because of earthquake • Identify and tabulate all the area wise vulnerable property details for multiple incidents types like flood, fire, earthquake etc • Identify and highlight the potential aftereffects of any incident by analysing the previous incidents	• Access to CCTV Network across the city providing regular video feeds and provide real-time updates to the concerned stakeholders for various incident types • Trigger the SOPs, staring with Instantaneous event reporting to respective authorities (e.g. Police, hospital, City administration) • Route traffic analysis and provide the shortest route available to the emergency vehicles to reach to the incident location. • Co-ordination and communication with multiple stake holders of various emergency services they all reach on time. • Identify and plan the relief materials required on the ground and ensure that it reaches in the shortest possible time. • Do traffic analysis and plan Creation of Green/Emergency corridors by traffic signal management for quicker response • Drones for better situational awareness • Use of Field level warning systems (e.g. Sirens, PAS, VMDs, etc) to dispatch the information to the citizens • Dashboards, heat maps, graphs for various sensor and other data sets for analysis.	• Automated messaging to citizens for regular updates through Social Media/WhatsApp/ SMS • Automated Messaging to the all the concerned stakeholders and respective departments with real time update. • Training & Awareness campaigns by authorities involving citizens at large • Use VMDs, PA System to update people and avoid any scenarios of rumours. • Communicate with various NGO's to come and help for any incident (like food donation, volunteering) • Communicate the property details to the departments and to the other emergency services for providing help.

(E) SERVICE DELIVERY

Linked Indicators: Ease of Living Index Framework

- Percentage of citizen services available online
- Percentage of services integrated through Command Centre
- Percentage of citizens using online services
- Average delay in grievance redressal
- Tax collected as percentage of tax billed
- Extent of cost recovery (O&M) in water supply services
- Capital spending as percentage of total expenditure
- Percentage of population covered under Ward Committees/Area Sabhas

Use Case 12: How to monitor and manage civic complaints effectively?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Grievances received from citizens (through Social Media, Mobile App, Portal, CFCs, etc.) • Inputs from Live feeds of CCTV cameras across City to register complaints • Inputs from Asset Management System for various infrastructure – Roads, Community Halls, Street Lights, etc. • Inputs from Project Management System for various citywide projects • Affiliated Street Infrastructure as well as other Assets details on GIS Map along with their maintenance schedule	• Classification of grievances across the different domains (Road, Water, SWM, Sewerage etc.) • Analysis of grievances/ feedback received from Social Media, Mobile App, Portal, CFCs, etc. • View the SLA compliance status of complaints : Department wise, Officer Wise, Location Wise (Ageing Report) • Co-relation of Complaints on GIS MAP along with affiliated attributes – nearby manholes, Vehicle Depots (JCB, Pumping / Hydraulic machine etc.) • Root cause analysis of complaints, identify top complaints area wise, department wise etc.	• Visualisation/ Dashboard on the GIS Map • Dispatch of the information to relevant stakeholders (Respective Departments, Contractors etc.) • Live monitoring of the work through CCTV Cameras • Close monitoring of Social Media & Grievance redressal system while work is going on • Post Complaint redressal, feedback from Complainant • Publish the Satisfactory Index on Internal Portal – Department /Zone/ Domain wise	• To Internal stakeholders (Respective Departments, Zonal Offices, etc.) • Alerts to department officers if higher number of complaints are logged or with lesser satisfaction score in given time interval • To Contractors • To Complainant on status of complaint • To affected Citizens through VMDs, PAS, Social Media, Mobile Apps, Portal, etc. • In case there are any major service disruptions (like water/gas pipeline damage, etc.) timely communication to the respective authority & to the affected citizens

Use Case 13:
How to gauge Citizen Satisfaction to citizens to improve service delivery?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Grievances received from citizens (through Social Media, Mobile App, Portal, CFCs, etc.) • Inputs from Live feeds of CCTV cameras across City to register complaints • Inputs from Citizen Feedback System for the handling of the entire Compliant Management Lifecycle	• Classification of Major no of Complaints/ grievances across the different domains (Road, Water, SWM, Sewerage etc.) • Analysis of grievances/ feedback received from Social Media, Mobile App, Portal, CFCs, etc. • City wide and domain wise Analysis of repetitive complaints/ grievances • SLA compliance status of complaints : Department wise, Officer Wise, Location Wise (Ageing Report) • Analysis on customer satisfaction on different dimensions of Complaint Management Lifecycle	• Visualisation/ Dashboard on the GIS Map • Dispatch of the information to relevant stakeholders (Respective Departments, Contractors etc.) • Close monitoring of Social Media & Grievance redressal system while work is going on • Post Complaint redressal, feedback from Complainant • Publish the Satisfactory Index on Internal Portal – Department /Zone/ Domain wise	• To Internal stakeholders (Respective Departments, Zonal Offices, Municipal Commissioner etc.) • Alerts to department officers if higher number of complaints are logged or with lesser satisfaction score in given time interval • To Complainant on status of complaint • To Citizens through, WhatsApp, Social Media, Mobile Apps, Portal, etc. • Top Achiever – Zone/ Department with higher level of Satisfactory Index

Use Case 14:
How to reduce victim transit time from accident location to Hospital?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Information from Police/ Other sources on accidents • Feed from various CCTV cameras of the city including feeds from private camera feeds of (societies, offices etc.) which can be used to monitor the incident spot • Live traffic data from ATCS and other traffic cameras of the city • Ambulance availability data	• Qualification of the incidence as mild/ moderate/severe • Analyse the traffic impact • Identify the nearest Ambulance(s) • Analyse the hospital bed availability	• Trigger the appropriate SOP based upon the incidence severity • Co-ordinate with Ambulances, Traffic Police, Hospitals for quick action on ground • Co-ordinate with blood Banks for the requirements • Continuously monitor the spot from CCTV cameras	• Automated messaging to citizens for regular updates through social media/WhatsApp/SMS • Automated Messaging to the all the concerned stakeholders and respective departments with real time update • Use VMDs, PA systems to update people • Regular updates to all the stakeholders (Disaster Management Cell, Traffic Police, Hospital, etc.)

• Hospital details with their specialty and bed status • Data on the specialist doctors, if need arises for critical care • Data from Blood Banks within the city		• Manage traffic movement through ITMS • Coordinate with traffic police for continuous traffic regulation • Use of drones as per severity & feasibility	• Regular updates to the City Leadership

(F) CIVIC HEALTH USE CASES

Linked Indicators: Ease of Living Index Framework

- Number of in-patient hospital beds per 10,000 population
- Healthcare professionals per 10,000 population
- Average response time in case of health emergencies
- Period prevalence of water borne diseases
- Period prevalence of vector borne diseases

Use Case 15: How to effectively tackle mosquito borne diseases in city?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Input from civic health department for locating water logging/ potential mosquito breeding areas across cities • Grievances received from citizens (through Social Media, Mobile App, Portal, etc.) • fumigation plan from civic health department • Real time Bed/ medicine/staff availability details from Hospital Management System	• Heat maps creation with Ward/Zone wise Hot-Spot Analysis. • Trend analysis of patient footfalls with timelines. • Co-relation of data from mosquito breading season, fumigation schedule and impact on mosquito bone disease	• Visualisation/Dashboard on the GIS Map • Predictive Alert in case of available bed is lesser than daily patient count • Planning and monitoring of resources (Medicines/staff/ bed etc.) • Triggering SOPs in case of emergency alerts • Close monitoring of Social Media & Grievance redressal system • Bulk SMS to citizen in locality to educate on mosquito borne diseases.	• Communication over VMDs, PAS and Social Media for regular updates and advisory through city health department • Communication with Hospitals, City Health and Sanitation officers based on alerts generated by the system

Use Case 16:
How to strengthen Civic Health Care delivery in the City using Data Analytics?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Ward /Zone wise data of Vaccination drive carried across the city • Data from health care surveys • Real time Bed/medicine/ staff availability details from HMS • Patient data from primary, secondary and tertiary care. OPDs (Indicating major and minor treatments) • Grievances received from citizens related to healthcare delivery in the city (through Social Media, Mobile App, Portal, etc.)	• Correlation of water quality, air quality on diseases reported at primary, secondary and tertiary care. • Ward/Zone wise heat-map generation of different diseases across city • Identify common diseases based on patient data etc. on daily, weekly and monthly basis to gauge the impact of preventive care program • Predictive analysis of historical data to identify outbreak of disease.	• Planning and monitoring of resources (Medicines/staff/ bed etc.) • Triggering SOPs in case of emergency alerts	• Communicate with patients/ Hospitals/ Citizens/Labs • Communicate with sanitization/heath department during alerts • Awareness drive for citizens in targeted areas through email, SMS, WhatsApp, PAS

Use Case 17:
How to predict Stray Dog menace in the City?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Dog bite/menace grievances received from citizens (through Social Media, Mobile App, Portal, etc.) • Ward/Zone wise sterilization drive data conducted by municipal department • Monitoring of stray dogs on cameras through video analytics	• Ward/Zone wise heat maps creation of grievances with Hot-Spot Analysis	• Review the thresholds of dog bites incidents every monthly against reported cases • Monitoring grievance redressal system	• To hospitals, concerned departments • Increase awareness among citizens about dog bites and its treatment using SMS, WhatsApp, Website and mobile app etc.

(G) **STREET LIGHT**

Linked Indicators: Ease of Living Index Framework

- Percentage of households with authorized electrical supply
- Percentage of electrical connections covered through smart meters
- Average number of electrical interruptions per year
- Average length of electrical interruptions per year
- Percentage of total energy derived from renewable sources
- Energy consumption per unit - water supply and sewerage
- Energy consumption per unit - street lighting
- Percentage of new and redeveloped buildings following green building norms
- Total energy consumption per capita

Use Case 18: How to effectively monitor streetlight functioning and keep the city illuminated?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Data feeds for the street light monitoring and control from 1) controllers, 2) any other intermediary software, 3) Data from feeder panel • Feeds from various CCTV cameras of the city including feed from private camera feeds of (societies, offices etc.) • Location of streetlights marked on GIS map • Realtime locations of the Street light monitoring/beat Marshals and Rapid action teams on city map	• Classification of Crimes/accidents as per their types for the areas where the streetlights were off • No of times when feeder panel did not had electricity when streetlights were not functioning • Citizen sentiment analysis on social media for the non-functioning/non availability of lights • Identify new areas to install streetlights analyzing the crime hotspots in the city.	• Burning ratio of the streetlights (what % of total streetlights were lit up and for how much time they were lit up) • Amount of electrify consumed month on month and identify potential gaps and leakages/pilferages if sudden surge in consumption is found in a particular area and overall. • Streetlights burning during the daytime and close them • Preventive checks on availability of power on feeder panels, functioning of controllers • Trigger the SOPs, when a streetlight is off or not sending data at desired frequency.	• Automated messaging to citizens for regular updates through Social Media/WhatsApp/ SMS • Automated Messaging to the Rapid Action teams/Field teams with the location of pole and problem description to help them solve the issue faster and take other necessary actions as per SOPs • Inform city administration, city police and citizens about non-functioning of streetlights, preventive maintenance so that they take necessary actions to provide any untoward incidences

• Complaints and grievances from the citizen from the city's grievance redressal platform or one city one app. • Data/feed from social media, mobile apps and other city level systems (e.g. Emergency call boxes)		• Control of streetlights illumination- Try and identify the areas and time to decrease illumination and save energy and cost. • Check and track if all the grievances and complaints are completed within defined timelines. • Dashboards, heat maps, graphs for various sensor and other data sets for analysis.	

(H) TRANSIT AND MOBILITY USE CASES

Linked Indicators: Ease of Living Index Framework

- Geographical coverage of public transport
- Availability of public transport
- Mode share of public transport
- Percentage of road network with dedicated bicycle tracks
- Percentage of interchanges with bicycle parking facilities
- Mode share of non-motorized transport
- Availability of Passenger Information System
- Extent of signal synchronization
- Availability of paid parking spaces
- Percentage coverage of footpaths – wider than 1.2 m
- Percentage of traffic intersections with pedestrian crossing facilities
- Extent to which universal accessibility is incorporated in public right-of-way

Use Case 19: How to manage the City Bus Operations effectively?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Inputs from Automatic Vehicle Location System (AVLS)	• Route wise Bus Operation Performance Index– Ridership, Violations, Trips etc.	• Visualisation/ Dashboard on the GIS Map	• To internal concerned stakeholders (Road Department, Transport SPV, Fire etc.)

• Inputs from Incident Management System • Inputs from Bus Scheduling and Depot Management System • Information from AFCS/Bus ticketing System • Grievances received from citizens (through Social Media, Mobile App, Portal, CFCs, etc.) • Input from Project Management System on the maintenance work being undertaken • Schedule from Roads Dept on Roads Maintenance on GIS • Information about events happening across the city which will have impact on traffic movement & cause crowd gathering	• Routes and bus wise Alerts - Breakdown etc. • Ability to correlate the Bus routes with the road Maintenance/ construction work for route diversion. • Ability to correlate of Incidents on GIS MAP along with affiliated attributes – nearby Depots, Ambulance, Fire Vehicles etc. • Traffic impact analysis for diverted routes • Analysis of grievances/feedback received from Social Media, Mobile App, Portal, CFCs, etc.	• Live Monitoring of the Bus through AVLS and Incident Management System • Dispatch of the information to relevant stakeholders in case of alerts/ incidents (traffic police, Fire, Transport SPV, Ambulance, Bus operators etc.) • Close monitoring of Social Media & Grievance redressal system	• To Depot Managers for various Violations, breakdown etc • To Traffic Police • To Bus Operators • To Citizens through PIS, PAS, Social Media, Mobile Apps, Portal, etc. for route diversions & Revised Schedules

Use Case 20: How to do City Traffic Planning using Data Analytics?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Inputs from Adaptive Traffic Control System (ATCS) – Vehicle Density • Inputs from Sensors for Vehicle Classification • Inputs from Live feeds of CCTV/PTZ cameras • Information on Total Road Accidents, violations etc. • Grievances received from citizens (through Social Media, Mobile App, Portal, CFCs, etc.) • Input from Project Management System on Road Network and the maintenance work being undertaken • Total station Survey on GIS including road geometry	• Analysis of the traffic volume and peak time data to identify the Crossroads /Junctions for zero tolerance for traffic violations, Infrastructure health (Roads, Traffic signal etc.) • Ability to correlate the road geometry with the traffic impact analysis/ road accidents/violations • Ability to correlate the Existing Signal Cycle at Hot-spot Junctions • Traffic analysis on city map for different time zones of the day • Traffic impact analysis on the affiliated roads for maintenance/construction	• Visualisation/ Dashboard on the GIS Map • Live Monitoring of the Bus through AVLS and Incident Management System • Dispatch of the information to relevant stakeholders for effective Traffic Operations (traffic police, ATCS Nodal Person, Road Department etc.) • Close monitoring of Social Media & Grievance redressal system	• To internal concerned stakeholders (Traffic Department, Road Department etc.) • To ATCS System (Cycle Timing) • To Traffic Police • Real Time Traffic Congestion information/ Route diversion To Citizens through VMD, PAS, Social Media, Mobile Apps, Portal, etc

• Schedule from Roads Dept on Roads Maintenance on GIS • Information about events happening across the city which will have impact on traffic movement & cause crowd gathering	• Analysis of grievances/ feedback received from Social Media, Mobile App, Portal, CFCs, etc. • Mapping of the city traffic, footfall with parking data for future planning		

Use Case 21: How to reduce parking of vehicles in non-parking zones?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Inputs from Live feeds of CCTV/PTZ/ANPR cameras • Hot listed/watch listed vehicle list • Restricted Area with geofence on GIS • Grievances received from citizens (through Social Media, Mobile App, Portal, CFCs, etc.)	• Suspect person/Vehicles/ Proclaimed offenders/ absconders (Offender's Pattern Matching - real time) • Analysis of grievances/ feedback received from Social Media, Mobile App, Portal, CFCs, etc. • Validation of grievances by the ICCC Operator from ICCC (CCTV Cameras, or any other mechanism	• Visualisation/ Dashboard on the GIS Map • Planning/forecasting manpower required for surveillance in high risk area • Dispatch of information to various stakeholders (Police, Towing department etc.)	• To Police for Hot listed/watch listed vehicle list • To Towing Van for unauthorized vehicles at restricted area • Sharing info on parking lots with citizens through multiple channels

Use Case 22: How to monitor entry of vehicles to restricted Zones?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Inputs from Live feeds of CCTV/ PTZ/ANPR cameras • Hot listed/watch listed vehicle list • Restricted Area with geofence on GIS • Grievances received from citizens (through Social Media, Mobile App, Portal, CFCs, etc.)	• Suspect person/ Vehicles/Proclaimed offenders/absconders (Offender's Pattern Matching - real time) • Analysis of grievances/ feedback received from Social Media, Mobile App, Portal, CFCs, etc. • Validation of grievances by the ICCC Operator from ICCC (CCTV Cameras, or any other mechanism	• Visualisation/ Dashboard on the GIS Map • Planning/forecasting manpower required for surveillance in high risk area • Dispatch of information to various stakeholders (Police, Towing department etc.)	• To Police for Hot listed/ watch listed vehicle list • To Towing Van for unauthorized vehicles at restricted area • To Complainant

(I) ROADS MANAGEMENT

Use Case 23: How to reduce citizen inconvenience during road digging/ maintenance?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Input from Project Management System on the maintenance work being undertaken • Schedule from Roads Dept on Roads Maintenance on GIS • Permissions given to other agencies (telecom/utility firms) & tentative schedule for their work • View the underground utility network on the map • Grievances received from citizens (through Social Media, Mobile App, Portal, CFCs, etc.) • Information about events happening across the city which will have impact on traffic movement & cause crowd gathering • Affiliated road network on GIS Map	• Ward/Zone wise requirements for Road Digging/Maintenance • Co-relation of multiple requests for digging/ maintenance of same road stretch • Analysis of grievances/feedback received from Social Media, Mobile App, Portal, CFCs, etc. • Validation of grievances by the ICCC Operator from ICCC (CCTV Cameras, or any other mechanism) • Traffic impact analysis on the affiliated roads • Ability to correlate the potholes complaints with road maintenance schedule and defect liability period	• Visualisation/Dashboard on the GIS Map • Identification of exception situation if the digging/ maintenance requirements are getting scheduled at different point of time within the 3 months (or whatever time period defined by the city). • Planning of the road digging/maintenance work and dispatch of the information to relevant stakeholders (traffic police, Roads Dept, Contractors) • Live monitoring of the work through CCTV Cameras • Close monitoring of Social Media & Grievance redressal system while work is going on. • Traffic Management through ATCS during work execution.	• To Internal stakeholders (Roads Dept, Traffic Dept, Sewerage Dept, Water Supply, etc.) • To Traffic Police • To Contractors • To People through VMDs, PAS, Social Media, Mobile Apps, Portal, etc. for route diversions • In case there are any major service disruptions (like water/gas pipeline damage, etc.) timely communication to the respective authority & to the affected citizens

Use Case 24: How to effectively tackle potholes problems in City?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Grievances received from citizens (through Social Media, Mobile App, Portal, CFCs, etc.)	• Ward/Zone wise requirements for Potholes Maintenance	• Visualisation/Dashboard on the GIS Map	• To Internal stakeholders (Roads Dept., Zonal Offices etc.)

• Input from Live feeds of CCTV cameras across the road Network (Pre-Monsoon & Post – Monsoon Survey) • Schedule from Roads Dept on Roads Maintenance on GIS • Permissions given to other agencies (telecom/utility firms/ Implementation Agencies) & tentative schedule for their work • Input from Project Management System on the field work being undertaken for digging activities	• City wide Hot-Spot Analysis based on potholes • Ability to correlate the potholes complaints with road maintenance schedule and defect liability period • Analysis of grievances/ feedback received from Social Media, Mobile App, Portal, CFCs, etc. • Validation of grievances by the ICCC Operator from ICCC (CCTV Cameras, or any other mechanism) • Aging Report of potholes and road construction and maintenance	• Identification of exception situation if the maintenance requirements are getting scheduled at different point of time within the 3 months (or whatever time period defined by the city). • Planning of the road maintenance work and dispatch of the information to relevant stakeholders (traffic police, Roads Dept, Contractors) • Live monitoring of the work through CCTV Cameras • Close monitoring of Social Media & Grievance redressal system while work is going on. • Traffic Management through ATCS during work execution, if any	• To Traffic Police • To Contractors • To People through VMDs, PAS, Social Media, Mobile Apps, Portal, etc. for route diversions • In case there are any major service disruptions (like water/gas pipeline damage, etc.) timely communication to the respective authority & to the affected citizens

(J) WASTE WATER TREATMENT

Linked Indicators: Ease of Living Index Framework

- Coverage of toilets
- Coverage of sewerage network
- Correlation efficiency of sewerage network
- Extent of reuse and recycling of waste water
- Coverage of storm water drains

Use Case 25:
How to control affluent disposal into city river water?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Feed from relevant CCTV cameras	• Co-relate the data on sewerage created v/s sewerage treated v/s sewerage disposed off	• Create hot spots of water contamination areas	• Automated messaging to citizens for regular updates through Social Media/WhatsApp/ SMS

• Data from sensors put on sewerage Lines • SCADA System at Sewerage Treatment Plants/Sewerage Lines • Complaints and grievances from the citizen from the city's grievance redressal platform or One City One App or Social Media on disposal of sewerage into the city river/sea • Levels of pH and other chemical composition of water at spots where nalla water connects with the river/sea • Data on diseases due to water contamination	• Check the quality of water at the disposal spots • Analyse the diseases reported due to water contamination	• Control parameters and set thresholds for alerts at various location across the river • Alert and shoot message to the concerned personnel in case of threshold breach (water surpasses the threshold.)	• Issue warnings to industries/commercials establishments restaurants/housing societies who are releasing untreated sewerage into nalas/river • Publish weekly dashboard to Commissioner & Mayor on the disposal of Sewerage/Affluent waste into Nallas/City River/Sea

Use Case 26:
How to ensure the storm water network readiness before rains?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Feed from relevant CCTV cameras • Data from sensors put on storm water drainage • Complaints and grievances from the citizen from the city's grievance redressal platform or One City One App or Social Media on non-cleaning of storm water network • Storm water network cleanliness schedule and progress of cleanliness plan along with details of concerned officers and contractors • View the area wise budgetary provision of each area for cleanliness of storm water	• Create simulation of water flow in different scenarios across storm water network • Use Predictive analytics based on complaints and cleanliness schedule • Create dashboard on the storm water network clean-up work, especially for 2 months prior to monsoon season • Create history patterns on the past flooding due to overflowing of storm water network	• Monitor the SLA compliance of contractor and officers wrt of maintenance of storm water network • Raise triggers to City Commissioner if the work on Storm Water cleaning is not as per the schedule • Create dashboard on the Citizen grievances related to storm water cleaning	• Communicate with Storm Water department officers and contractors if the progress is not as per plan • Communication to citizens through website, mobile app, SMS, WhatsApp to update them about maintenance drive • Educate citizens on importance of keeping Storm Water Nallas/Drains clean through multiple channels

(K) ENVIRONMENT

Linked Indicators: Ease of Living Index Framework

- Concentration of SO_2 - air pollution
- Concentration of NO_2 - air pollution
- Concentration of PM_{10} - air pollution
- Level of noise pollution, temp, humidity etc.
- Quality of water in public surface water bodies

Use Case 27: How to address air and noise pollution in city using environmental Sensors?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Feed from various CCTV cameras of the city including feed from private camera feeds of (societies, offices etc.) • Data from environment, seismic, flood, fire, smoke, water etc. sensors • Complaints and grievances from the citizen from the city's grievance redressal platform or One City One App • Live feeds of traffic cameras, ITMS, ATCS systems providing the traffic density, volume of the traffic and peak hours • Navigation maps of the city • Data/feed from social media, mobile apps and other city level systems (e.g. Emergency call boxes)	• Regularly monitor and correlate the environment data with the state and national pollution benchmarks and highlight exceptions • Correlate and identify routes with high traffic, peak hours and their corresponding noise levels • Correlate the solid waste dump yard data or pending collection data and corresponding impact on NOX, SO_2, CO_2, 0_3, PM_{10}, $PM_{2.5}$ and AQI levels in the respective areas	• Analyse frequently high polluted routes/areas and try to divert the traffic to alternate routes to decongest them • Identify the types of industries in highly polluted areas and identify the opportunities to relocate them with the authorities • Identify any unauthorized industries in the city and attempt to regularize them • Constantly monitor the NO_X, SO_2, CO_2, O_3, PM_{10}, $PM_{2.5}$ and overall AQI levels in the city and compare with the benchmarks to identify the aberrations and area wise trends • Doing historical analysis create a pollution profile in the city for various weather and even types and plan their mitigation actions accordingly	• Automated messaging to citizens for regular updates through Social Media/WhatsApp/ SMS • Awareness campaigns by authorities with citizens at large (for example to reduce honking or to use more greener fuels or to plant trees) • Use VMDs, PA System to update people about route diversions, reducing noise levels etc. • Communication to various authorities (police, traffic department for route diversions and other maintenance activities • Issue warnings to industries/restaurants/ other commercial establishments which are contributing to more than usual pollution

• Benchmarking data from state and national pollution boards • Details about various events to be held in the city. • Details about solid waste collection in the city and the status of the dump yards		• Use of Field level warning systems (e.g. Sirens, Public address systems, VMDs, etc) to dispatch the information to the citizens • Correlate the solid waste collection, timings of decomposition/burning of waste in the dump yards with the ambient Dashboards, heat maps, graphs for various sensor and other data sets for analysis.	

Use Case 28: How to increase the green cover of the City?

Data Acquisition	Data Correlation and Analysis	Command and Control	Communication
• Feed from various CCTV cameras of the city including feed from private camera feeds of (societies, offices etc.) • GIS maps highlighting green cover of the city, industrial hotspots of the city, densely, sparsely populated areas of the city • Complaints and grievances from the citizen from the city's grievance redressal platform or one city one app. • Navigation maps of the city • Data/feed from Social Media, mobile apps and other city level systems (e.g. Emergency call boxes) • Nation or state benchmarking data of green spaces/trees per million • Details of various construction projects in the city • Census data for the city • Data from environment, seismic, flood, fire, smoke, water etc. sensors • GIS maps showing green cover of the city	• Regularly monitor and correlate the green space data with national and station level benchmarks for number of trees per million. • Correlate the high polluted areas and their corresponding green cover and identify areas lacking green cover. • Correlate the number of trees which shall be cut for all the construction projects and plan afforestation initiatives	• Analyse frequently high polluted routes/areas and try to divert the traffic to alternate routes to decongest them by looking at the cameras and sensor readings. • Determine the need for green spaces (number of trees) for every area considering the air pollution levels in the area. • Keep a check on the growth of newly planted trees. • Identify areas on roadside or on dividers or any stretch of land where in green spaces can be created • Identify areas were the green cover is not managed properly	• Automated messaging to citizens for regular updates through Social Media/ WhatsApp/SMS • Awareness campaigns by authorities with citizens at large (to plant trees) • Communication to various authorities (department of parks and gardens for plantations and maintenance of trees. • Issue warnings to respective commercial spaces on depleting green spaces

07

ANNEXURE III

ICCC MATURITY ASSESSMENT INDICATORS – DEFINITION & SCOPE

7.1 FUNCTIONAL CAPABILITY ASSESSMENT ANALYSIS

Functional Capability Assessment is designed to assess the functional aspects of ICCC i.e. city utilities and operations are categorized under various domains vis.

a) Civic Utilities and Services (water supply, solid waste, drainage etc.)

b) Mobility Services (traffic, transport and parking)

c) Safety and Surveillance (security)

d) Crises and Emergency Management

e) Convergence (Integration with common enterprise systems)

Functional Capability Assessment

Component: Data Acquisition

1.1	**Indicator**	Have sensor devices and activators been deployed as a part of field infrastructure?
	Explanation	The city should have deployed sensors/devices (including IoT sensors) in the field locations to capture the required information. For example, whether environmental sensors are deployed to provide information on PM 2.5, PM 10, CO_2 etc.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	- PO/WO copy mentioning the details of sensors/devices procured - Latest report from ICCC System mentioning required details

1.2	**Indicator**	Are the sensors deployed on the field geo-referenced?
	Description	The sensors should be geo-tagged with latitude/longitude details.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	The screen shot of GIS map with geo-tag attributes

1.3	Indicator	Do the sensors provide real-time data?
	Explanation	The sensors deployed in the field locations should be able to provide real-time data such as asset ID, latitude/longitude, last reported time, device status (on/off) etc. (Real-time data is data that is immediately updated in the ICCC as sensor values change. Manual data transfer should not be considered as real-time)
	City Response (Yes/No)	City should enter applicable option
	Supporting document	Screenshots from the system describing the functionality

1.4	Indicator	Is the sensor data available at ICCC?
	Explanation	The sensors/devices data should be visible and tracked at ICCC video wall.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	ICCC dashboard report

1.5	Indicator	Is domain-specific data available at ICCC?
	Explanation	The domain specific data should be digitally available at ICCC for further analysis and decision-making. For example, CCTV surveillance domain application video data should be stored & available at ICCC digitally.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	ICCC Dashboard report with domain-specific data

1.6	Indicator	Is the sensor data available in a geo-referenced manner at ICCC?
	Explanation	The sensors/devices data should be available with geo-tagging (latitude/longitude details). For example, environmental sensors deployed at location A with its geo-reference co-ordinates should be available at ICCC for processing and decision making.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	Real-time ICCC dashboard report for all devices/sensors connected on the network

1.7	Indicator	Is the data from respective domain application/smart solution available in a geo-referenced manner at ICCC?
	Explanation	The sensors deployed in the field locations should be able to provide domain specific application data along with asset ID, latitude/longitude details etc. at ICCC.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	Real-time ICCC dashboard report for all devices/sensors connected on the network

Component: Data Analytics and Correlation

1.8	Indicator	Does the sensor data generate exceptions based on pre-defined SLA thresholds?
	Explanation	The ICCC should have the functionality for advanced data analytics and visualization to prioritize the work by use of sensor data for improved service delivery through pre-defined SLAs.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	SLA report of minimum 30 days from the system

1.9	Indicator	Are the thresholds automatically refreshed based on ground conditions?
	Explanation	ICCC should have functionality to dynamically monitor various parameters
	City Response (Yes/No)	City should enter applicable option
	Supporting document	Screenshots of the functionality from ICCC

1.10	Indicator	Is the data from sensor/systems **analyzed** with the data from other sensors/applications based on the time of event?
	Explanation	ICCC should be able to provide multidimensional analysis for data captured through systems/sensors. For example, the environmental data about a particular time can help in analyzing the traffic data.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	Output report of the analysis

1.11	Indicator	Is the data from sensor/systems **correlated** with data from other sensors based on location of the event?
	Explanation	ICCC should be able to provide functionality for multidimensional correlation analysis for data captured through systems/sensors. For example, correlation drawn from the environmental data and traffic data can help in improving ambient air quality.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	Output report from the system

1.12	Indicator	Does the correlation from multiple sensors/systems result in generation of alerts/exception?
	Explanation	ICCC should be able to correlate data from multiple sensors/systems in providing alerts/exception based on the event. For example, street light data should be able to correlate with crime data in a particular area to provide alerts/notification to act.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	Output report from the system

1.13	Indicator	Does the correlation offer diagnostic analysis of an event?
	Explanation	ICCC should be able to correlate data from multiple sensors/systems for diagnostic analysis. For example, the streetlight operation data along with pedestrian footfalls data can help to spot the structural deficiencies that lead to increased/decreased crime rate in an area.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	Output report of the analysis done from the system

1.14	Indicator	Does the correlation offer prescriptive actions from event?
	Explanation	ICCCs should be able to correlate data from multiple sensors/systems for prescriptive analysis. For example, to reduce the citizen inconvenience during road maintenance the ICCC should be able to provide the status of all ongoing road projects (up to ward level) and their allocated budget so that priority can be assigned to the field staff/contractors.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	Output report of the analysis done from the system

Component: Command and Control

1.15	Indicator	Does the system offer standard operating procedures based on alerts?
	Explanation	The ICCC system should offer standard operating procedures based on alerts, notifications generated through sensors/devices.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	SOP document

1.16	Indicator	Does the system provide real-time views of videos & geo-location post generation of alert?
	Explanation	ICCC system should provide dashboard with real-time view of video, geo-location. For example, in a surveillance domain, the real-time video and asset location should be available at all time on the ICCC video wall for addressing the alarms.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	ICCC dashboard report

1.17	Indicator	Are the standard operating procedures (SOP) defined to include point of contact responsible?
	Explanation	ICCC should have well defined standard operating procedures (SOP) with names and details of relevant stakeholders point of contact responsible for managing a particular activity/service.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	SOP document

1.18	Indicator	Are the standard operating procedures defined to include action for person responsible?
	Explanation	ICCC should have well defined standard operating procedures (SOP) mentioning the roles and responsibilities of identified stakeholders including communication methodology.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	SOP document

1.19	Indicator	Are the standard operating procedures defined to include pre-requisites?
	Explanation	ICCC should have well defined standard operating procedures (SOP) mentioning the pre-requisites for functioning of the SOP.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	SOP document

1.20	Indicator	Are the standard operating procedures defined to include step-by-step procedures?
	Explanation	ICCC should have well defined standard operating procedures (SOP) approved by the competent authority mentioning step-by-step activities to provide clarity to relevant stakeholders.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	SOP document

1.21	Indicator	Are the standard operating procedures defined to include on-field/ premise assets?
	Explanation	ICCC should have well defined standard operating procedures (SOP) approved by the competent authority covering entire ICCC functions in including field assets.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	SOP document

Component: Communication

1.22	Indicator	Is the communication protocol (mode, contact details, alternates) included in the SOP?
	Explanation	ICCC should have an up to date SOP document capturing required details.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	SOP document

1.23	Indicator	Does the system provide for audio communication over multiple channels to first respondent?
	Explanation	ICCC should have more than one method of audio communication. For example, multiple channels may include PA system, call centre facility, ECB, phone/mobile calls etc.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	10-30 sec audio recording on min 2 channels at ICCC

1.24	Indicator	Does the system provide for audio communication over multiple channels to all responders?
	Explanation	ICCC should have more than one method of audio communication. For example, in case of an accident or emergency ICCC helpdesk team may communicate with multiple stakeholders (such as ULB, police, fire department, health etc.) Over multiple channels (phone/emails/video call etc.)
	City Response (Yes/No)	City should enter applicable option
	Supporting document	10-30 sec audio recording on min 2 channels at ICCC

1.25	Indicator	Does the system provide for video communication to first respondent?
	Explanation	ICCC should have facility for video communication. For example, these channels may include tele-conference, WhatsApp, etc.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	10-30 sec video/screen recording.

1.26	Indicator	Does the system provide for video communication to all responders?
	Explanation	ICCC should have facility for video communication. For example, in case of an accident or emergency ICCC helpdesk team may communicate with multiple stakeholders (such as ULB, police, fire department, health etc.) Over various video channels such as telepresence, WhatsApp etc.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	10-30 sec video/screen recording

1.27	Indicator	Does the system provide for video communication to all responders?
	Explanation	ICCC should have provisions for recording and playback options in case of any event/notification. For example, in case of any traffic violation/ accident, video data captured through CCTV cameras could be used for analysis.
	City Response (Yes/No)	City should enter applicable option
	Supporting document	10-30 sec video/screen recording

7.2 TECHNOLOGICAL CAPABILITY ASSESSMENT ANALYSIS

Technological Capability Assessment is designed to assess the product maturity i.e. product features and components used by ICCC which are categorized as follows:

a) Data Acquisition and Visualization Components

b) Configuration

c) Data Analytics and Correlation

d) Command and Control

Technological Capability Assessment

Component: Data Acquisition and Visualization

City Response Options:

1. **Yes:** Implemented and component capability could be demonstrated with various functional use cases.
2. **No:** Not implemented but product component is available to the city administration.
3. **Not Applicable (NA):** If component was not part of product specifications at the time procurement thus not implemented at ICCC.

2.1	Indicator	**Integration with Sensors:** Ability to collect and aggregate data in real-time generated from on-field sensors/edge infrastructure like bin sensors, water sensors, environment sensors, access sensors, actuators sensors.
	Explanation	ICCCs should have an integrated view of field sensors to collect, process and aggregate data in real-time.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	Dashboard report including the PO copy

2.2	Indicator	**ETL Capability:** Ability of ICCC platform to consume raw data feeds from different data sources and ability to prepare information for downstream uses. E.g. Ability to process data coming through online systems, mobile apps, social media, edge sensors, third party applications and tools, data files (Microsoft Excel, GIS etc.) and different data bases for effective interpretation.
	Explanation	ICCCs should have the ability to process and analyze multi-dimensional data coming from various systems/applications for effective decision making. The data fetched through these systems/applications should be extracted, transformed (removing inconsistencies/redundancies etc.) and processed with improved quality for analysis/reporting. E.g. Ability to process data coming through online systems, mobile apps, social media, edge sensors, third party applications and tools, data files (Microsoft Excel, GIS etc.) and different databases for effective interpretation.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	Dashboard report from the ICCC system

2.3	Indicator	**Integration with video feeds:** Ability to consume video feeds generated from various application capturing videos like surveillance, parking, traffic etc.
	Explanation	ICCCs should able to consume, process and analyze video feeds being captured by surveillance/parking sensor camera installed at field locations.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	- Dashboard report from the ICCC system - At least one (1) use case with screen shots

2.4	Indicator	**Integration with data feeds and publishing data feeds:** Ability to consume real-time data feeds from various systems/applications using APIs.
	Explanation	ICCC should be able to consume, process and analyze video feeds being captured by ANPR/RLVD/other sensor devices installed at field locations for traffic management and improve congestion problem in the city.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	Dashboard report from the ICCC system

Component: Configuration

2.5	Indicator	**Configuration of SoP, Alerts:** Ability to configure standard operating procedure using ICCC platform using data feeds from different systems/ applications converging at ICCC.
	Explanation	ICCC should have the ability to configure the standard operating procedure using ICCC platform and be able to demonstrate. E.g. Allocating compliant no./docket no. to field engineer of road department when ICCC receives potholes complaint or generating alert to hospitals and police station in an event of Fire break out.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	Dashboard report from the ICCC system with configured SOPs

2.6	Indicator	**Configuration of GIS:** Ability of ICCC platform to configure and use GIS application and Open Street Maps/or any GIS application for GIS analysis of domain specific use cases.
	Explanation	The ICCC platform should have the ability to demonstrate and use GIS for spatial analytics specific use cases as per their requirements. e.g. ability to analyze civic utilities like fire hydrants across the city on a city map, or display the ability to analyze city slum pockets on city map.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	- Dashboard report from the ICCC system integrated with GIS application - Screenshot of at least one (1) use case

2.7	Indicator	**Configuration of SLAs:** Ability to view SLA compliance/non-compliance of various projects and applications using ICCC application.
	Explanation	ICCC platform should have the ability to configure based on configured SLAs for various services & applications. For e.g. garbage collection SLA, water quality, network operations SLA etc.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	SLA report from the ICCC system for services configured

2.8	Indicator	**Configuration of Data Security Features:** Ability to configure user access and authorization control to provide specific set of information/ data/application control to designated or authorized set of users.
	Explanation	ICCC platform should have data security feature configurable through role-based user access and authorization mechanism. E.g. Ability to restrict water department operation team to view water billing data (if not authorized).
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	Details of user modules and configured authorization details

2.9	Indicator	**Configuration of Network Control:** Ability to manage and monitor network performance through ICCC platform using NMS application or third-party application.
	Explanation	ICCC platform should be able to manage and monitor network performance. For example, EMS/NMS application installed should be able to provide health status of services/device running on the network.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	ICCC system report with all devices/asset health status report

2.10	Indicator	**Configuration of User Access Control:** Ability to configure and manage user access to different application/facilities through ICCC.
	Explanation	Please refer to the serial no. 2.8 of this section.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	Details of user modules and configured authorization details

2.11	Indicator	**Configuration of Notification Control:** Ability to configure and manage user notification as per configured protocol.
	Explanation	ICCC system should have a facility to configure multiple notifications for e.g., in case of SLA breach or alert, notification should be generated to configured user to take required action.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	- SLA report with details of notification control module - Last one-month alert/notification audit trail report

Component: Data Analytics and Correlation

2.12	Indicator	**Sentiment Analytics:** Ability to provide sentiment analytics of configured key words/accounts through internet crawling using ICCC platform. Ability to categorize key issues/topics/words in real-time on social media platform (Twitter, Facebook, Website Discussion Forums, News Papers) which are contributing to negative/positive perception among citizens.
	Explanation	ICCC should be able to demonstrate this functionality as per the service configured and other third-party data sources by the city.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	At least one (1) use case with screen shots showcasing the functionality

2.13	Indicator	**Predictive Analytics:** Ability to make predictions about future events using historical data. Predictive analytics uses many techniques from data mining, statistics, modeling to analyze current data to make predictions about future.
	Explanation	For example, predicting key areas of civic concerns in specific areas using past and current data from city compliant management application/social media etc. or predicting bill projections of property tax using collection trends in past year.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	At least one (1) use case with screen shots showcasing the functionality

2.14	Indicator	**Prescriptive Analytics:** Ability to find best course of action for a given variable situation/scenarios.
	Explanation	ICCC should have the functionality to demonstrate action for situational analysis. For e.g. Choosing shortest routes or number of vehicles to collect garbage in given time slot in a day based on various factors like traffic congestion, proximity to transfer stations etc. Or planning best traffic planning with an objective to reduce congestion during festivals at different point of time in a day.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	At least one (1) use case with screen shots showcasing the functionality

2.15	Indicator	**Descriptive Analytics:** Ability to view insights using past data for given data set.
	Explanation	ICCC system should have built-in functionality to develop insights. For example, viewing property tax collection through different channels in a given month based on past three years data.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	At least one (1) use case with screen shots showcasing the functionality

2.16	Indicator	**Descriptive Analytics:** Ability to view insights using past data for given data set.
	Explanation	ICCC system should have built-in functionality to develop insights. For example, viewing property tax collection through different channels in a given month based on past three years data.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	At least one (1) use case with screen shots showcasing the functionality

2.17	Indicator	**Video Analytics:** Ability to automatically analyze video to detect and determine temporal and spatial events.
	Explanation	ICCC should be the functionality for advanced video analytics. For example, identifying number plates of vehicles in parking zone to levy penalty for defaulters.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	At least one (1) use case with screen shots showcasing the functionality

Component: Command and Control

2.18	Indicator	**Operations/Process Control:** Ability to aid city operations in various civic domains namely water, drainage, solid waste, fire etc.
	Explanation	ICCC platform should be able to aid in improved coordination for different city operations including management & control of multiple stakeholders. For example, in case of hazardous chemical gas leakage situation, metrological dept along with health dept. can collaborate with ICCC central helpdesk to extend support to at-risk citizens as well as field staff.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	At least one (1) use case with screen shots showcasing the functionality

2.19	Indicator	**SOP Control:** Ability to manage the SOPs lifecycle configured in ICCC platform.
	Explanation	ICCC platform should manage the life cycle of incidents and related entities via pre-defined workflows which cut across multiple systems via the interfacing modules.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	SOP document

2.20	Indicator	**Access Control:** Ability to provide access or restrict access to user group for any facility or applications in real-time.
	Explanation	ICCC platform should have built-in user access and authorization mechanism. For example, the water billing data can't be accessed by operation team but can be accessed by water dept. head.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	Details of user modules and configured authorization details

2.21	Indicator	**Device Control:** Ability to provide access or restrict access to user group for any actuators/devices like water supply sensors or edge devices on network in real-time.
	Explanation	ICCC should be able to control devices/sensors access rights or system privileges based on defined SOPs & role-based access mechanism.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	Details of user modules and configured authorization details for actuators/devices

2.22	Indicator	**Sensors Control:** Ability to access control like reboot and control any sensors on network in real-time through ICCC platform.
	Explanation	ICCC should be able to control sensors on network based on access rights or system privileges as per defined SOPs.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	- SOP document - At least one (1) use case with screen shots showcasing the functionality

2.23	Indicator	**Field Force Control:** Ability to assist field force of city administration by providing requested information and support in real-time to manage civic operations.
	Explanation	ICCC should be able to provide field force control on real-time to manage civic operations. For example, workflow for operational field alerts and escalations should be triggered without human intervention. Standard Operating Procedures (SOPs) must be adhered to, in case of any incident.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	- SOP document - At least one (1) use case with screen shots showcasing the functionality

2.24	Indicator	**Asset Control:** Ability to control the access to field assets through ICCC platform.
	Explanation	ICCC platform should be able to do asset control with an integrated view of all field assets (such as sensors/devices etc.) accessible and managed through a console application.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	- SOP Document - At least one (1) use case with screen shots showcasing the functionality

7.3 OPERATIONAL CAPABILITY ASSESSMENT ANALYSIS

Operational Capabality Assessment is designed to assess the governance dimension i.e. organization governance features which are categorized as follows:

a) Governance Framework

b) Field Force Governance Framework

c) Decision Making Framework

d) Knowledge Management

e) Cyber security

Operational Capability Assessment

Component: Governance framework

3.1	Indicator	Is the approved data governance policy in place?
	Explanation	The city should have approved data governance policy in place for data management (data sharing, privacy, security and ownership), implementation along with key responsibilities mentioned for all stakeholders.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	City data governance policy duly approved by the department committee managing the operations at ICCC

3.2	Indicator	Is the approved ICCC management structure in place?
	Explanation	The city should have approved ICCC management structure including organogram, stakeholder's roles and responsibilities for managing day to day operations and decision-making.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	Organogram illustrating management structure

3.3	Indicator	Is the approved ICCC resourcing policy in place?
	Explanation	The city should have approved ICCC resourcing policy in place to facilitate hiring the right people as and when they are needed.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	ICCC resourcing policy duly approved by the department committee managing the operations at ICCC

3.4	Indicator	Is ICCC seat occupancy SLA monitoring in place?
	Explanation	The city should have 100% ICCC seat occupancy SLA monitoring for various citizen services being offered and monitored through ICCC. e.g. tracking of field force, garbage collection issue in an area for management and resolution.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	Monthly SLA Report

3.5	Indicator	Is an intern on-boarding policy in place?
	Explanation	This could be a section in the ICCC resourcing policy framed by the city in their document.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	ICCC on-boarding policy document

3.6	Indicator	Is the ICCC training and capacity annual budget in place?
	Explanation	To help appropriate human resource placed at ICCC adapt to changing technologies and benefit from data analytics efforts of the City and provisioning for the same in their annual budget.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	Copy of internal circular with amount of the budget allocated

Component: Field Force Management

3.7	Indicator	Does the field force use mobile apps connected with ICCC?
	Explanation	Field forces include on-ground surveyors, ULB ground force etc. to improve efficiency in data collection efforts and helps standardize datasets for quick analysis
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	- SOP Document - At least one (1) use case with screen shots showcasing the functionality

3.8	Indicator	Does field force use ICCC Geospatial Information Systems (GIS) services for day to day operations?
	Explanation	Improved spatial understanding and analytics will help in decision-making and city field force should use GIS service for handling day-to-day operations.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	- SOP Document - At least one (1) use case with screen shots showcasing the functionality

3.9	Indicator	Are two-way communication channels in place between the field force and the City ICCC?
	Explanation	ICCC system should enable effective coordination to help on-ground field force in improved service delivery to citizens.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	- SOP Document - At least one (1) use case with screen shots showcasing the functionality

3.10	Indicator	Is the field force SLA monitoring in place?
	Explanation	ICCC system should have SLA monitoring in place to support various citizen and municipal services being monitored at ICCC.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	Monthly SLA report

3.11	Indicator	Is scientific work/area allocation being conducted through ICCC analysis?
	Explanation	ICCC system should have provision to analyze the type of work to be assigned based on skills and/or location.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	- SOP Document - At least one (1) use case with screen shots showcasing the functionality

Component: Decision-making Framework

3.12	Indicator	Is the city leadership making decisions on a weekly or daily basis using ICCC analytics?
	Explanation	This will validate the utility of the ICCC infrastructure. City leadership includes municipal commissioners, additional municipal commissioners, ULB HoDS etc. **for effective decision making and improving citizen services.**
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	- Daily/weekly dashboard - Action taken report

3.13	Indicator	Are city officers able to make decisions on a weekly and daily basis using ICCC analytics?
	Explanation	City data officers should be able to make decisions based on available/ configured ICCC analytics and inform respective line department to look into the issue for faster resolution.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	- Daily/weekly dashboard - Action taken report

3.14	Indicator	Are area wise/department wise KPIs configured in the ICCC?
	Explanation	The ICCC system should have the functionality of configuring KPIs based on the city requirements. For example, in case of solid waste management; area-wise route planning should be possible to configure.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	- SOP document - Dashboard report

3.15	Indicator	Is KPI compliance monitored online?
	Explanation	City Leadership should be able to assess performance of its officers/ employees on KPI compliance using ICCC?
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	Monthly report from e-governance module, compliant redressal module/ Field officer app + weightage of municipal performance index score of the city

Component: Knowledge Management

3.16	Indicator	Are knowledge management application/services operational for improved management?
	Explanation	These applications/services should include capacity building modules, case studies, data repository, ICCC system documents including SLA, FAQ, local knowledge and solutions, citizen feedbacks & responses, with proper classification/cataloguing, and updation for improved operations and transition management.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	Snapshot of the knowledge management module with report of at least 3 months on above specified components.

3.17	Indicator	Can stakeholders update any piece of information or intelligence in knowledge base using ICCC interface?
	Explanation	The ICCC system should provide the functionality to configure knowledge management module for update and control of the information.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	Screen shots for role-based access rights and at least 5 updates report in last 3 months.

3.18	Indicator	Are FAQs for services, processes and utilities made available to citizens?
	Explanation	The city should provide a portal or access to various FAQs on citizen services, processes and utilities along with helpdesk details.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	Screen shots of last 3 months providing details of the functionality.

Component: Cyber Security

3.19	Indicator	Have cybersecurity policy, data privacy policy, security procedures and minimum baseline security guidelines been designed to protect edge devices, networks and applications integrated with ICCC from different cyber-attacks?
	Explanation	The city should have their cyber security policy in place to manage, protect and monitor various assets, system applications, network including ICCC infrastructure.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	Copy of city cyber security policy duly approved by the dept committee

3.20	Indicator	Are periodic assessments conducted to assess security for ICCC?
	Explanation	A periodic assessment needs to be performed for ICCC on a regular basis to ensure that security is continuously maintained during the operations.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	Cyber security assessment report

3.21	Indicator	Has a Security Operations Centre (SOC) been setup to detect and protect the ICCC from cyber-attacks?
	Explanation	The city should have established security operations centre (SOC) to set, detect, and protect the ICCC and associated infrastructure, applications as well as network from cyber-attacks.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	- Details of the purchase order - User acceptance test document

3.22	Indicator	Are regular training programs being conducted for creating awareness about cyber security amongst stakeholders managing ICCC?
	Explanation	The city should have designed regular training programs for creating awareness about cyber security.
	City Response (Yes/No/NA)	City should enter applicable option
	Supporting document	-Training calendar -Attendance sheet with feedback form

7.4 ENGAGEMENT CAPABILITY ASSESSMENT ANALYSIS

Engagement Capability Assessment is designed to assess the dimension features which are categorized as follows:

a) Citizen outreach

b) Employee outreach

c) Sentiment Analysis

Engagement Capability Assessment

4.1	Indicator	Percentage (%) of unique citizens interactions with ICCC with respect to overall city population?
	Explanation	The ICCC should provide reports for citizen interactions through various channels for example, phone/email/chat etc.
	City Response (Yes/No)	0% of the total population marks- 0, >0 but <1% of the total population marks- 1, 1-5% of the total population marks- 2, 5-10% of the total population marks- 3, 10-15% of the total population marks- 4, 15 % and above marks- 5
	Supporting document	Past 3 months consolidated report supported by individual system report.

4.2	**Indicator**	Percentage (%) of city corporation employee connected with ICCC with respect to overall strength?
	Explanation	The ICCC should provide reports for corporation employee engagements made through various channels for example, phone/email/chat etc.
	City Response (Yes/No)	0-10% employees Marks- 5, 10-20% employees Marks- 10, 20-30% employees Marks- 15, 30-40% employees Marks- 20, 40-50% employees Marks- 25, 50% and above employees Marks- 30
	Supporting document	Past 3 months consolidated report supported by individual system report.

4.3	**Indicator**	City ability to carry out Feedback/Sentiment analysis at the citizen level through ICCC?
	Explanation	Percentage (%) of feedback received from citizens/employees connected with ICCC?
	City Response (Yes/No)	0-10% feedback of total complaints marks- 0, 10-20% feedback of total complaints marks-1, 20-30% feedback of total complaints marks-2, 30-40% feedback of total complaints marks- 3, 40-50% feedback of total complaints marks- 4 50% and above feedback of total complaints Marks- 5
	Supporting document	Past 3 months consolidated report supported by individual system report.

FREQUENTLY ASKED QUESTIONS (FAQs)

a) What does a city need to do to undertake the IMAF?

Cities are recommended to undertake self-assessment of their respective ICCCs, identify areas for improvement and improve the maturity level over a period of time. Recommended process to be followed by cities is:

- Self-assessment by the cities using the toolkit given in the IMAF document
- Maturity score calculation and identification of improvement areas
- Formulation of action plan to improve ICCC maturity
- Fresh self-assessment after a gap of 3 months

b) What is the role of Smart Cities Mission in ICCC maturity assessment?

Smart Cities Mission shall facilitate cities to share their maturity assessment score & learnings with other cities. The mission may offer capacity building, assist in understanding the framework and identifying the right evidence.

c) What are the scoring components in ICCC maturity assessment?

Scoring Components are outlined below:

Pillar	Components	Weightage
ICCC	Functional Capability Assessment	**80%**
	Technological Capability Assessment	
	Operational Capability Assessment	
	Engagement Capability Assessment	
Data	Data Maturity Assessment	**20%**

d) What are different ICCC maturity levels?

Various ICCC Maturity levels proposed are given in the table below:

Maturity Level	Score
ICCC L1 **(Lighthouse)**	Above 80
ICCC L2 **(Advanced)**	60 - 80
ICCC L3 **(Progressive)**	40 - 60
ICCC L4 **(Evolving)**	Below 40

e) Which cities should undertake this ICCC maturity assessment?

It is recommended that Smart Cities which have already implemented an ICCC undertake this ICCC maturity assessment. Other cities, which are in the process of implementing or conceptualizing, should use this tool-kit to design/implement their ICCCs to and assess themselves based on the framework provided.

f) What should be the frequency of this maturity assessment?

Cities should make the Maturity Assessment a continuous exercise to evaluate and improve.

g) How to conduct ICCC maturity assessment exercise?

City may follow the approach outlined below:

1. **Appoint a nodal officer:** Appoint a nodal officer to lead the ICCC maturity assessment exercise, who will coordinate with various stakeholders namely ICCC System Integrators, other vendors, ULB officials, etc. Then, study the ICCC maturity assessment framework in detail before initiating the assessment exercise. Finally, the nodal officer should prepare a team of PMC, SI & city officials for undertaking the assessment exercise.

2. **Set up an IMAF Committee:** Form a committee of key city officials, who shall monitor the assessment exercise & the outcome thereafter. Identify the stakeholders and assign roles and responsibilities to respective stakeholders to undertake the assessment using the toolkit.

3. **Prepare and validate the responses:** Collect and validate the data. Refer to the ICCC maturity assessment framework to understand the assessment indicators and scoring mechanism. Calculate the score using scoring mechanism outlined under the framework. The best way to validate the claim is to check if the ICCC platform can demonstrate all the capabilities marked as "yes" under functional, technological, operational and engagement dimensions.

4. **Gap assessment, improvisation, re-assessment:** Ultimate aim of IMAF is to identify improvement areas and make the assessment a continuous process to achieve the best out of ICCC.

h) How to leverage this ICCC Maturity Assessment Framework?

ICCC team can leverage the Maturity Assessment Framework on a regularly basis to identify gaps and improve the maturity of their functional use cases.

- Functional Capability Assessment: To assess the maturity of various civic operations, services and utilities integrated at ICCC.

- Technological Capability Assessment: To assess the maturity of ICCC technology layers namely sensor layer, network layer, data center layer, application layer, analytics and correlation layer, command and control layer, service delivery layer, security layer.

- Operational Capability Assessment: To assess the maturity of ICCC operational capabilities namely governance, ability to support field force, decision making framework, knowledge management, and cyber-security

- Engagement Capability Assessment: To assess the maturity of ICCC engagement related capabilities covering citizen outreach, employee outreach and sentiment analytics.

i) Who should be onboarded on the IMAF Committee for the duration of Maturity Assessment?

Indicative list of stakeholders are as follows:

S.no.	Stakeholder	Role
1	ICCC Head or ICCC Manager	To act as nodal officer for this maturity assessment exercise. This could also be led by the IT head of the smart city/municipal corporation who is currently managing the ICCC infrastructure.
2	Department Heads – Functional and Operational Capability Assessment	To identify, integrate, operationalize and demonstrate functional utilities at ICCC for maturity assessment **Refer section 4.1 for details on Functional Capability Assessment**
3	City Data Officer	The data officer will help you to provide DMAF score and certification of the current assessment cycle. Data officer and his team will assist ICCC head in formulating data governance and management approach for ICCC. **Refer section on CDO in Data Maturity Assessment**
4	Smart City Consultants-Technology Expert	Smart Cities project management consultants, especially technology expert, GIS expert, cybersecurity expert and domain experts are recommended to be involved to provide necessary handholding during this assessment cycle. **Refer section 4.2 for details on Technological Capability Assessment**
5	ICCC - Master System Integrator and Solution Architect.	ICCC master system integrator will assist ICCC head in integration (IoT, data feeds, IT systems, business applications) and configuration (ICCC features and capabilities) for various use cases at ICCC in collaboration with respective IT vendors. ICCC MSI should provide logistical support to ICCC head during the maturity assessment phase. Solution architect will assist in technology and functional assessment, debottlenecking integration issues and address configuration challenges by providing standard approach and necessary guidance to stakeholders. **Refer section 4.2 for details on Technological Capability Assessment**

Note: These are indicative of who should be on the committee. The city may decide to add/remove experts depending on their requirement.

S.no.	Stakeholder	Role
6	Other IT Vendors	All the IT vendors who are providing operational and maintenance support to various departments/SPVs and integration of their respective systems at ICCCs. These IT vendors would need to play an active role in integration and configuration of the identified use cases at ICCC.
7	Domain Experts	Domain experts available at disposal of Smart City or Municipal Corporation to formulate the use cases for assessment.

j) Our stakeholders don't have the required clarity over ICCC as a system and its capabilities. How to bring everyone on same page?

IMAF document outlines the basic ICCC philosophy, indicative ICCC architecture and sample use cases to demystify the ICCC platform and its capability. Cities are encouraged to use this information & related frameworks as guidelines to develop further clarity over ICCC and its implementation.

k) Which functional utilities can be assessed for Functional Capability Assessment?

City may choose any service and utilities integrated at ICCC for functional capability assessment. Services and utilities are mapped under following categories:

- Civic utilities and services: This includes water supply management, waste-water management, solid waste management, roads management, street light management, environment, complaints management, civic service delivery management, etc.
- Mobility services: This includes public transit management, traffic management, and parking management
- Safety and security
- Crises and disaster management: This includes fire management, flood management, epidemic or disaster management operations.
- Convergence: This includes services and utilities core ULB systems namely ERP, GIS etc.

Note: Civic utility and service should be evaluated on following dimensions - data acquisition, data correlation and analytics, command and control, communication. Detailed KPIs are outlined under **Annexure III.**

l) How to approach Technological Capability Assessment?

Technological capability assessment framework is conceptualized to assess the maturity of technology components and layers of the deployed ICCC platform. 20+ Assessment Indicators are designed around core layers namely data acquisition and visualization, configuration layer, data analytics and correlation, and command and control layer.

City should formulate technology team comprising of MSI, other vendors, ICCC platform engineers, developer, technology experts, solution architects and IT consultants to self-assess the technological capability of ICCC platform, assess the gaps and formulate an action plan to address those gaps.

Cities should keep in mind that all claims made during the self-assessment stage should be validated and cross-checked during city level validation stage by the expert team. Cities must plan on how to demonstrate the ICCC capabilities against each assessment indicator.

Cities should assess and formulate a short term, medium term and long-term plan to address the gaps and enhance the technological capabilities of ICCC Platform.

m) How to approach Operational Capability Assessment?

City should allocate responsibility to respective team comprising of ULB officials, MSI, Vendors, ICCC platform engineers, developer, technology experts, solution architects and domain experts to self-assess the operational capability of ICCC platform, assess the gaps and formulate an action plan to address those gaps.

Operational capability of ICCC ecosystem should be assessed by evaluating the ICCC ability to manage end-to-end operations in real-time. The sole objective is to assess the people and process aspects of the ICCC ecosystem. 20+ indicators are designed around various components namely governance, field force support, decision making capability, knowledge management, and cyber security.

Cities should keep in mind that all the claims made during the self-assessment stage should be validated and crosschecked during city level validation stage by the expert team. Cities must plan on how to demonstrate the ICCC capabilities against each assessment indicators.

Cities should assess and formulate a short term, medium term and long-term plan to address the gaps and enhance the operational capabilities of ICCC platform.

n) How to approach Engagement Capability Assessment?

City should allocate responsibility to respective team comprising of city officials, MSI, Vendors, ICCC platform engineers, developer, technology experts, solution architects and domain experts to self-assess the engagment capability of ICCC platform, assess the gaps and formulate an action plan to address those gaps.

Engagement capability of ICCC ecosystem should be assessed by evaluating the ICCC ability to engage employees and citizens in real-time. The sole objective is to assess the people

aspect of ICCC ecosystem. 3 indicators are designed around various components namely citizen outreach, employee outreach and ability to do sentiment analysis to assess the service quality.
Cities should keep in mind that all the claims made during the self-assessment stage should be validated and crosschecked during city level validation stage by the expert team. Cities must plan on how to demonstrate the ICCC capabilities against each assessment indicators.

Cities should assess and formulate a short term, medium term and long-term plan to address the gaps and enhance the engagement capabilities of ICCC Platform.

o) How to design use cases at ICCC?

IMAF document outlines 25+ indicative use cases. Cities should study them/use them as reference for designing more such use cases at ICCC.

p) Currently we are in the design and tender stage of ICCC. How can we effectively use this document?

Refer to this document to develop an understanding of ICCC as a platform and outline business and technical requirements in the design stage. Also, through this document, you can outline core requirements of ICCC platform over functional, technological, operational and engagement dimensions.

ABBREVIATIONS

Abbreviation	Full Form
AI	Artificial Intelligence
ANPR	Automatic Number Plate Recognition
API	Application Programmable Interface
BIS	Bureau of Indian Standards
BPR	Business Process Reengineering
CCTNS	Crime and Criminal Tracking Network & Systems
CCTV	Closed Circuit Television
DPIIT	Department for Promotion of Industry and Internal Trade.
DSS	Decision Support System
ECB	Electronic Code Book
eKYC	Electronic Know Your Customer
ERP	Enterprise Resource Planning
ETIM	Electro Technical Information Model
ETL	Extract, Transform, Load
FAQ	Frequently Asked Question
GIS	Geographical Information System
GPS	Global Positioning System
HRMS	Human Resources Management System
IaaS	Infrastructure as a Service
ICCC	Integrated Command and Control Center
IMAF	ICCC Maturity Assessment Framework
IndEA	India Enterprise Architecture
IOC	Integrated Operations Center
IoT	Internet of Things
IT	Information Technology
ITMS	Intelligent Traffic Management System
KPI	Key Performance Indicator
LED	Light Emitting Diode
MeitY	Ministry of Electronics and Information Technology
MII	Make In India
ML	Machine Learning
MoHUA	Ministry of Housing and Urban Affairs
NASSCOM	National Association of Software and Service Companies
NGO	Non-Government Organization
NMS	Network Management System
NMT	Non-Motorized Transport

NUIS	National Urban Innovation Stack
NULP	National Urban Learning Platform
PAS	Public Address System
PPP	Public Private Partnership
PTZ	Pan-Tilt-Zoom
RFID	Radio-Frequency Identification
SaaS	Software as a Service
SCADA	Supervisory Control and Data Acquisition
SCOC	Smart City Operation Centre
SLA	Service Level Agreement
SMS	Short Message Service
SoP	Standard Operating Procedure
SPV	Special Purpose Vehicle
SWM	Solid Waste Management
ULB	Urban Local Bodies
USD	US Dollars
VIP	Very Important Person
VMD	Variable Message Display
Wi-Fi	Wireless Fidelity

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