Ministry of Housing and Urban Affairs
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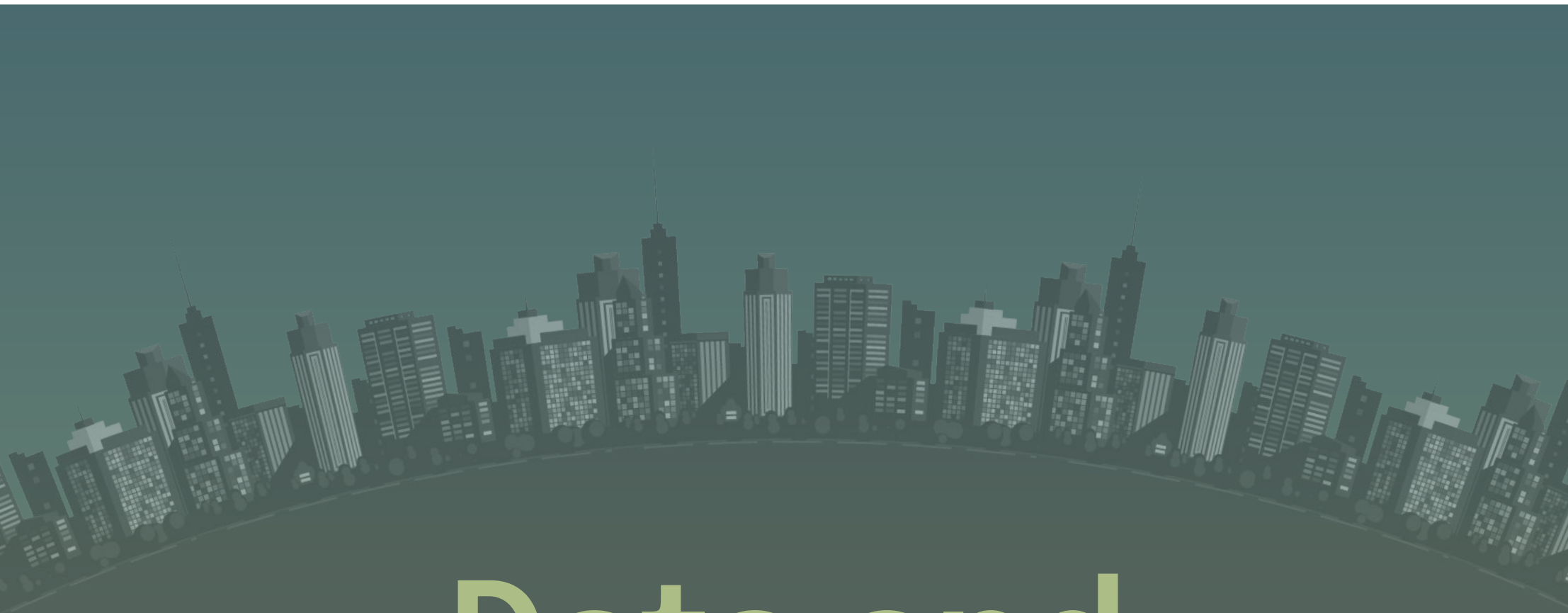

Data and Technology to drive Liveable Cities

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Foreword

Shri Kunal Kumar

Joint Secretary and Mission Director,
Smart Cities Mission at Government of India

In an era characterized by rapid urbanization and technological advancements, cities have emerged as vital engines of economic growth in India. Technology and better transportation blur the traditional limits of urban, semi urban and rural areas with cities acting as clusters for economic development. These clusters therefore have the capacity to become fulcrums of either economic growth or decline.

There is tremendous transformative potential of data-driven approaches in shaping urban environments and propelling cities towards sustainable development. NIUA and Primus Partners have prepared this report that highlights how data and embedded technology, especially in cities (cluster) planning will drive sustainable development of these areas by recommending actions to leverage the vast potential of technology.

This report delves into crucial factors relating to data identification and generation, data governance, data analysis, related enabling technologies, meaningful citizen engagement, long term sustainability, capacity building, financial investment, and regulatory frameworks, all with a central focus on their role in fostering economic growth in cities.

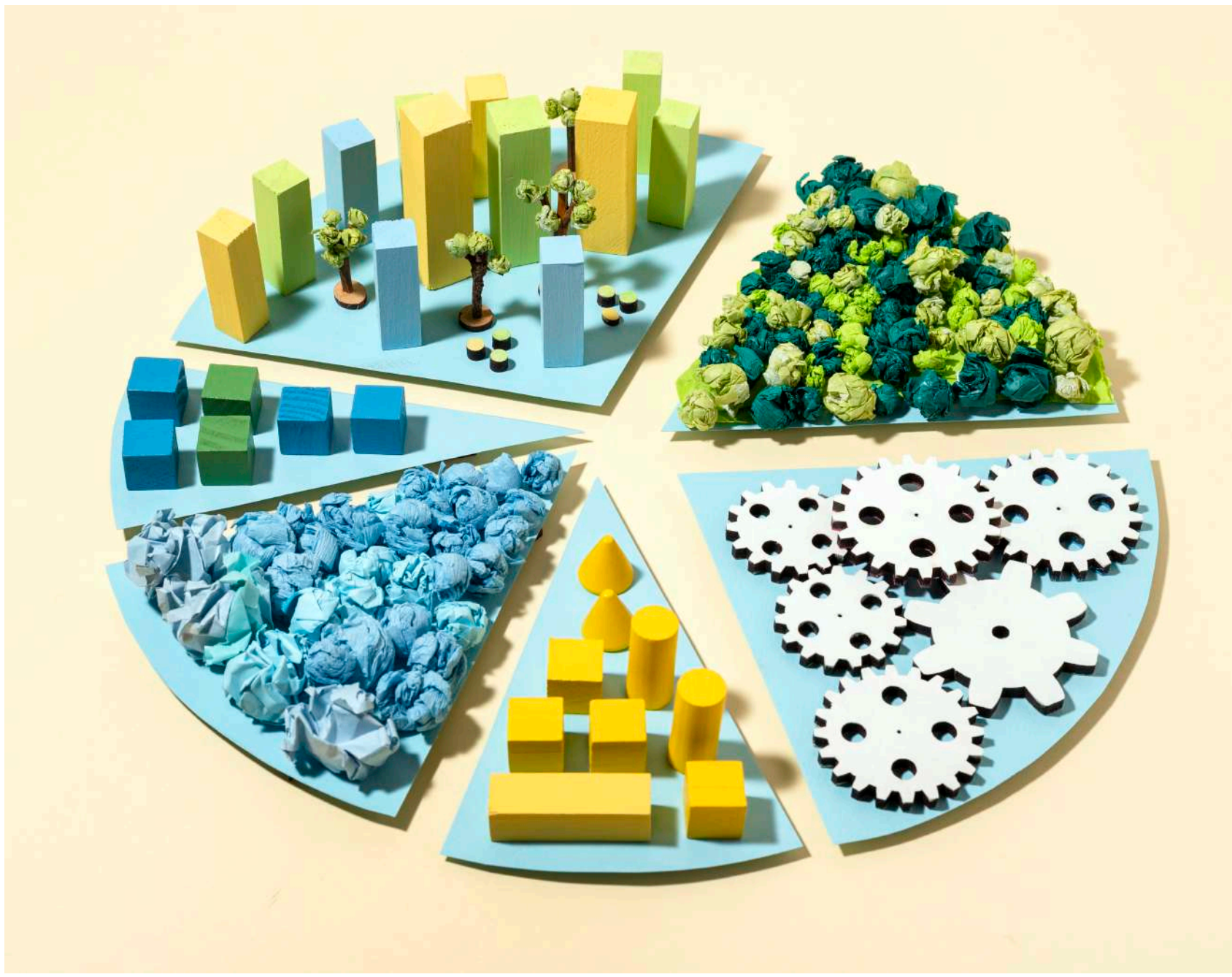
Placing data-driven approaches at the forefront ensures that interventions genuinely cater to community needs and aspirations. Ethical and responsible data governance is of paramount concern also, which necessities the need for robust frameworks that protect privacy, confidentiality, and promote transparency in data usage and management.

Success stories and initiatives from diverse Indian cities emphasize the remarkable progress achieved through data-driven strategies. Concrete examples highlight how data has positively impacted urban development and enhanced the lives of citizens, serving as an inspiration for other cities to embark on their own data-driven journeys.

Competitiveness is vital for city performance as it drives innovation, attracts investments, and fosters sustainable economic growth, ultimately enhancing the overall prosperity and quality of life for its residents. Similarly, collaboration and partnerships across stakeholders are essential for successful implementation. By fostering strong collaborations and pooling resources, cities can collectively address the challenges of data-driven urbanization.

Financial investment and long-term sustainability are also key considerations. Acknowledging the need for strategic planning and investment models that prioritize impactful projects, ensures the lasting sustainability of data-driven initiatives for the benefit of cities and their residents.

This report serves as an inspiring resource, encouraging urban planners, policymakers, and stakeholders to embrace data-driven approaches and pave the way for a sustainable and inclusive urban future. Together, cities can be empowered through data-driven transformation.



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Report Coverage

Cities are drivers of economic growth, especially in the context of developing countries, such as India. Indian cities contribute 63% to India's GDP, estimated to grow to 70% by 2030. A rapidly evolving urban landscape, such as in India, thus presents both opportunities and challenges for city leaders and policymakers. In this context, the effective use of data & technology has emerged as a transformative force, enabling cities to address pressing urban issues and enhance the quality of life for their residents.

The report highlights the critical role of data-driven decision-making and technological advancements in driving an iterative urban management process. In order to establish an effective structure, the report suggests recommendations under the pillars of data and technology, capacity building, and performance assessment.

The recommendations are summarized below:

Objective: Establish an iterative urban planning and management process by improving data availability, privacy, and governance, and harnessing advanced analytics and technology infrastructure to help in informed decision making and improve the liveability of cities

Recommendations addressing current challenges related to:

Collecting data and leveraging technology

1. Establishing City Data Hubs to Revolutionize Urban Management
2. Adoption of Building Information Modelling (BIM) across the Planning & Implementation Life cycle
3. Prioritizing Data Privacy and Security: Building Public Trust
4. Developing Data Analytics and AI Capabilities: Leveraging Insights for Informed Decision-Making
5. Encouraging Government Departments to Embrace Tech-Based Solutions

Capacity building and Institutional Strengthening

1. Establishing a Centre of Excellence at NIUA for Innovation and Expertise
2. Unlocking Potential through Lateral Entry at Government Departments
3. Envisaging Dynamic Budgeting for Cities
4. Nurturing Tech Talent at the Entry Level through Public Private Partnerships
5. Upskilling Civil Servants through Annual Capacity Building Plan for Sustainable Expertise
6. Empowering Urban Planners: Subsidies for Certifications in Modern Tools to Drive Innovation and Excellence

Performance Assessment

1. Striking a Balance: Standardization and Customization in Assessing City Performance
2. Implementing an Iterative Approach for Progress and Performance Assessment
3. Tier-wise Performance Ranking of Cities
4. Encouraging Public Input for Regular Service Availability Evaluation and Management Analysis

The report also provides a framework for a **City Report Card** to help create competition amongst cities and inspire them to reach global benchmarks. The city report card will assess the cities based on the following parameters:

Framework for City Report Card: Parameters for Assessment

- Data Availability, Accessibility and Usage
- Citizen Engagement and Participation
- Data Governance and Privacy
- Sustainability and Resilience
- Data Analysis and Insights
- Collaboration and Partnerships
- Technology Infrastructure and Connectivity

By embracing the transformative potential of data and technology in urban planning and management, cities can become more sustainable, resilient, and responsive to the needs of their residents. With continued innovation and strategic implementation, we can shape cities of the future that are smart, inclusive, and built on evidence-based decision-making.

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01

Introduction and Context

Mr. Keshav Varma
Chairman of High-Level Committee on Urban Planning, MoHUA

“In the realm of urban planning, data is the new currency, and professionals are the ones who unlock its transformative power. The importance of data cannot be overstated, as it holds the key to understanding the intricate complexities of our cities. By building the expertise of professionals, we can unravel urban challenges, unveil hidden patterns, and pave the way for evidence-based decisions that shape the future of our communities. In this data-driven era, the collaboration between data and specialists is the driving force that propels urban planning towards innovation, efficiency, and sustainable development.”

1.1

Urbanization and its Significance to Developing Countries such as India

Urbanization holds immense significance for developing countries like India. It is a catalyst for economic growth, creating abundant job opportunities, fostering entrepreneurship, and attracting investments. Furthermore, urbanization facilitates the development of essential infrastructure, improving access to vital services such as healthcare and education. Urban areas act as centers of innovation and technological advancements, driving progress and fostering competitiveness. Efficient resource utilization and improved policy and governance mechanisms are additional benefits. Given the increasing daily influx of migration into Indian cities, meticulous planning and management are imperative for effective service delivery. Indian cities already contribute 63% of the GDP, a figure expected to rise to 70% by 2030. The role of data and technology in urban planning can significantly boost cities' GDP contribution, acting as a roadmap for India's aspiration to achieve a USD 5 trillion economy.

1.2

Challenges in Urban Planning & Management

Indian cities face numerous challenges that necessitate a shift in planning and management approaches. Firstly, traditional master planning in India occurs infrequently, typically once every 10 years or more, resulting in the expansion of statutory towns without proper guidance. This leads to unplanned urban sprawls, with approximately 32.5% of the urban population residing in slums. Additionally, at least 50% of India's statutory towns expand without a master plan. Secondly, inefficient planning often cause proposed plans to misalign with available finances, resulting in project delays and cost escalations. For instance, the Master Plan of Delhi-2041, which took four years to complete, has yet to be notified.

Lastly, there is uneven growth across cities and towns in India, attributable to a lack of detailed assessment in the planning and implementation process, which hinders the standardization of facilities.

In terms of urban management, the provision of adequate infrastructure is essential for future-ready cities, including transportation, waste management, healthcare, and education. Furthermore, the absence of iterative monitoring systems hampers service delivery. Bangalore, for instance, has become an example of poor planning, with unrealistic traffic burdens, inadequate public transport, and service mismanagement.

1.3

Paving the Path for Future-Ready Cities

As cities become increasingly critical to India's growth, optimal planning and management are paramount. This necessitates a shift from traditional master planning to viewing urban planning and management as an iterative process.

Effective and iterative urban planning and management are founded on the pillars of data and technology, capacity building, and assessment. Data forms the foundation for effective planning, requiring standardization in collection methods, frequency, sharing protocols among departments, and other relevant factors to ensure efficient utilization.

Technology plays a vital role in efficiently collecting and analyzing data. Advanced tools such as AI, Blockchain, and GIS enable real-time data collection. Leveraging technological processes, like Building Information Modeling (BIM), enhances efficiency and shortens project lifecycles, significantly reducing cost overruns.

To integrate data and technology into urban planning, institutional and individual capacities must be enhanced. This can be achieved by mandating technological adoption, providing budgetary support, and fostering skill development through training and pilot projects.

It is crucial to prepare cities for decision-making supported by data, as well as flexible and thorough planning and management. These measures will enable cities to assess their implementation of data and technology in urban planning and management. Data-driven governance represents the future, and Indian cities are embracing this shift in their operations. Effective data management and technology play a pivotal role as we transition towards governance focused on achieving specific outcomes. The objective is to create sustainable cities and develop city governance that can accommodate unplanned growth. Ultimately, this will enhance residents' quality of life through improved service delivery and infrastructure.

Mr. R Srinivas

Consultant (Urban Planner), Ministry of Housing and Urban Affairs | Formerly worked with TCPO for more than a decade

“Urban Planning in India during the past two decades has witnessed series of innovation in terms of strategy, policy and methodology. Planners need to respond towards the cities and towns growing needs. With more and more digital mode being adopted, all efforts are to be made to harness geospatial and data analytics to strengthen our formulation of Master Plans. The geospatial and data analytics to be truly effective, planners must translate their findings into action and make the Master Plans a dynamic entity with timely implementation and bringing much ease in the liveability of the citizens of cities and towns.”

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02

Leveraging Data & Tech in Urban Solutions

> *In order to ensure accurate and sufficient data collection, it is crucial to establish a standardized and uniform approach. Cities should identify the specific data requirements for their intended purposes, which can include demographic information, geographic data, infrastructure details, environmental factors, economic indicators, and social insights. To achieve consistency across departments, cities can implement a comprehensive data collection mechanism that includes guidelines, protocols, and standardized formats. This mechanism will facilitate the collection process, promote uniformity, and enable effective data management. By following these steps, cities can enhance their digitalization mechanisms and leverage existing centers, such as Integrated Command and Control Centers (ICCCs), to obtain real-time data for various departments, ultimately making data more applicable and beneficial for decision-making processes.*

Dr. PSN Rao
Director,
School of Planning & Architecture (SPA),
New Delhi

2.1

Harnessing the Power of Real-Time Data in Urban Planning

While embracing data and technology in urban planning can lead to transformative outcomes, absence of accurate and real-time data results in decision-making based on incomplete information, causing inefficient resource allocation and inadequate infrastructure planning. This, in turn, leads to poorly designed transportation networks, insufficient housing, inadequate provision of basic services, and environmental degradation. Moreover, the reliance on outdated or mismatched data often results in delays in plan completion, adding to the already burdensome process of formulation. The lack of technological tools and processes further hampers effective planning and management, resulting in costly overruns and wasted time. Overcoming these hurdles is crucial to unlock the full potential of data and technology in urban planning and management. Nevertheless, certain prerequisites must be met to effectively utilize data and technology as key inputs. These include ensuring standardized and accurate data, overcoming the challenges of scattered data from various sources, addressing concerns related to data privacy, and establishing connectivity between different departments for efficient data processing. Many cities worldwide have successfully harnessed data and technology to plan and manage their urban areas.

Here are some compelling examples:

Case Study from the US:
Smart Waste Management in New York City

New York City implemented an intelligent waste management system to reduce costs and labor. The system utilizes sensors in waste containers to monitor fill levels, enabling efficient collection route planning. This cloud-based solution incorporates solar-powered garbage compactors and machine learning algorithms that predict waste accumulation. The result has been a reduction in waste trucks on the road, alleviating traffic congestion and lowering greenhouse gas emissions. Additionally, the system has improved public health by reducing litter and overflowing trash cans, which attract pests.

Case Study from Japan:

Fukuoka's Water Management System

Fukuoka, a Japanese city vulnerable to water shortages, developed a system to monitor and control water flow and pressure in different areas. Special sensors enable precise operation, allowing the city to distribute its limited water supply efficiently. Predictive models based on sensor data help forecast water requirements, ensuring effective water distribution. As a result, Fukuoka has achieved significant water savings, with its citizens using the least amount of water among Japan's major cities. The city's leakage rate has also fallen to a globally recognized standard of 2%.

Case Study from India:

Utilizing BIM in the Construction Industry

The Chandrawal Water Supply Project in New Delhi utilized Building Information Modeling (BIM) for the timely construction of a water treatment plant. BIM reduced costs and facilitated timely project execution. With 3D visualization and transparent communication, the project achieved seamless approval and coordination. This case exemplifies the benefits of adopting BIM in the construction industry, leading to cost and time savings.

Mr. Ranjan Chattopadhyay

Professor at Amity School of Architecture & Planning, Former Senior Urban Planning Consultant, World Bank, Former Director-General Planning, Kolkata Metropolitan Development Authority and Former Vice President at Institute of Town Planners India

“I believe that in our current system, acquiring relevant data poses significant challenges. It is imperative to consolidate important data sets into a single, easily accessible website or portal. Real-time data availability is crucial in today's fast-paced world, and it is equally important to ensure accessibility of this data for key stakeholders. Furthermore, I have observed disparities in institutional and individual capacities across different departments. It is essential to establish standardized practices and ensure that trained professionals are available across all cities, promoting a consistent understanding of institutional frameworks.”

2.2

Recommendations for Maximizing the Potential of Data and Technology in Urban Planning & Management

Leveraging the National Urban Digital Mission for all Efforts

The National Urban Digital Mission (NUDM) was launched by the Ministry of Housing and Urban Affairs to streamline and coordinate efforts of the urban ecosystem by harnessing technology to leapfrog India's urban transformation journey. NUDM is anchored by the CDG (Centre of Digital Governance) under the NIUA, which is the implementing body for the initiative.

The NUDM operates under a set of technology and governance principles. The technology principles encompass an ecosystem-driven approach, interoperability, inclusivity, minimalism, privacy and security, unbundling, scalability, transparency, non-repudiation, domain modelling, federated architecture, extensibility, and multi-channel access. The governance principles prioritize citizen-centric urban governance and development, accessibility for small cities, collaboration, building trust, efficient resource utilization, and fostering innovation. Further, the Urban Platform for delivery of Online Governance (UPYOG) under NUDM streamlines the usage of data across urban local bodies, enabling effective planning, monitoring, and service delivery.

Given the commonalities in the vision, it is imperative to leverage NUDM and the tremendous work underway and synergize efforts to implement the below recommend-ations in a combined action to further strengthen the mutual goal of data- and tech-driven cities.

Establishing City Data Hubs to Revolutionize Urban Management

To gather data for effective urban management, dedicated city data hubs should be established with state-of-the-art digital infrastructure. These hubs would centralize data collection and provide real-time solutions to urban challenges, optimizing data collection methods by using technology. The data collected from these city data hubs should be integrated at the state and national levels, allowing for interoperability, and facilitate data-driven decision-making.

Additionally, the utilization of advanced technology can optimize data collection methods, improving the accuracy and timeliness of data. To implement this effectively, pilot runs in existing smart cities with data hubs can be conducted. These pilots should define the purpose, define the data parameters and sets to be collected, establish standard methods of data collection, determine the frequency of data collection, identify specific data sets required for urban planning and management, and assign responsibility to relevant departments. By conducting these pilot runs, cities can prepare for the successful implementation of future city data hubs, ensuring their functionality and identifying any necessary improvements.

Adoption of Building Information Modeling (BIM) across the Planning & Implementation Life cycle (contd.)

> *A better world - fueled by data interoperability—is close at hand for the architecture, engineering, and construction industry. When stakeholders can share data freely between tools and disciplines, projects are more likely to be delivered on time and within budget.*

Ms. Amy Bunszel
Executive Vice President, Autodesk

In our rapidly growing cities, where space is at a premium and the demand for efficient infrastructure is high, BIM plays a crucial role in optimizing urban development. BIM integrates structured, multi-disciplinary data to produce a digital representation of an asset across its lifecycle, from planning and design to construction and operations. While BIM has been implemented across the lifecycle of many projects worldwide, adoption in India is still at a nascent stage. Nonetheless, it can provide significant return on investment (RoI) that ranges from reduction in time and cost overruns, compliance and productivity improvement and rework reduction, to name a few.

In order to gain familiarity with BIM, cities can begin by adopting the model into key infrastructure projects. The benefits have been substantiated through several projects, such as Delhi Metro Phase 4, construction of Terminal 2 at the Bangalore International Airport, CPWD projects for development of campus in Palakkad, Kerala.

Further, NITI Aayog has also stated that BIM could save up to 20% of the cost by shortening the project life cycle.

6 Benefits of BIM-based Value Engineering in Indian Infrastructure Projects

- 33% ↓ Reduction in Project Duration
- 33% ↓ Reduction in Cost of Construction and Whole Lifecycle of Assets
- 43% ↑ Increase in labour productivity
- 50% ↓ Reduction in Green-house Gas Emissions in the Built Environment
- 36% ↓ Reduction in Construction Rework
- 64% ↓ Reduction in Documents Errors / Omissions

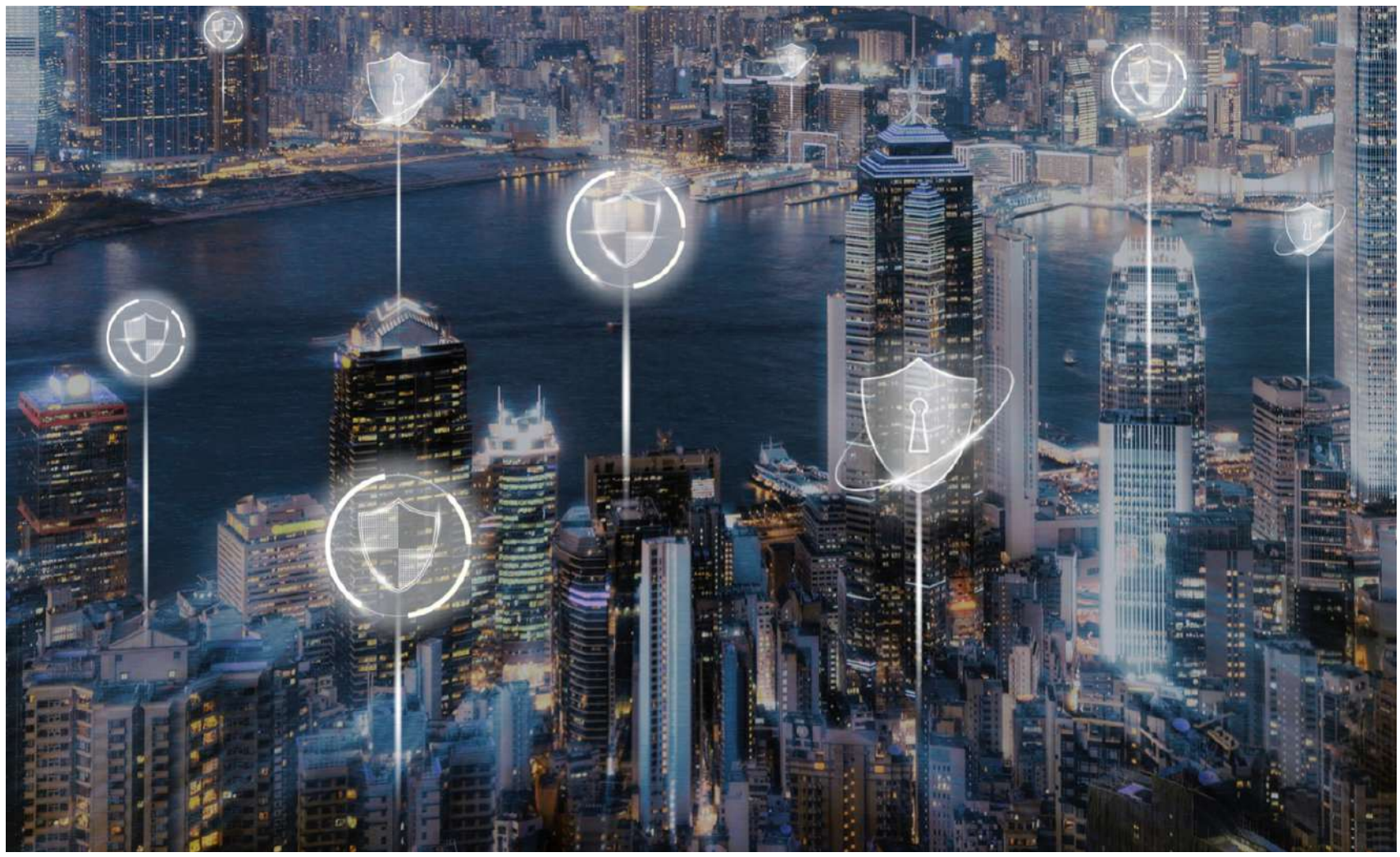
Adoption of Building Information Modeling (BIM) across the Planning & Implementation Life cycle

BIM can be leveraged to create digital twins for cities. Zurich Digital Twin is an innovative initiative aimed at creating a comprehensive digital replica of the entire city. The project utilizes advanced technologies, such as BIM, geospatial data, and real-time sensors, to create a virtual representation of Zurich's physical environment. This is not only a valuable tool for urban planning but also for enhancing the city's resilience and sustainability. By continuously updating and monitoring the digital twin with real-time data, authorities can detect and respond to issues promptly, such as optimizing traffic flow, managing energy consumption, or improving emergency response. A detailed analysis of how digital twins can facilitate the urban planning and implementation process has been placed in Annexure.

Finally, the entire master planning exercise can be done using BIM. Singapore not only utilizes BIM in infrastructure projects, but also in urban planning exercises to create digital models of entire neighbourhoods and assess their impact on the city's infrastructure and environment.

The following functions of BIM can be leveraged for urban planning:

1. *Analysis* by creating a three-dimensional model of the project which can be utilized to perform analytical functions and determine the impact on the immediate environment.
2. *Management* of documents and information across the entire lifecycle.
3. *Visualize* the design model and develop an accurate understanding of the final product before starting construction.
4. Standardization and management of all the physical assets through *Information Control.*
5. *Communication and collaboration* between multiple stakeholders by allowing to share relevant & accurate information among them.



Prioritizing Data Privacy and Security: Building Public Trust

As data becomes an essential component of urban planning and management, ensuring data privacy and security is paramount. Governments must establish robust data protection frameworks that safeguard sensitive information. Public trust can be built by implementing transparent data policies, conducting privacy impact assessments, and actively involving citizens in the decision-making process. Awareness campaigns should be launched to educate the public about data privacy and its importance in urban planning.

To facilitate effective data sharing and interoperability between departments, it is essential to develop a comprehensive data sharing policy at the central and state levels. This policy should establish protocols for data sharing, define data classification, address data privacy and security concerns, and outline measures for data access and protection. The existing National Data Sharing and Access Policy (NDSAP) is a step in the right direction, but it should be expanded to encompass aspects like data privacy, security, and intellectual property rights. Implementing the policy effectively requires coordination among various government entities and efforts to build the capacity of stakeholders. Keeping pace with technological advancements is also crucial to ensure the policy remains relevant. By establishing a more comprehensive data sharing policy, emphasizing standardized data collection processes and prioritizing interoperability between departments, urban management can benefit from improved data access and analysis.

Developing Data Analytics and AI Capabilities: Leveraging Insights for Informed Decision-Making

Investing in data analytics and artificial intelligence (AI) capabilities enables cities to derive valuable insights from the vast amount of data collected. By harnessing AI algorithms, urban planners can gain a deeper understanding of urban trends, predict future scenarios, and make informed decisions. These technologies also enable real-time monitoring and management of critical urban systems, allowing for proactive interventions and efficient resource allocation.

Encouraging Government Departments to Embrace Tech-Based Solutions

To foster the adoption of tech-based solutions in government departments, incentivization measures should be implemented. One approach is to organize citywide hackathons that promote collaboration between government agencies, technology enthusiasts, and citizens. These hackathons can serve as platforms for developing innovative solutions to urban challenges. Cities that win these hackathons can be rewarded with dedicated budgets to implement their ideas, ensuring tangible outcomes and encouraging further technological advancements. Additionally, allocating a portion of city funds towards cost-saving tech initiatives can create a positive feedback loop. These measures not only promote a culture of innovation within government departments, but also drive sustainable urban development, benefitting both the government and the citizens.

Additionally, multilateral agencies play a crucial role by providing essential support expertise and resources. Cities must look at forging partnerships with such institutions with intent of providing technical assistance and grants. These efforts can be coordinated at the state or national level.

Mr. Nikhil Jani
Sr. Vice President,
Genesys International
Corporation Ltd.

> *“Leveraging data and technology, such as high-resolution elevation models and digital twin technology, presents immense opportunities for addressing urban challenges. By harnessing AI and ML algorithms, cities can develop innovative solutions for disaster and fire management, as well as infrastructure development. High-resolution elevation models provide precise data for assessing vulnerable areas prone to natural disasters, enabling proactive planning and targeted response strategies. Digital twin technology creates virtual replicas of cities, allowing authorities to simulate and optimize infrastructure projects for enhanced efficiency and sustainability. By integrating these data-driven technologies, urban environments can be transformed into safer, smarter, and more resilient spaces that meet the evolving needs of their inhabitants.”*

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03

Strengthening Institutional & Individual Capacities for Effective Urban Management

Dr. Saswat Bandyopadhyay
Urban Development Expert,
Ahmedabad, India

“With the rapidly changing world, it is imperative to enhance the skills and capabilities of institutions and individuals. I believe that regular training and upskilling of departments from a top to bottom approach is vital. Trained individuals are required at the planning and management level who are equipped with understanding of new age data analytics and technology to facilitate the world class infrastructure of today. Additionally, there is also a need to enhance the capacity of the future workforce with courses specific to urban planning & management with an understanding of incorporating the necessary technological tools of today.”

3.1

Empowering Individuals and Institutions

Robust urban planning and management heavily rely on digital infrastructure. This includes essential elements such as, data storage and management systems, open data standards, cybersecurity, and data security. To enable effective digitalized urban planning, cities must have the necessary infrastructure and a well-trained workforce. This can be achieved by mandating technological adoption, providing budgetary support, developing skillsets through training and pilot projects, and establishing a framework for digital infrastructure development. Strengthening institutional capacity is crucial, as it ensures the provision of a robust digital infrastructure for effective urban planning and monitoring. Real-time monitoring of critical urban systems, such as traffic management, waste management, and public safety, can be achieved, enabling prompt responses to emergencies and resource optimization. Furthermore, citizen engagement can be facilitated through digital platforms, empowering residents to actively participate in the planning process and contribute to the development of inclusive and liveable cities.

Building a skilled workforce is vital for successful city-of-the-future initiatives. Equipping the workforce with expertise in emerging technologies, data analysis, and urban planning and management is essential to effectively harness the potential of smart technologies and drive innovation in urban development. By investing in training programs, fostering collaborations with educational institutions and industry partners, and attracting talented professionals, governments can cultivate a skilled workforce capable of leveraging technology to improve urban infrastructure, enhance the quality of life, and promote sustainable and inclusive growth.

3.2

Recommendations for Strengthening Institutional Capacity

Establishing a Centre of Excellence at NIUA for Innovation and Expertise

Creating a Centre of Excellence for Urban Planning and Management within the National Institute of Urban Affairs (NIUA) will be a significant step towards empowering urban development. This center will serve as a knowledge hub, fostering innovation and expertise. It will facilitate collaboration, capacity building, and the exchange of best practices, enabling cities to stay updated with the latest trends in urban planning. Additionally, the Center of Excellence should collaborate with Smart Cities' Integrated Command and Control Centers (ICCC) to monitor dedicated city data hubs and assess cities' progress in adopting technological solutions. Collaboration with ICCC centers will enhance the functionality and delivery of urban services through the use of artificial intelligence and sensor cameras.

Unlocking Potential through Lateral Entry at Government Departments

Creating additional lateral entry positions for town planners, as recommended by NITI Aayog, is crucial for cultivating a skilled workforce. These positions, sanctioned for a minimum of three to a maximum of five years, will allow the integration of professionals with expertise in modern urban solutions. This will also lead to continuity in the position and allow professionals sufficient time to bring about institutional changes into the system. Continuous training and upskilling opportunities must be provided to these professionals to ensure effectiveness. By combining lateral entry with ongoing education, the government can enhance urban planning capabilities, foster innovation, and effectively address the complex challenges of urban development.

Envisaging Dynamic Budgeting for Cities

Incorporating dynamic budgeting tools that leverage real-time data can greatly enhance the planning and expenditure management for cities. By integrating open real-time data from sources like meteorological departments, disaster management agencies, and environmental monitoring stations, cities can gain valuable insights into the prevailing weather conditions, water levels, and air quality. This data integration enables data analysis techniques to assess the risks and challenges faced by the city. Armed with this information, city officials can make more informed decisions regarding their annual budget allocations, effectively allocating resources to address specific issues such as flood mitigation measures.

3.3

Recommendations for Strengthening Individual Capacity

To leverage the available technologies and processes effectively, Indian cities should adeptly adopt modern solutions. The following steps are recommended:

Nurturing Tech Talent at Entry Level through Public Private Partnerships

Addressing the talent gap at the entry level is crucial for driving technological innovation and economic growth. Encouraging public-private partnerships (PPP) for training young talent can be highly beneficial. Platforms like FutureSkills Prime, launched by the Ministry of Electronics and Information Technology (MeitY) and NASSCOM, focus on bridging the talent gap at the entry level and upskilling India's existing workforce in emerging technologies. Further, creating a Sector Skill Council for Urban Planning and Management can help nurture the right talent required for effective implementation. Collaborating with these platforms and creating courses specific to urban planning and management, while integrating technology and data, can help fill talent gaps in government departments.

Upskilling Civil Servants through Annual Capacity Building Plan for Sustainable Expertise

Ensuring that civil servants are trained in the latest technology and urban solutions is essential for effective utilization of resources. The National Platform for Civil Services Capacity Building - Mission Karmayogi – can be leveraged for such training programs. Capacity building efforts should also adopt a bottom-up approach with focus on improving the institutional, organizational and individual competencies required to effectively deliver roles and responsibility of each designation, function and department, aligned to overall development vision or objectives of the city.

The Capacity Building Commission's push for annual capacity building plans for cities helps align training efforts with strategic goals and improve employee performance through targeted skill development. These annual plans should provide comprehensive training programs covering smart city technologies, data analytics, sustainable urban development, and innovative planning strategies is vital. This mechanism would enable civil servants to acquire the necessary knowledge and skills, empowering them to make informed decisions and drive positive change in urban planning and management.

Empowering Urban Planners: Subsidies for Certifications in Modern Tools to Drive Innovation and Excellence

Government subsidies should be provided to support urban planners in upskilling through certification courses focused on modern tools. This initiative will foster innovation, improve planning practices, and ensure that urban planners possess the necessary skills to address contemporary urban challenges. Subsidies can specifically target advanced GIS applications, data analytics and visualization, smart technologies, and 3D modeling tools. Empowering urban planners with evidence-based decision-making skills, data-driven approaches, and smart solutions will enhance urban design practices.

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04

Paving the Path for Future-Ready Cities: Comprehensive Assessment Framework

Dr. Amit Kapoor
Honorary Chairman,
Institute for Competitiveness (IFC)
Professor, Stanford University

“Performance assessment serves as the compass guiding effective urban planning, enabling cities to navigate towards sustainable, resilient, and liveable futures. By systematically evaluating the performance of urban systems, cities can make data-driven decisions that optimize resources, enhance efficiency, and improve their competitiveness. Performance assessment is not just a tool; it is the key that unlocks the potential for transformative urban development, ensuring our cities thrive in an ever-evolving world.”

4.1

Navigating Toward Future-Ready Urban Centers

To ensure that cities are prepared for the future, it is crucial to adopt key elements that enhance their urban focus. These elements include developing an integrated digital infrastructure, implementing a robust data governance framework, embracing IoT technologies, fostering citizen engagement platforms, promoting open data initiatives, encouraging collaboration and partnerships, and investing in capacity building and skill development. By incorporating these elements, cities can smartly equip themselves, paving the way for sustainable growth and an improved quality of life for their residents.

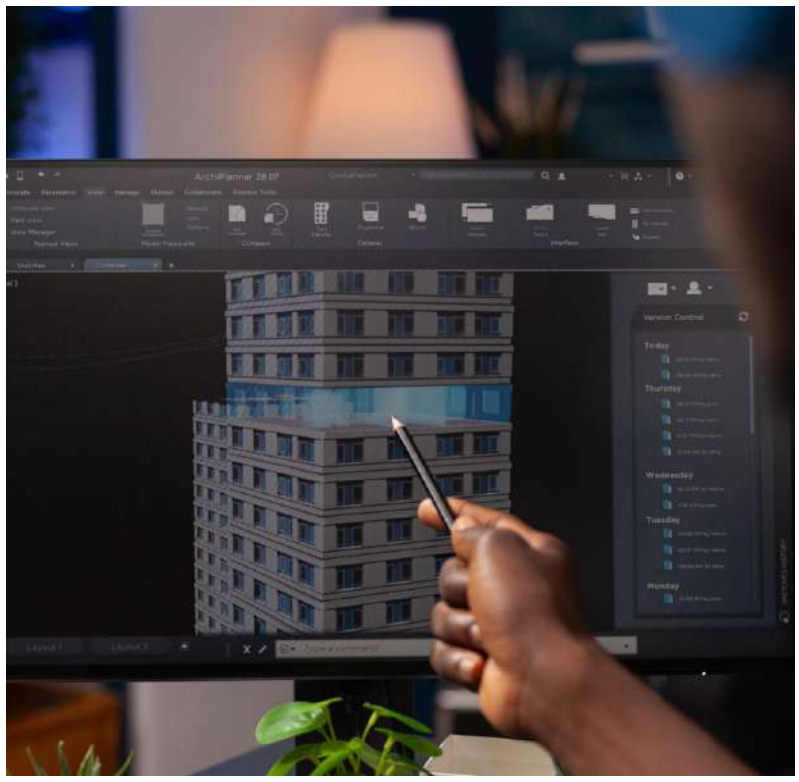
For instance, Surat's Municipal Administrative Center (SMAC center) is an excellent initiative that combines technology and data for urban management. Surat has successfully established a comprehensive digital infrastructure with smart grids and a centralized command center for efficient resource management. Similarly, IoT has contributed to projects such as the Delhi-Mumbai Industrial Corridor, the Kashi Smart City Challenge Plan, and the Kalinga Nagar Tata Steel township, providing real-time data insights and analytics for asset management. Moreover, the implementation of Smart Card Transit Systems and GPS monitoring in Kochi's public transportation system has proven to be essential for the urban population.

However, it is important to note that these interventions have been implemented in a fragmented manner in India, lacking proper standardization. Despite these interventions, there is a need for a comprehensive assessment framework that can assist Indian cities in adopting these advancements uniformly and ensuring standardized facilities overall.

4.2

Holistic Assessment Framework: Enabling Comprehensive Planning & Management for Urban Centers

The pressing need for a holistic assessment framework to facilitate comprehensive urban planning and management cannot be overstated. Such a framework is essential to address the evolving needs of cities in a rapidly changing world. By adopting this approach, cities can ensure that planning decisions encompass various factors, including social dynamics, environmental sustainability, economic viability, infrastructure and mobility, governance and institutional capacity. This integrated planning approach will enable cities to create urban environments that are liveable, resilient, and inclusive, meeting the diverse needs of their residents. The framework will also encourage sustainable development, promote effective resource allocation, and foster collaboration among stakeholders.



The Ministry of Housing and Urban Affairs (MoHUA) has developed a Data Maturity Assessment Framework (DMAF) to evaluate the maturity of data-related practices and capabilities within organizations. The framework aims to assess an organization's ability to effectively manage, analyze, and leverage data for decision-making and innovation. This framework looks at data governance, data architecture, data management, data analytics, data culture and data innovation. It provides a comprehensive evaluation to identify strengths and areas for improvement.

Nonetheless, a **city report card** specific to data and technology is needed to complement the DMAF developed by MoHUA for several reasons. A city report card can provide a **more comprehensive assessment** by incorporating additional dimensions of data and technology. It can include evaluation criteria related to smart city initiatives, digital infrastructure, open data policies, cybersecurity measures, innovation ecosystems, and citizen engagement through digital platforms.

The report card can also define specific benchmarks and indicators relevant to digital transformation and data utilization. It will allow cities to measure their performance against these indicators, track progress over time, and compare themselves with peer cities nationally and internationally. This enables cities to identify gaps, set targets, and make informed decisions for improving their digital and data capabilities.

4.3

Principles for Effective Performance Assessment

This section delves into the principles of effective performance assessment for urban planning and management. By understanding and applying these principles, stakeholders can gauge the effectiveness of interventions, make informed decisions, and foster the creation of livable, resilient, and inclusive cities.

Striking a Balance in Standardization and Customization

An effective performance framework should establish definitive standards for cities, providing a consistent baseline for evaluation. Additionally, it is crucial to accommodate customization in the assessment process, depending on the city tiers. This approach will foster healthy competition, inspiring Tier 3 cities to aspire to the standards set by Tier 1 cities while motivating Tier 1 cities to benchmark against global standards. This will facilitate an equitable and progressive evaluation of cities' progress and performance.

Tier-wise Performance Ranking of Cities

Implementing a healthy competitive ranking system is crucial to drive effective implementation and adoption of initiatives. This ranking mechanism serves as a powerful motivator, encouraging cities to strive for excellence and continuously improve their urban development efforts. Recognizing the top cities and offering incentives not only celebrates their achievements, but also serves as a catalyst for knowledge sharing and replication of best practices.

Implementing an Iterative Approach for Progress and Performance Assessment

To ensure the assessment process remains relevant and responsive to evolving needs, it is vital to adopt an iterative approach for generating assessment report cards. This allows for timely updates and necessary adjustments in parameters.

Encouraging Public Input for Regular Service Availability Evaluation and Management Analysis

To foster greater citizen engagement, departments can integrate a platform that allows for quarterly public input. Through an engaging application, citizens can actively participate in assessing parameters and indicators, providing valuable insights into their awareness, satisfaction, and suggestions for further improvement of facilities.

4.4

City Report Card: Parameters for Assessment

PARAMETER #1

Data Availability, Accessibility and Usage

To ensure effective urban planning and management, it is crucial to make comprehensive and relevant datasets readily available. Drawing inspiration from successful initiatives like India's Open Government Data Platform (data.gov.in), cities should strive to create similar platforms where data can be easily accessed and utilized.

Enhancing data accessibility for various stakeholders, including government agencies, researchers, and the public, is vital for informed decision-making. Following the example set by the Bangalore Metropolitan Transport Corporation (BMTC) in providing accessible data, cities should prioritize the development of user-friendly interfaces and data portals to enable easy access and utilization of urban data.

PARAMETER #2

Data Governance and Privacy

Robust data governance policies and frameworks need to be implemented to safeguard data security, privacy, and compliance. It is essential to take inspiration from measures proposed in the Personal Data Protection Bill to establish comprehensive and effective data governance practices.

Clear guidelines and protocols for data collection, storage, sharing, and usage should be established. Cities can refer to the Smart Cities Guidelines for Data Management and Privacy as a resource to develop their own frameworks, ensuring transparency, accountability, and ethical use of data.

Protecting personal information and adhering to data protection regulations are of utmost importance. The Unique Identification Authority of India (UIDAI) can serve as a model for cities to prioritize data privacy, secure data storage, and enforce data protection regulations effectively.

PARAMETER #3

Data Analysis and Insights

Advanced data analytics techniques and tools should be harnessed to extract meaningful insights from urban data. Following the lead of the Pune Municipal Corporation, cities should invest in building analytical capabilities and employing data scientists to unlock valuable insights that can drive evidence-based decision-making.

Embracing predictive modeling and data-driven decision-making is essential for effective urban planning and management. Drawing inspiration from the Chennai Smart City initiative, cities should adopt these practices to optimize resource allocation, mitigate risks, and enhance overall urban development outcomes.

Real-time data analysis capabilities should be integrated to enable proactive monitoring and responsive actions. The Mumbai Police's approach serves as an example of leveraging real-time data analysis for efficient crime prevention and emergency response. Cities should invest in technology and analytical tools that enable real-time data processing and decision-making.

PARAMETER #4

Technology Infrastructure and Connectivity

A reliable and robust technology infrastructure, including networks, hardware, and software systems, is critical for successful data-driven initiatives. Taking inspiration from the Smart Cities Mission, cities should prioritize investments in infrastructure development to provide a solid foundation for data management and analysis.

Seamless connectivity and interoperability among various technology platforms and systems are crucial to enable effective data exchange and integration. The Delhi Metro Rail Corporation (DMRC) provides a model for achieving interoperability in complex urban systems. Cities should strive to establish open standards and protocols that allow different systems to communicate and share data seamlessly.

Embracing emerging technological tools and process such as BIM, the Internet of Things (IoT), Artificial Intelligence (AI), and Big Data analytics is vital for maximizing the potential of urban data. The Gandhinagar Municipal Corporation's approach demonstrates the benefits of leveraging these technologies. Cities should explore innovative applications of these technologies to improve service delivery, enhance efficiency, and enable data-driven insights.

PARAMETER #5

Citizen Engagement and Participation

Implementing digital platforms & tools is key to facilitating citizen engagement and participation in urban planning and decision-making processes. Taking cues from successful platforms like MyGov, cities should develop user-friendly digital platforms that enable citizens to contribute their ideas, provide feedback, and actively participate in shaping their urban environments.

Incorporating feedback mechanisms is essential to gather public opinions and preferences effectively. The Coimbatore Smart City initiative showcases the importance of actively seeking and incorporating public feedback. Cities should implement mechanisms such as surveys, public consultations, and interactive forums to ensure inclusive and participatory decision-making processes.

Ensuring the inclusion of diverse stakeholders & communities in technology-driven initiatives is crucial for equitable urban development. The Bhopal Plus mobile app serves as an example of actively involving different groups in decision-making processes. Cities should prioritize outreach efforts and collaboration with underrepresented communities, NGOs, and community-based organizations to ensure inclusivity and diversity in urban planning and implementation.

PARAMETER #6

Sustainability and Resilience

Cities must integrate data and technology solutions into urban development strategies to promote sustainability, resource optimization, and environmental conservation. Taking inspiration from the Surat Smart City initiative, cities should leverage data-driven approaches to develop sustainable infrastructure, reduce resource consumption, and enhance the overall quality of urban life.

Resilience measures must also be adopted to address the challenges posed by climate change, natural disasters, and urban vulnerabilities. Following the example of the Kochi Metro Rail Ltd., cities should integrate resilience considerations into urban planning and infrastructure development, ensuring cities are prepared to withstand and recover from shocks & stresses.

Cities must also monitor and evaluate the impact of data-driven initiatives on sustainability and resilience goals. Similar to the approach taken by the Jaipur Smart City initiative, cities should establish robust monitoring and evaluation frameworks to assess the effectiveness of data-driven interventions, identify areas for improvement, and track progress towards sustainability and resilience targets.

PARAMETER #6

Collaboration and Partnerships

Cities must foster collaborative partnerships between government agencies, private sector entities, academic institutions, and community organizations, as exemplified by the Pune Smart City initiative. By promoting cross-sector collaboration, sharing resources, and leveraging collective expertise, cities can create synergistic partnerships that drive innovation, foster knowledge exchange, and accelerate the implementation of technology-driven urban solutions.

Shri Mahendra Singh Tanwar
Vice Chairman of Gorakhpur Development Authority,
Ex Municipal Commissioner.

“Regular and iterative assessment of cities' performances is crucial for effective urban management and development. It is equally important to leverage the knowledge and challenges faced by Urban Local Bodies (ULBs) on a regular basis, along with the solutions they offer at the local level. By incorporating their inputs and involving them in the assessment process, a comprehensive understanding of the city's performance can be achieved. This collaborative approach ensures that assessments are holistic, considering the perspectives and experiences of the ULBs, leading to more effective urban management and development strategies.”

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Conclusion & Way Forward

Mr. Sameer Jain
Managing Director,
Primus Partners Private Limited

“By embracing the transformative power of technology, cities are poised to unleash the tremendous potential for an urban revolution. Through the utilization of cutting-edge data analytics, IoT, and innovative digital solutions, cities can effectively optimize resources, elevate service delivery, and empower informed decision-making. Technology assumes the pivotal role of a catalyst, propelling the creation of smarter, more sustainable, and resilient cities, wherein efficiency, inclusivity, and an exceptional quality of life thrive for all residents.”

The importance of data and technology in urban planning and management cannot be ignored. The integration of data-driven decision-making processes and innovative technologies holds immense potential for addressing the complex challenges faced by cities today. This report has highlighted the crucial role that data and technology play in enhancing urban planning, infrastructure development, and service delivery. From collection and analysis of data to the application of advanced technologies, urban planners and managers can gain valuable insights, optimize resource allocation, and improve the quality of life for residents.

The implementation of a comprehensive assessment framework, commonly known as a "report card," plays a pivotal role in evaluating and benchmarking the progress and performance of cities in their journey towards sustainable urban development. This paper has highlighted the significance of such a framework and provided recommendations for its successful implementation.

A report card serves as a valuable tool for cities to assess their achievements, identify areas for improvement, and track their progress over time. By establishing definitive standards and incorporating the essential elements of integrated digital infrastructure, data governance, IoT technologies, citizen engagement platforms, open data initiatives, collaboration and partnerships, and capacity building, cities can effectively evaluate their performance and set ambitious goals for future development.

The framework outlined in this paper emphasizes the importance of striking a balance between standardization and customization. While standardization ensures consistency and provides a baseline for evaluation, customization allows cities to address their unique challenges and aspirations. This approach fosters healthy competition among cities of different tiers, enabling them to learn from one another and work towards common goals while considering their individual contexts.

However, while recognizing the importance of data and technology, it is essential to address potential challenges and concerns associated with their use. Privacy and data security, digital divide, and ethical considerations must be carefully addressed to ensure equitable access and protect the rights of all individuals in urban areas.

Looking ahead, the way forward involves strengthening the capacity of cities to effectively utilize data and technology, fostering partnerships between public and private sectors, and promoting interdisciplinary collaborations. Furthermore, integrating community engagement and participatory approaches will ensure that the benefits of data and technology are realized by all segments of society.

By embracing the transformative potential of data and technology in urban planning and management, cities can become more sustainable, resilient, and responsive to the needs of their residents. With continued innovation and strategic implementation, we can shape cities of the future that are smart, inclusive, and built on evidence-based decision-making.

Concluding Remarks

Mr. Hitesh Vaidya

Director,
National Institute of Urban Affairs

This report highlights the transformative power of data and technology in driving urban transformation. By harnessing the potential of data-driven approaches, cities can unlock new opportunities for sustainable development, improved governance, and enhanced quality of life for their residents. NIUA strongly believes in four pillars of city planning and governance which are:

1. ***Shringar:*** Beautification, infrastructure & aesthetics of cities
2. ***Shakti***: Economic power of cities
3. ***Sugamin:*** Upcoming and futuristic developments
4. ***Sudarshan:*** Monitoring of all initiatives to ensure objectives are being met

These pillars form the foundation for the report, which focuses on driving data-driven urban transformation and promoting inclusive and sustainable cities.

One of the key tools discussed in this report is the use of city assessment report cards, which provide a comprehensive and objective evaluation of a city's performance across various dimensions. These report cards serve as valuable instruments for measuring progress, identifying areas for improvement, and benchmarking against peers. They enable cities to track their own growth, set targets, and make informed decisions to enhance their overall performance.

Moreover, report cards foster transparency and accountability by making data accessible to citizens, policymakers, and stakeholders. They promote a culture of openness and collaboration, encouraging civic engagement and enabling evidence-based decision-making. By providing a clear snapshot of a city's strengths and weaknesses, report cards empower stakeholders to work together in addressing urban challenges and shaping a more sustainable and inclusive future.

However, it is important to acknowledge that city assessment report cards are just one piece of the puzzle. The success of urban transformation relies on holistic approaches that consider social, economic, and environmental factors, alongside data and technology. Effective governance, strong leadership, and collaboration across sectors are essential for translating the insights from report cards into actionable policies and projects.

As we move forward, it is crucial to continually refine and improve the methodologies used in city assessment report cards, ensuring that they capture the evolving needs and aspirations of urban dwellers. Additionally, efforts should be made to expand their adoption across a wider range of cities, ensuring that the benefits of data-driven urban transformation are accessible to all.

The combination of data, technology, and city assessment report cards holds immense potential for catalyzing urban transformation. By leveraging these tools effectively, cities can embrace evidence-based decision-making, enhance their performance, and create sustainable, liveable, and prosperous urban environments for generations to come.

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Annexure: Leveraging Digital Twins for Urban Transformation

Planning Cities Smartly with Digital Twins

Urban cities are struggling to keep up with the rapid growth in population, and this trend is bound to continue in the coming years. The United Nations predicts that 70% of the world's population will be living in urban cities by 2050, up from 50 percent today. Since decisions made today have a critical impact on the future, there is less room for trial-and-error when it comes to urban planning. With this in mind, **cities such as Shanghai, New York, Singapore and Helsinki are already embracing the "digital twin" technology for effective urban management.**

Urban planners have traditionally relied on static 2-D and 3-D maps for their planning needs. However, the increasing complexity of cities and the evolving demands for sustainable communities have necessitated the development of more dynamic tools. By integrating digital twin technology with traditional urban planning tools, it is possible to create real-time, highly detailed virtual models of cities.

Digital twins effectively are more valuable with BIM. Correct data can simplify and streamline asset collaboration during design and construction phases to craft digital twins.

Unlocking the Benefits for Urban Management

Digital twins empower urban planners to **virtually construct and test new cities** before physical construction begins. They also offer valuable **insights into existing cities,** helping urban planners understand persistent issues. By running real-time simulations of policy scenarios, planners can analyze feasibility and anticipate potential outcomes, reducing the risk of project failures.

Furthermore, the technology allows for **optimal asset utilization** by experimenting with different variables and evaluating their impact. Additionally, these virtual models **enable rapid iteration** on a city-wide scale, facilitating efficient decision-making.

They also provide a means to monitor the performance and sustainability of **service delivery**. The virtual replicas aid in managing traffic flow, reducing energy consumption, and disaster mitigation. They also play a crucial role in streamlining planning and operational processes.

Cities Maximizing Impact and Return on Investment

Cities around the world are already reaping the benefits of Digital Twins. Recent reports estimate that cities will save USD 280 billion by 2030 “by using digital twins for more efficient urban planning.”

Virtual Seoul, also known as S-Map, is a virtual copy of the entire city. It shows everything in 3D, including buildings, underground facilities, and even the inside of buildings like subway stations. S-Map is used to help plan the city, evaluate buildings, and analyze different scenarios. It can predict the impact of disasters, understand wind patterns, and find ways to reduce problems like fine dust pollution.

The **digital twin of Des Moines, Iowa,** created since 2019, has improved workflows and made it easier to discuss project impacts with developers. Having real-time access to the 3D map during meetings saves time in the planning process. It has been used for building proposals and site analysis. Its use will continue to analyze how surrounding structures affect the area and involve other departments to explore more benefits.

Virtual Singapore integrates real-time data from various sources to support urban planning, simulation, and decision-making. It helps analyze different scenarios, optimize resource allocation, and monitor aspects like traffic flow and energy consumption. It serves as a platform for collaboration among stakeholders and promotes smart and sustainable urban development.

Dubai has embraced digital twin technology to enhance its urban development and management strategies. Through the **Dubai Pulse platform**, the city has created a comprehensive digital twin that offers real-time data and insights about its infrastructure and services. This has revolutionized urban planning and design by allowing stakeholders to simulate and visualize proposed developments, optimizing designs, and ensuring sustainable growth. By harnessing the power of the digital twin, Dubai has transformed into a smarter city, improving operational efficiency and enhancing the quality of life for its residents.

Creating Cities of the Future

Leveraging digital twins for urban planning holds immense potential in shaping the cities of tomorrow. By integrating real-time data, predictive analytics, and simulation capabilities, digital twins can provide decision-makers with valuable insights into urban systems, enabling them to make informed decisions and optimize resource allocation. To fully capitalize on this technology, it is crucial to foster collaboration between public and private stakeholders and invest in robust infrastructure. With a holistic approach and forward-thinking strategies, digital twins can pave the way for smarter, more sustainable cities, fostering economic growth, improving quality of life, and addressing the complex challenges of urbanization.

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About National Institute of Urban Affairs

The National Institute of Urban Affairs (NIUA) is India's leading national think tank on urban planning and development. As a hub for generation and dissemination of cutting-edge research in the urban sector, NIUA seeks to provide innovative solutions to address the challenges of a fast urbanising India and pave the way for more inclusive and sustainable cities of the future. NIUA was established as an autonomous body in 1976 under the aegis of the Ministry of Housing and Urban Affairs (MoHUA). Since then, it has worked closely with the Ministry of Housing and Urban Affairs, alongside other government and civil sectors, to identify key areas of research, and address the lacunae in urban policy and planning. In its aims of enriching and expanding urban knowledge bases within the country, its work today addresses 5 major thematic concerns, Urbanization & Economic Growth, Urban Governance (Digital) & Municipal Finance, Urban Infrastructure & Built Environment, Environment, Climate Change & Resilience, Social Development (Inclusive and sustainable cities). With a team spanning planners, engineers, researchers, architects and analysts, the Institute provides cross disciplinary expertise and technical assistance for city and state-level projects, as well as developing toolkits and customised training programmes to strengthen the capacity of local and regional, and governing agencies.

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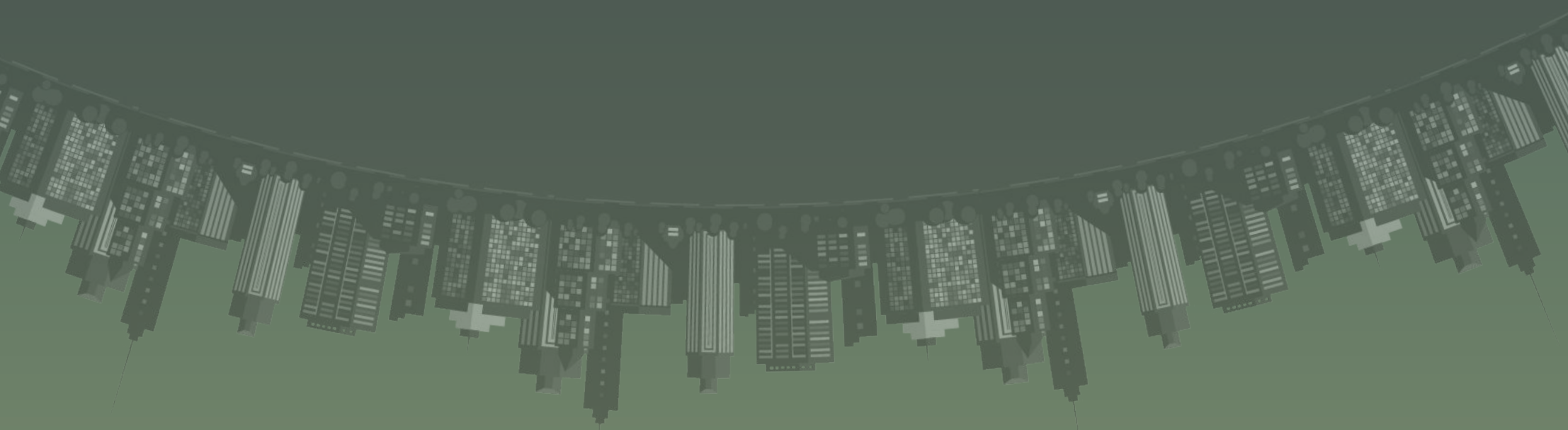
About Primus Partners

Primus Partners has been set up to partner with clients in ‘navigating’ India, by experts with decades of experience in doing so for large global firms. Set up on the principle of ‘Idea Realization’, it brings to bear ‘experience in action’.

‘Idea Realization’— a unique approach to examine futuristic ideas required for the growth of an organization or a sector or geography, from the perspective of assured on ground implementability.

Our core strength comes from our founding partners, who are goal-oriented, with extensive hands-on experience and subject-matter expertise, which is well recognized in the industry.

Our core founders form a diverse cohort of leaders from both genders with experience across industries (Public Sector, Healthcare, Transport, Education, etc.), and with varied specialization (engineers, lawyers, tax professionals, management, etc.)



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