

CATALYSING DIGITAL URBAN FUTURES

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White Paper.

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Catalysing Digital Urban Futures

White Paper



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Abbreviations

AI	Artificial Intelligence
API	Application Programming Interface
AR	Augmented reality
CDM	Climate Data Model
CODES	Coalition for Digital Environmental Sustainability
DFFT	Data Free Flow with Trust
DPG	Digital Public Goods
DPGA	Digital Public Goods Alliance
DPI	Digital Public Infrastructure
G20	Group of 20
G7	Group of Seven
GDC	Global Digital Compact
GDP	Gross Domestic Product
GPR	Government Process Reengineering
GSOM	Growing Self-Organising Map algorithm
HCX	Health Claims Data Exchange
ICT	Information and Communications Technology
IGF	Internet Governance Forum
IoT	Internet of Things
ITU	International Telecommunication Union
LDC	Least Developed Countries
LGBTQI	Lesbian, Gay, Bisexual, Transgender, Queer and Intersex
MDS	Mobility Data Specification
ML	Machine Learning
NIUA	National Institute of Urban Affairs
NLP	Natural Language Processing
NUDM	National Urban Digital Mission
OECD	Organisation for Economic Co-operation and Development
OSM	Open Street Map
PII	Personally Identifiable Information
SDG	Sustainable Development Goals
SOP	Standard Operating Procedure
UNCDF	United Nations Capital Development Fund
UNDP	United Nations Development Programme
VR	Virtual reality
WCRP	World Climate Research Programme

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Introduction – defining digital urban futures

“ **The future is digital, defining how we will live, work, and interact with each other.**

Whether technology becomes an empowering force for good or a sower of more division and exclusion will depend on the choices we make now. ”

Achim Steiner, UNDP Administrator, (from his address to the UNDP Executive Board, 2023)

Cities have emerged as vital drivers of sustained and accelerated economic growth, coinciding with the rapid transformations brought about by industrial revolutions. The 'digital' revolution or the fourth industrial revolution has completely changed the way human beings live, akin to all the previous industrial revolutions. For the first time, the power of technology can be harnessed towards integration of the physical, digital, and biological realms to create universal benefits. Digital technology has been called the 'great equaliser' that can shape a human centric society.

Digital Transformation is a prominent priority highlighted under India's G20 Presidency and Japan's G7 Presidency for harnessing Digital Public Infrastructure (DPI)¹ and promoting Data Free Flow with Trust (DFFT)² respectively. Given that cities contribute to more than 80 percent of the global GDP (World Bank, 2023), the strategic utilisation of digital technologies in urban management can drive sustainable growth and foster innovation. Thus, "Catalysing Digital Urban Futures" has been identified as a priority under Urban 20, one of the engagement groups under G20. The deliberations in all three forums recognise that it is essential to address common governance challenges, placing particular emphasis on bridging the digital divide and nurturing the advancement of knowledge societies to have global impacts.

The term "digital future" refers to the ever-evolving

landscape of technology and its impact on various aspects of our lives. It encompasses the ongoing advancements in digital technologies, such as Artificial Intelligence (AI), Machine Learning (ML), Internet of Things (IoT), blockchain, Virtual Reality (VR), Augmented Reality (AR), and more. However, the exact manifestation may vary depending on contexts, choices of technology, aspects of inclusion, technological advancements and societal changes. In the urban context, Digital Urban Futures refers to the future trajectory and potential outcomes of application of digital technologies and innovations in the context of urban development. It encompasses the evolving landscape of urban areas as they embrace and integrate digital advancements to create smarter, more sustainable, and more connected cities. While cities have been utilising digital technology towards more effective operations and delivery, some of the emerging applications of digital technology in the urban context are the following:

- A. Simulation Technologies support in simulating scenarios to model urban environments. Utilising advanced visualisation techniques, planners, designers and decision makers are enabled to make informed decisions. These techniques have been proven to work very well for new and green-field developments. Cities across the world are also using these for projection of environmental impacts, leading to better evaluations and environmentally sensitive planning. Combined with data processing and analytics such as AI and predictive

1 DPI are a set of shared digital building blocks, such as applications, systems, and platforms, powered by interoperable open standards or specifications with principles of inclusive, foundational, accountable. They are accessible to everyone and facilitate data exchange and enable essential society-wide functions and benefits by inviting participation from all relevant actors in the ecosystem. The benefits of DPIs span across all 17 SDGs.

2 DFFT refers to a set of rules, regulations and policies to enable trustworthy cross-border data exchange and invigorate the digital economy

analysis, ML etc. simulation can support in monitoring, management and mitigation of effects of disaster risks and impacts in the face of escalating extreme events (Satterthwaite & Dodman, 2023) such as heat waves, flooding, heavy precipitation and droughts, etc. Further, creation of integrated city operations centres help in sustaining the application of simulation and integration of technology for better predictive capacities at city level.

- B. Cities are generating and collating data every second from numerous sources and in multiple ways. With adoption of digital systems for operations, service delivery and monitoring, this becomes faster and more voluminous and cities can have very rich datasets that develop transactionally, leading to creation of Big Data (Oracle India. n.d.). Once cities overcome issues of managing such voluminous data, big data can be utilised to address issues with urban systems that were not understood before and help a city in serving its people better.
- C. Promoting cross-border multi-stakeholder approaches for the development of international technical standards for emerging technology, especially AI is critical (Komiya & Mukherjee, 2023). In order to promote responsible AI, countries would have to be respectful of legally binding frameworks, and recognise the importance of procedures that ensure transparency, accountability, open and fair processes, privacy and inclusiveness.
- D. A self-building AI framework capable of providing self-learning and self-adapting capabilities within an unsupervised learning paradigm (Alahakoon et al., 2020) such as the Growing Self-Organizing Map (GSOM) algorithm can be integrated in city functions. The GSOM algorithm and its extensions can be used by cities to develop a 'positioning' mechanism for local incidents and detected patterns. This can provide a Global Position Map for the local on-site applications and for integrated global processing where appropriate.

Cities have to prioritise the digital imperative³ in their governance not only as a driver of sustainable urban transformation but also as a constant catalyst that enables cities to keep up with evolving developments in technology, demographics, economics, sociology, and other relevant areas. City governments face mounting pressure to address increasingly complex problems around planning and management and efficient delivery of government services⁴. Therefore, it is crucial to ensure responsive and collaborative governance of cities with digitalisation as a key priority in urban development plans and cities assuming the role of incubators for innovation and digital transformation across all sectors.

Cities have been unable to fully capitalise on the social and economic advantages of urbanisation and transfer

the resulting benefits to their citizens. Limited resources as well as technical capacities are two consistent issues that hinder this ability leading to inequalities social segregation, particularly in terms of access to essential necessities, which is exacerbated by the digital divide. By placing the digital imperative at the centre of city governance, digitally empowered cities can be created with a holistic view of city functions and resources being utilised. Moreover, such cities can effectively leverage technology towards unlocking of silos, optimisation of resources, enhancing sustainability measures, fostering inclusive and resilient urban development, driving collaboration and forming testbeds for innovation.

The discourse around "smart cities" places digital innovation at the core of sustainable urban development, by aiming to construct urban environments that are not only more efficient but also highly liveable (OECD, 2019). One of the most significant possibilities unleashed through digital transformation is integrated city operations, where inter-connected systems, common and shared databases and data-driven platforms shall enable seamless allocation, coordination, and management of various urban functions and assets. Connectivity also enables cities to function as a network promoting peer-to-peer learning opportunities and adapting each other's learnings to be relevant in their own context.

Cities can themselves become platforms for knowledge exchange and collaboration given the rise of online knowledge networks and communities. Further, digital transformation may also empower cities to serve as 'Urban Living Labs' or 'Innovation Incubators' for testing, refining and scaling up emerging technologies and data-driven solutions to effectively address urban challenges. These possibilities can be encouraged by exploring DFFT, DPIs, interoperable solutions, and open-source technologies as key enablers. In fact, the option or flexibility to adopt any digital technology as per the relevant context of a city/country is essential for digitalisation to truly become a catalyst in achieving sustainable urban futures.

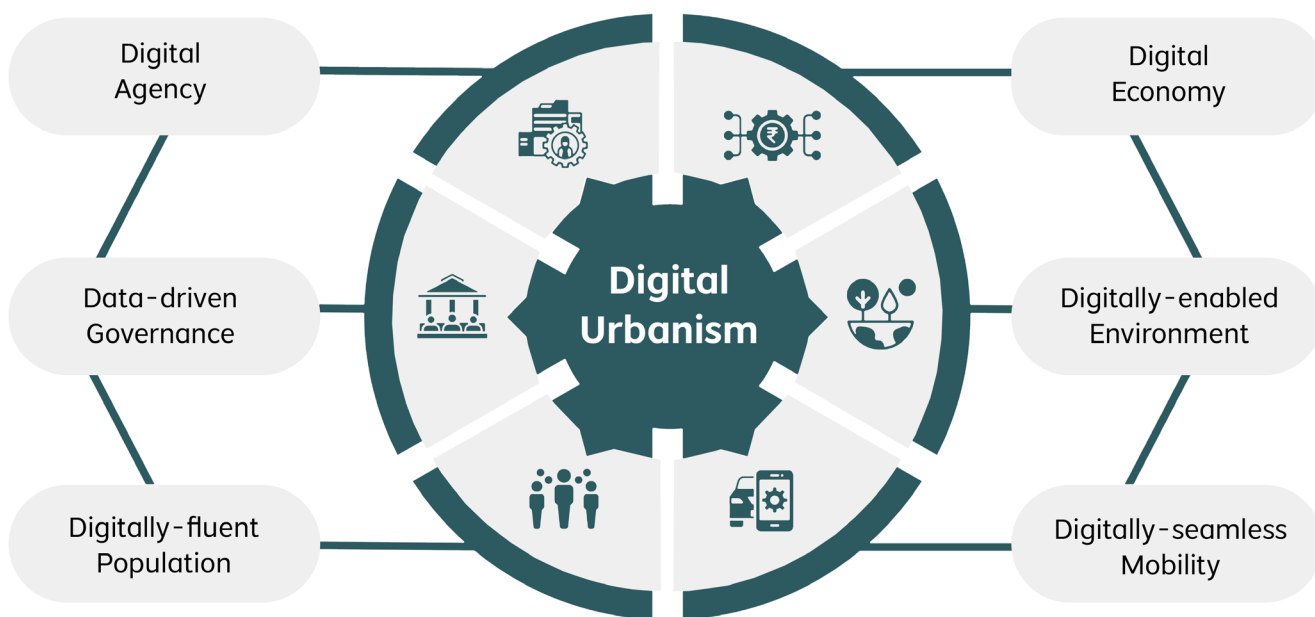
Information and communications technology (ICT) and advanced interconnectedness also entail significant risks, such as misinformation, misuse of data, inequitable access to digital initiatives, cyber-crimes, breach of privacy, and prejudicial and monopolistic business approaches, amongst others. However, not utilising digital technologies to enhance urban functioning and myriad urban complexities would not be advisable in today's time and age. Thus, to ensure cross-cutting technological interventions in all domains and build safeguards against all these threats, it is essential that there is inter-agency coordination and

3 The digital imperative revolves around maximising the potential of technology to achieve greater outcomes with fewer resources, enabling an organisation to stand out and strengthen its resilience.

4 Government services include Government-to-Citizen (G2C), Government-to-Business (G2B), Government-to-Government (G2G)

that suitable regulatory, governance, and educational responses are garnered. It is imperative to enable cities to mindfully leverage digital technology to become smart and sustainable and more productive, inclusive, safe and resilient.

In this digital era of rapid urbanisation and technological advancements, the journey towards digital urban futures is a long-term transformation process that requires ongoing collaboration, investment, and the engagement of all stakeholders. Digital Urban Futures hold the potential to transform cities into more efficient, liveable, and sustainable environments. By embracing digital technologies, data-driven approaches, citizen engagement, and innovation, cities can tackle urban challenges, improve quality of life, and create vibrant and resilient urban communities. The figure given below is a diagrammatic representation of the ecosystem of digital urbanism.



Ecosystem of digital urbanism
Source: Authors' depiction

02/

Challenges in ensuring sustainable digital urban transformations

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*Looking to the future,
two seismic shifts will shape the 21st century:
the climate crisis,
and digital transformation.*

”

- Secretary General's Nelson Mandela Lecture: "Tackling the Inequality Pandemic: A New Social Contract for a New Era"

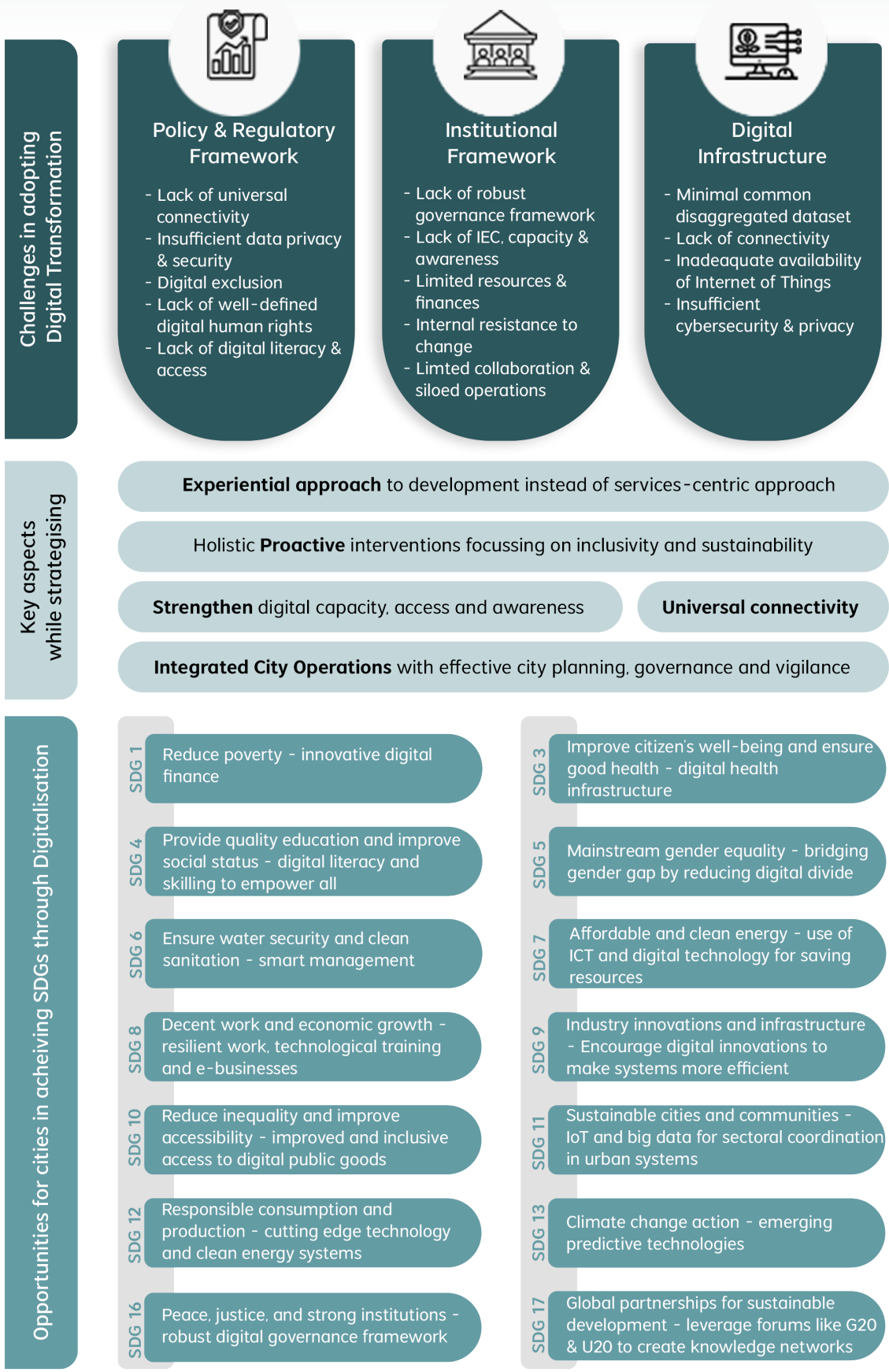
Cities operate as intricate ecosystems characterised by numerous interdependencies, making them susceptible to challenges and risks when undertaking transformative initiatives such as digitalisation of the urban systems and services. It is essential to be cognizant of the challenges and negative externalities that would arise out of application of new processes. At local level, such challenges surface where services and infrastructure are seldom able to match those that are planned and implemented through a top-down strategy and consequently, manifest as vulnerabilities or barriers. These barriers are experienced not only in city functions but in all geographies and sectors where economically, infrastructurally, and digitally mature entities or systems are intermixed with ones that are yet to achieve the same level of developmental maturity. Different countries and cities may encounter different challenges and in varying degrees across various phases of digitalisation from adoption to operationalisation to ensuring security and equity of its use and application. Many of these issues are also entrenched in the design of the existing institutional and governance structures, which is unsuitable for quick adaptation to a digital mode of functioning. Thus, to achieve systematic and phased digitalisation at city level, it is essential that national and sub-national policies are aligned with the local needs.

Another aspect that would facilitate resolution of a number of challenges is multi-stakeholder buy-in and coordination, especially between the government and the private sector. This partnership is crucial for successful digitalisation. While private sector entities can make long-term

investments in research and development, as well as swiftly commercialising and implementing technologies, the government at various levels can implement effective regulations, align funding cycles to promote technological advancements in critical areas, and ensure seamless connectivity and adoption of technology-enabled systems by users, citizens and workforce. Any technology can only be impactful if it is thoughtfully deployed.

Effectively leveraging digital technologies for sustainable and inclusive urban development requires a comprehensive understanding of the inherent challenges. Hence, it is critical to sensitise decision makers as well as the citizens about human and institutional behaviour in interaction with technology. This will inform multiple strategic choices including creation and effective use of digital infrastructure, choice of relevant and fit-for-purpose technologies, choice of programs and priorities to drive development, and choice of regulatory and governance mechanisms to ensure oversight and risk.

Figure on next page summarises key gaps, key strategic aspects and opportunities for cities while adopting sustainable digital transformation. Responses to these challenges will come from governments at multiple levels: city, regional, country, and possibly global / multilateral; and shall also have to involve a mix of actors outside government, including private industry as well as civil society or citizens' organisations.



Key gaps, key strategic aspects and opportunities for cities while adopting sustainable digital transformation

Source: Authors' depiction

By leveraging existing strategies where applicable, valuable time and resources can be saved. Some of the key barriers while adopting digital transformation are specifically related to the aspects mentioned below:

A. Digital infrastructure and universal connectivity:

Approximately 3.7 billion people do not have access to the internet presently, especially in the Least Developed Countries (LDC) (United Nations, n.d.) that have on an average only 19% people connected to the internet (United Nations, 2021). The major challenge faced by countries is the establishment of national, sub-national and local digital infrastructure; and achieve universal and affordable digital connectivity.

B. Digital Divide is a huge barrier to achieving digital urban futures that are also inclusive. It is essential to acknowledge that concepts of digital access and inclusion are significantly influenced by society and context and thus defining these terms is essential at national level for all sub-national and local governments to be guided by a universal code of conduct in this regard. Recognising the reality of digital divides, cities must take into consideration the impact of any proposed technology on various groups of residents. Factors such as political and climate crises, terrorism, territorial conflicts, forced displacement and economic inequality all amplify the digital divide making access to digital opportunities even more difficult⁵. It is important to note that facilitating digital access to services and goods should not jeopardise equitable access that may have been possible in non-digital formats.

C. Digital Human Rights are often not incorporated while provisioning IT initiatives. "Digital" rights are interpreted as existing human rights which need to be protected in the context of digital technologies as physical and digital spaces are increasingly intertwined (UN-Habitat, 2022b). While digitalisation has led to advancement of human rights in many ways, misuse of digital technologies leads to violation of human rights online as well as offline. The UN urges all countries to ensure that digital human rights are at the heart of all regulatory frameworks and legislations related to digital technologies (United Nations, 2020b). This is especially imperative in the case of digital technologies being utilised for facilitating access to basic services and social schemes. In such cases if human rights and inclusion is not safeguarded, it can result in lack of trust in the government as well as of digital systems and processes.

D. Government process reengineering (GPR) is one of the requisite steps to adopt digital systems since resistance to change and inertia of existing bureaucratic systems are prime deterrents to a successful digital transformation. Many government processes are rooted in traditional, paper-based approaches, making it difficult to transition to digital systems seamlessly. These approaches can hinder the agility and flexibility required for transformation initiatives. GPR ensures a systemic change and promotes ease of doing business by streamlining processes and workflows, thus bypassing administrative hurdles. This requires careful examination and reengineering of existing administrative functions to eliminate redundant or time-consuming tasks. Moreover, ensuring inclusivity and accessibility while reengineering existing workflows as well as procurement processes is essential to prevent the creation of digital divides and ensure equitable access. Addressing these challenges and concerns through strategic planning, robust change management, and continuous evaluation are key parameters to enable successful GPR. There are three essential aspects to take care of at city level:

- **Institutional restructuring** - The institutional set-up and staffing in cities presents a significant challenge. It is essential to transform the organisational structure to ensure that individuals with a strong understanding of technology are placed in decision-making positions and data scientists/experts are hired by various levels of government.
- **Capacity Building** - The presence of leaders who understand technology greatly facilitates the adoption of digital initiatives. There is a lack of digital capacity at all levels and this barrier needs to be addressed for government officials to remain relevant in a digital age. Targeted capacity creation and capacity building has to be ensured for comprehensive digital transformation. Citizens also lack the knowledge and skills to access and fully utilise the benefits of digital technologies. Thus, cities must formulate programmes and schemes to orient people towards using the digital provisions effectively.
- **Earmarking finances for adoption of digital systems and innovations** - The existing municipal budgets hardly account for costs related to digital infrastructure and services that the city may be requiring. This leads to sporadic investments by cities on singular and disconnected technologies and various systems remain disconnected and incompatible. This lack of interoperability of systems and technologies leads to inefficiencies in governance and service delivery.

⁵ This is especially true of already-marginalised communities, since the digital divide is likely to be replicated and amplified along the lines of these pre-existing marginalisations. These challenges especially affect women, migratory populations, older generations, people with disabilities and indigenous populations. Additionally, individuals lacking the necessary digital skills get excluded from the digitalized economies if proper digital literacy and upskilling efforts are not included in the strategy.

E. Data management and governance: Multiple challenges are faced at all levels of governments in this regard. Cities with efficient data management can drive governance decisions more effectively. Presently, the data being generated and owned across departments, agencies and institutions is in non-standardised formats and stored in silos. Lack of standardisation and absence of common and shared data bases leads to inefficiencies. While many cities are adopting powerful systems and platforms, most lack the required internal skill sets and capacity. There are also risks and concerns over security and privacy. Municipalities commonly become targets of cyber breaches that can be mitigated by having robust ecosystems. In 2020, municipalities were the target of 44 per cent of ransomware attacks globally (Verizon, 2022). With enormous data being constantly generated, it is also essential for cities to manage it, which includes processes for proactively collecting, organising, protecting, storing, and sharing data. Following are a few major challenge areas related to data management and governance:

- **Appropriate and effective data generation:**

While every digital application used by a person is collecting data of some kind, the sensitivity, protocols and existing models for ensuring proper consent for data collection and sharing are inadequate⁶. Additionally, data collection has to be targeted to obtain information that would eventually lead to decision making that would positively impact a majority of stakeholders/ people. This is not the case in many cities especially in developing countries as there is lack of systematic methodology or processes to carry this out effectively. In fact, the funds and skills required for effective data collection are also inadequate as an IT cadre including positions for data scientists or statisticians are not traditionally part of a city's administrative set-up.

- **Data protection, data privacy and data security:** Rapid digitalisation and multi-stakeholder involvement results in government, police forces, and private agencies having unfettered access to Personally Identifiable Information (PII) of the users⁷. Historically, such data has been misused to significantly exclude marginalised communities (Amnesty International, 2021; 2022). This results in inequitable access to services and amenities. The challenge lies in effectively managing the secure collection, utilisation, and sharing of data. As cybersecurity is a cross-border and intersectoral

subject, lack of national regulatory frameworks will hamper strengthening cybersecurity measures. The exponential surge in digitisation of critical services and infrastructure exposes residents to various vulnerabilities and risks. Countries have lost trillions of dollars to data breaches and billions in lasting damage to IT hardware necessary for key societal and economic functions (ITU, 2019; UNCDF, 2022). Repeated instances of breach in cybersecurity, ransomware attacks, theft of individual data, and compromised devices are all examples of such risks and costs. For the users, this results in reluctance in adoption of digital initiatives, services and goods while also impeding digital wellbeing and trust in technology.

- **Leveraging Big Data:** Massive volumes of data are generated every second, and most cities are hardly strategising data harvesting. Application of human resources as well as AI to become digitally smart, providing more effective services and predictive systems that can warn in advance about various risks, thus helping save unnecessary loss of life, time, and money. However, the large volumes of structured, semi-structured and unstructured data from millions of devices and sources, has little or no use unless it is analysed and processed into actionable information. In fact, this 'infodemic' or abundance of both accurate and inaccurate information (World Health Organisation, 2022) tends to reduce its quality and people's trust in its validity. It hinders the capacity of users to identify trustworthy sources of information and compromises the impact of evidence-based responses that could be provided by governments and service providers. Big Data Analytics is the answer but is being utilised more by private sector entities to improve products and services rather than by government agencies. The concept of smart cities has been debated in one strand of literature that argues that data can provide cities the power to put citizens under surveillance and exercise control on various aspects of urban living (Kandt, J and Batty, M, 2021). This is however, an extreme view, as cities, especially in developing countries lack the resources and capacities to process the data being collected by various applications and devices into usable information. In order to use the 5Vs⁸ of Big Data effectively, city governments would need extensive institutional restructuring and capacity building.

6 Even if data collection / use / sharing frameworks are in place, weak or redundant data protection systems still expose individuals to harm and risk. Unauthorised or non-consensual sharing or disclosure of data can disproportionately affect religious and ethnically diverse groups, as well as marginalised communities, including LGBTQI+ communities.

7 An individual's activities, movement, and personal associations can be tracked, both spatially and in digital domains, potentially without their knowledge or consent. Whether due to lack of awareness, lack of meaningful options, or lack of policy / regulatory oversight and response, access depends on such privacy infringements, leaving individuals unable to meaningfully opt out of surveillance.

8 Volume (size and quantity of the data); Velocity (rapidity with which data is generated and continuous flow of information); Variety (innumerable heterogeneous sources of data and types of data); Veracity (accuracy and quality of data that is impacted by the 'variety' resulting in inconsistencies); Value (how much of the data can be converted into usable and actionable resource)

- **Balancing digital dependence** is being experienced by cities with advanced digitalisation. In sectors and services where the original analogue systems are completely digitalised and dependent on software, the associated tacit knowledge and human improvising is also completely replaced. This has resulted in severe disruptions such as interruption of train services and subway systems coming to a standstill as the software controlling these systems malfunctions. The past decade has seen a rise in such incidents. Townsend (2013) has given numerous examples of varying scale to describe this dependence for e.g. automated toilet flushes and crashing of the till of the supermarket brings all shopping to a standstill as products cannot be scanned and payments cannot be made. More

recent literature sees debates about complete digital control versus a hybrid model and argues that whilst digitalisation takes care of myriad of inefficiencies in urban systems, it also makes the city services vulnerable and dependent, exposed to security breaches, viruses and crashes. Networked and distributed systems and services that are software enabled can face catastrophic consequences due to software malfunction. They also face the challenge of having to be routinely patched and updated to cope with new contingencies. Thus, with systems becoming ever more complicated, interconnected and dependent on software, the challenge of producing stable, robust and secure devices and infrastructures increases.

03/

Recommendations for Catalysing Digital Urban Futures

“ Education and digital technology must be two great enablers and equalisers. ”

-Secretary-General's Nelson Mandela Lecture: "Tackling the Inequality Pandemic: A New Social Contract for a New Era"

Cities of the future shall rely heavily upon integrating digital technologies into their operations, governance and planning to enhance the efficiency of the urban systems and enhance the quality of life of citizens. Given the promise that digital technology can generally be low-cost, low-energy, equitable, time-saving as well as highly effective, its adoption is inevitable in cities. It is expected that cities will change their functioning from being reactive to immediate challenges and problems to being proactive by utilising data to understand needs of people and by using predictive technology for increasing preparedness and become more transparent, efficient and resilient. Leveraging digital technologies also presents an opportunity to accelerate efforts towards sustainable urban development.

Thus, in the future, creating integrated and interoperable digital urban management systems shall become the norm for cities to fulfill existing and forecasted needs, optimise utilisation of resources, ensure effective provisioning of urban services, mitigate climate change impacts and build risk resilience. While digitalisation is a necessity, it can only play the role of a facilitator of processes and an instrument to provide solutions for systemic problems. Simultaneously, it is important to develop and implement multiplex strategies (i.e., across all levels of governance and in collaboration with private sector and civil society), and identify and address potential gaps and fragmentation in global technology governance (G7 2023 Hiroshima Summit, 2023).

The UN Secretary-General's High-level Panel for Digital Cooperation convened from 2018-2019, and was informed by a series of roundtable discussions with key stakeholders from Governments, the private sector, civil society,

international organisations, academic institutions, the technical community, and other relevant stakeholders (UN, 2020). The Panel recommended strengthening of the Internet Governance Forum (IGF) and collective effort towards building a co-governance and digital commons architecture. The Panel set out eight key actions to enable digital cooperation as shown in the figure below.

Key recommendations of this white paper to enable urban digital transformation are:

- A. Facilitating international cooperation on technological diffusion and creation of collaborative global protocols for digital governance** - Digitalisation has immense benefits and can enable an interconnected global knowledge network and facilitate seamlessly connected trade and economic production. Ensuring standardisation and protocols at the global level is necessary to enable universal and equitable distribution of the benefits of the digital economy.
- Promoting peer-to-peer learning environments and leveraging open databases to gain information and sharing tools is a key recommendation. This will help countries and cities refer use-cases for how to use existing tools for planning, design and investment in digitalisation. Leveraging existing platforms such as G7, G20, IGF, ITU, GDC, DPGA, CODES, etc., to work on global digital cooperation and innovation is the way forward. Global networks like UCLG and C40 facilitate peer-to-peer learning among cities to address climate change. Similar platforms can be created for knowledge sharing on digital strategies and to foster collaborations between government agencies, private sector entities, academic



Eight key areas of action for enabling digital cooperation

Source: Adapted from the UN Secretary-General's High-level Panel for Digital Cooperation, 2018-19

institutions, and community organisations and provide opportunities of partnering with interested organisations such as start-ups and promote new ideas in the ecosystem to drive innovation even across sectors inventions.

- Creating collaborative guidelines and standards for data security, data sharing, digital public goods and digital infrastructure - for seamless technology diffusion and to maximise benefits of digitalisation globally, such guidelines are imperative. Creation of an 'alliance' represented by all countries would be the way forward. Such multi-stakeholder efforts have to be initiated towards creation of digital public goods: open source software, open data, open AI models, open standards and open content (UN, 2020), while taking into consideration safety and privacy issues.
- Ensuring global standards on digital inclusion and digital human rights - Digital divides whether among nations or within countries among people only reflect and at times amplify the existing social and economic inequalities. In order to 'not leave anyone behind', global cooperation is required in this regard to understand the multiple typologies and contexts of digital divides and create collaborative policies and guidelines to mitigate the same. It is essential

to develop a global understanding and agreement on digital human rights and formulate regulatory frameworks on aspects such as right to internet access, content governance, data protection, digital ID, surveillance etc.

- B. Creating a favourable national, sub-national and local digital governance ecosystem** - Concerted policy reforms will be necessary at national level to devolve certain specific powers and functions to sub-national and city governments given that 'digitalisation' is a relatively new process. Increasing digital capacities by skilling and upskilling across all levels in the ecosystem to promote uptake and boost innovation, including by ensuring widely-accessible quality education (G7 2023 Hiroshima Summit, 2023) and life-long upskilling opportunities. At sub-national level, the focus should be on instituting an oversight mechanism to ensure local public authorities at local levels are effectively delivering their responsibilities.

- At the local level, formalising revenue instruments for strengthening finances of local governments are key enablers for the cities to contextualise solutions which are sensitised towards local issues. A robust, well-informed, and well-resourced city

administration is desirable to enable sustainable and contextual urban digital transformations. Adopting a City Systems Approach shall promote a connected, data-driven ecosystem that enhances urban life, improves service delivery, and addresses key challenges faced by cities making them more efficient, sustainable, and responsive to the needs of their citizens.

- Reforms in procurement processes and onboarding methods are needed to help all levels of governance build new partnerships and break vendor lock-ins. Having the agility in procurement processes provides the countries and regional⁹ governments with the power to onboard private players to implement solutions effectively at speed and scale.
- Reforms in financing frameworks to foster sustainable financing of digital infrastructure (including data) and digital transformations through innovative financing mechanisms such as digital financing, outcome or results-based financing for optimal use of the resources, innovation and growth. Countries and their cities may also allocate dedicated budgets to support innovation. Investments in digital transformations with a circular and inclusive focus rooted in the country's context shall support long term development. At a national level, these could especially focus on convergence in investments across various sectors to solve common issues¹⁰. Envisaging a circular strategy shall ensure streamlined implementation ensuring last-mile connectivity. Further, providing the regional or city level an opportunity to localise and add to the national strategy, developed with stakeholders across the quadruple helix (Curley, 2015) ensures a richer and more inclusive variation and implementation. Moreover, incorporating innovative private concepts and private investment into this equation fosters rapid and widespread transformations.
- Provision or upgradation to a robust digital infrastructure integrated with vertical and horizontal value chains in the urban ecosystem. Inclusive technologies and uninterrupted and affordable digital services as public utilities for all may be a mandate that could be adopted by countries, especially those with lower levels of ICT infrastructure and digitalisation in place today. An approach that focuses on shared building blocks and innovation across the ecosystem, with global/ multilateral collaboratives supporting the development of such building blocks, capabilities, and frameworks may be adopted.

- Creation of appropriate capacities and building digital skills of senior administrators and government employees has to be done on priority basis by providing them training and resources to equip them with the knowledge and tools to effectively leverage digital technologies and contribute to the transformation efforts. Promoting peer-to-peer learning among administrators is necessary to learn from tried and tested use-cases and gain information on tools, processes and investments

C. Enabling policies, strategies and frameworks for digitalisation – This integrates aspects of digital technologies such as circularity, agency¹¹, and power dynamics for all domains are the foundation to successful digital transformation and can keep pace with emerging technologies and unregulated development. These regulatory frameworks and policies should also be technology agnostic and focus on intended outcomes rather than prescribing specific technologies, as the latter keep changing rapidly. This approach allows for flexibility and encourages innovation by avoiding unnecessary restrictions on emerging technologies. Furthermore, policies should be inclusive and cater to diversity.

- It is recommended that countries develop their respective National Digital Policies that align with established global guidelines and standards. These policies can be tailored to suit the specific requirements of each country with pathways and the pace of technological transition and digitalisation adapted as per the development trajectories of every country. The national policies can further promulgate policies at sub-national and local level with more specific regulations and standards, oriented towards local needs and ensuring that investments are not wasted on outdated, expensive, or underperforming infrastructure.
- A framework for data management and strategy oversight may also be developed by countries at national level, adopting and adapting existing global protocols for the same. This framework would comprise organisation and implementation strategy for policies and regulations, institutions and processes, and people (roles and responsibilities) which outline and enforce rules of engagement, rights, and accountabilities for the effective management and governance of data assets (UN DESA, 2022) and are inclusive and respectful of diversity. Such frameworks could also be adopted by organisations. A good example of this is the United Nations Secretary-General's Data Strategy.

⁹ Regional/ state/ provincial level is a subdivision of government, which shares political, fiscal and economic powers with a central government. In a federal government, the regional level is represented by a state government. In unitary states, a regional government is known as a provincial government.

¹⁰ One example could be addressing SDG 6 - ensuring water security and clean sanitation which cuts across urban, climate, energy, health with technology being the common denominator.

¹¹ Agency can be seen as an embedded capacity for reorientation of (networks of) systemic components.

UN's Data Strategy: A Roadmap to Data-Driven Transformation

The United Nations Secretary-General's Data Strategy is a comprehensive framework that aims to enhance data availability, quality, analysis, and utilization for informed decision-making and effective implementation of SDGs. Key objectives of the strategy include promoting data-driven decision-making, fostering data innovation, strengthening partnerships for data collaboration, ensuring data governance and ethics, building data capacity, and emphasising data disaggregation for inclusivity. The roadmap, consisting of 30 immediate next steps and over 120 recommendations, aims to foster stronger enablers and nurture better capabilities. By adhering to the principles and recommendations outlined in the United Nations Secretary-General's Data Strategy, organisations can navigate the complex landscape of data management, utilisation, and governance, ultimately progressing towards the transformational stage in data maturity by 2030 (United Nations, 2020a).

More information is available at <https://www.un.org/en/content/datastrategy/index.shtml>

D. Ensuring equitable digital urban transformations -

Establishing appropriate regulatory and governance frameworks that balance innovation, privacy, security, and ethical considerations are essential to ensure that the benefits of digitalisation are maximised while mitigating potential risks. Countries should formulate Digital Transformational Strategies incorporating aspects of digital human rights, digital equitable inclusivity, digital access and consent as well as preventive and mitigative measures for digital violence. At the global and country levels, aspects of strengthening cyber capability and developing dedicated computer emergency response teams (ITU, 2019) may be included as part of any digitisation initiative. Further, these transformational strategies should be synchronised with existing policies and actions to reduce digital gaps; apply a gender lens to all digital interventions, and; be flexible to include solutions for migrants, people in conflict-affected situations and at

the time of disasters. These should advocate for a hybrid intersectional, human rights-based, systemic approach to advancing meaningful digital access and consent during rollout of transformation initiatives.

- Regional or city levels could identify priority areas from the broad agendas of the Transformational Strategy and evolve/ contextualise them in a phased manner with special focus on promoting digital access, rights, and agency to eliminate inequalities. Participatory governance may also be included as a key feature to engage citizens in the decision-making process and leverage their insights and feedback to ensure that data-driven decisions align with the needs and aspirations of the community. This aspect can enhance the capacity of city systems to design and implement locally-relevant responses as was experienced in Copenhagen and Barcelona, described in the box below.

Digital Urban Innovation: Copenhagen and Barcelona

Copenhagen, Denmark, commits to sustainable urban development through circular and inclusive digital transformations. "Copenhagen Solutions Lab," a digital platform, enables citizen participation in shaping the city's future. It fosters collaboration and innovation for urban challenges, including transportation, energy, and waste management. This approach promotes a circular economy mindset and empowers citizens to contribute to the city's development (State of Green, n.d.). More information is available at <https://stateofgreen.com/en/solution-providers/copenhagen-solutions-lab/>

Barcelona, Spain has implemented a comprehensive strategy known as "Barcelona Digital City" to bridge the digital divide and promote digital access, rights, and agency for all citizens. The city has focused on ensuring affordable and high-speed internet access throughout the city, including in low-income neighbourhoods. Additionally, Barcelona has established digital inclusion programs that provide training and resources to marginalised communities, empowering them to fully participate in the digital era. Barcelona City Council's "Smart City Fund" encourages collaboration between public and private sectors to develop innovative solutions that address urban challenges and promote digital transformation in the city. It has also established policies and guidelines to safeguard personal data and ensure transparency and accountability in the collection and use of data by the city and its partners (Ajuntament de Barcelona, n.d.). More information is available at:

https://ajuntament.barcelona.cat/digital/sites/default/files/pla_barcelona_digital_city_in.pdf
<https://ajuntament.barcelona.cat/digital/en>

E. Enhancing ability and agility to adopt emerging technologies - New technologies have emerged that are often associated with disruption and have the potential to fundamentally alter processes and operations to revolutionise governance and service delivery through digitalisation. However, these are still evolving and the knowledge of their application and potential is restricted to a few individuals/ agencies. Cities and other levels of government have to increase their risk appetite and find ways to encourage experimentation with such technologies to find their most suitable solutions to barriers in service delivery. In the context of cities, some of the emerging and potentially disruptive technologies include spatial technologies, new user interfacing capabilities (NLPs, touch, computer vision), data processing and analytics (machine learning /Artificial Intelligence (AI) / robotics, open data, data exchanges), simulation technologies (virtual worlds, digital twins, cyber physical systems), distributed databases (block chain), etc.

- Cities and other levels of government are seldom characterised as 'tech-savvy' and generally tend to hire consultants to advise on adoption of new technology. While that can be done, the city still needs the in-house know-how to understand whether the solution provided by the consultant would be suitable or not. Every government agency must create special units/ divisions/ positions with substantial know-how about emerging technologies and the wherewithal to adopt and adapt them to city functions and operations.
- As governments become equipped to adopt, implement or discard emerging technologies based on their needs, checks and balances are needed in the governance system to ensure that systems retain the shared democratic values such as inclusivity, transparency, accountability, safety and security, protection from online harassment, hate and abuse, and respect for privacy and human rights, fundamental freedoms, and the protection of personal data (G7 2023 Hiroshima Summit, 2023).
- Any government agency will become more comfortable with adopting new technology once they are able to assess the benefits of leveraging technology already employed in urban systems

such as those that can identify patterns, predict trends, optimise resource allocation, and support decision-making processes across various urban sectors.

F. Formulating and implementing a Digital Strategy at city level - This should include a multiplex arrangement to ensure a robust technology adoption roadmap taking into account all the challenges. The transition would also involve testing through pilots and proofs of concept as well as making the right choices of technologies (open source, proprietary solutions etc), approaches (agile, waterfall model, etc.) before scaling up the solutions. The strategy must recommend innovative financing models for creating and maintaining digital infrastructure and that cities adopt existing and available DPGs such as standards, data models and APIs, digital blueprints, specifications, software components developed globally or at national level. This could substantially reduce investment and time for development and deployment of solutions and also provide the benefit of contextualization of the existing solutions. Amsterdam is a good example for implementing such a strategy as given below.

- Encouraging interoperability through open-source transparent protocols, open Application Programming Interface (APIs), interoperable, non-discriminatory data platforms / solutions to eliminate functional bottlenecks and maximise the benefits of innovations should be prioritised in the City Digital Strategy. Collaborative development of technical and urban services standards, data models and APIs, data sharing protocols, blueprint and architecture and technical solutions as Digital Public Goods (DPGs)¹² to facilitate ease of sharing, analyses and quantitative and qualitative comparisons in order to inform specific levels of governments and services should be encouraged. This shall also optimise consumption of resources by promoting interoperability and contributing to GPR by streamlining the workflows and processes between various city departments. The box below presents examples of various standards, open APIs, interoperable, non-discriminatory data platforms / solutions being used around the world.

Amsterdam's Leading Role in Circular and Inclusive Digital Transformations

Amsterdam, Netherlands invests in circular and inclusive digital transformations. "City-zen," a digital platform, enables real-time energy monitoring and management by residents. Leveraging smart grids and digital solutions, Amsterdam cuts energy consumption, increases renewable energy use, and engages citizens in sustainable practices, positioning Amsterdam as a leading city in sustainable urban development (Euro Cities, 2019).

More information is available at http://www.cityzen-smartcity.eu/wp-content/uploads/2019/12/city-zen_d5-7_d5-10_d5-11_d5-12_d7-4_cityzen_smart_grid.pdf

¹² Digital public goods are open-source software, open data, open AI models, open standards, and open content that adhere to privacy and other applicable laws and best practices, do no harm by design, and help attain the Sustainable Development Goals (SDGs).

OpenStreetMap (OSM) is a global collaborative mapping initiative that offers free and editable geographic data. It operates on an open data model, enabling users to contribute and access a wide array of map features like roads, buildings, and points of interest. This community-driven approach has resulted in a highly detailed and comprehensive map dataset that rivals proprietary mapping services. OSM's data can be accessed and used for various purposes, including navigation, urban planning, research, and the development of location-based applications (OpenStreetMap, n.d.).

More information is available at <https://www.openstreetmap.org/about>

The **National Urban Digital Mission (NUDM)** of India, spearheads standards formulation in the urban and technical domains that can be adopted by individual cities. The 'knowledge and process (operational) standards' encompass terms, specifications, classifications, performance metrics, best practices, SOPs, and certifications to ensure accuracy and quality. The 'technology (software/hardware) standards' are essential for enabling interoperability and machine-readable data and consist of data models derived from knowledge standards, API specifications defining software interfaces, protocols for encoding messages, and data privacy and security standards in compliance with legal requirements. These standards ensure efficient data processing, & protection of sensitive information (NUDM, n.d.). More information is available at <https://nudm.mohua.gov.in/>

Mobility Data Specification (MDS), is a digital tool that enhances transportation management in public spaces. It facilitates standardized communication and data-sharing between cities and private mobility providers like e-scooter and bike share companies. It offers mobility service providers a reusable framework for seamless collaboration in new markets, leading to time and cost savings. MDS supports dynamic pricing, equitable access, and safety initiatives while significantly reducing operating costs and staff monitoring efforts in managing mobility programs (Open Mobility Foundation, 2023).

More information is available at <https://www.openmobilityfoundation.org/about-mds/>

The **Climate Data Model (CDM)** developed by the World Climate Research Programme (WCRP) defines a set of common data elements, including variables, units, coordinates, and attributes. This allows climate data to be exchanged and processed more easily, which can help scientists to better understand climate change and its impacts. The CDM is also used to develop climate data products, such as climate models, climate projections, and climate change impact assessments. It helps to ensure that climate data is accessible, consistent, and reliable to aid policymakers and other stakeholders who need to make decisions about climate change (WCRP, n.d.).

More information is available at <https://www.wcrp-climate.org>

The Health Claims Data Exchange (HCX) is an open source project inspired by the recommendations of the Joint Working Group of the National Health Authority of India and Insurance Regulatory and Development Authority of India. It aims to establish a protocol for exchanging health claims information among various stakeholders in a consistent, secure, and private manner. HCX functions as routing switches or gateways, specifically designed for the healthcare domain. The project was developed collaboratively by over 60 volunteers from different sectors of the healthcare industry and has undergone various enhancements over time (Health Claims Data Exchange, n.d.). More information is available at <https://docs.hcxprotocol.io/what-is-hcx>

The **Beckn Protocol** provides a set of recommendations and rules defining technical standards for industry, regional, or market participants. By adopting these specifications, Beckn functions as a transaction protocol, enabling seamless interactions such as discovery, ordering, fulfilment, and payment between buyers and sellers. Through the implementation of these specifications, a wide range of stakeholders including businesses, customers, and governments can establish integrated digital networks, opening up vast opportunities. Serving as a user-friendly and open infrastructure for digital commerce, it enhances market potential and ensures equitable participation for all market participants (Beckn, n.d.).

More information is available at <https://becknprotocol.io/imagining-with-beckn/>

- Creating a culture of leveraging data responsibly - by promoting creation and usage of minimum common open disaggregated datasets (leveraging DFFT) across all departments and service providers should be prioritised in the City Digital Strategy. These datasets may then be utilised for inclusive evidence-based policy making across various sectors. Anonymisation of datasets so as to mask Personally Identifiable Information (PII) is another crucial step to protect privacy and ensure that data collection, storage, sharing and usage adhere to guidelines and regulations of digital ethics. This shall foster public trust in open data and promote inclusiveness, transparency and accountability.
- Implementing open data initiatives that make relevant urban data accessible to the public, researchers, and businesses will encourage innovation, enable collaboration, and allow for the development of new digital solutions and services that benefit the city as a whole. It is also essential to ensure data integration and interoperability

among different urban systems and datasets to eliminate functional bottlenecks and maximise the benefits of innovations. By breaking down data silos and establishing data sharing mechanisms, cities can gain comprehensive insights and make more effective and informed decisions that span multiple domains.

Cities are constantly adopting digital systems to drive their planning, operations, coordination, monitoring, etc., hence, there can be very rich datasets that develop transactionally (i.e. during the running of these systems) with no additional efforts needed for data collection). These can then be vetted for safety and privacy considerations and used to derive insights that inform city-level decisions, provided as inputs for participatory and decentralised governance, and made open as a public good for innovators. A case study of evidence-based policy making is given in the box below (although it is not at city level, similar initiatives can work in cities).

Promoting Economic Mobility and Equality

The **Equality of Opportunity Project** was a research initiative led by economists Raj Chetty, John N. Friedman, and Nathaniel Hendren, aimed to understand the factors that contribute to economic mobility and inequality in the United States. By utilising large-scale administrative datasets of the Dept. of Education's College Scorecard covering all students from 1999-2013, the researchers analysed economic outcomes at a granular level to gain insights into the drivers of intergenerational economic mobility.

One key aspect of the project was its focus on studying inequality across various dimensions, including geographic areas, race, and gender. By examining differences in income, education, and upward mobility, the researchers uncovered the specific factors that shape economic outcomes and the transmission of advantage or disadvantage from one generation to the next. The project produced several significant findings, such as the impact of neighbourhoods on economic mobility.

The project emphasises the use of robust data and empirical analysis to inform policy decisions. By highlighting the importance of evidence-based approaches, the project encourages policymakers to rely on data and research findings rather than relying solely on intuition or anecdotal evidence. This shift towards data-driven decision-making can lead to more effective and efficient policy solutions (Chetty et al, n.d.).

More information is available at https://eml.berkeley.edu/~saez/coll_mrc_summary.pdf

- Encouraging urban innovation - by setting up Urban Innovation Incubation Centres / Urban Living Labs to provide opportunities of partnering with interested individuals, organisations and start-ups for a collaborative approach and promote new ideas in the ecosystem to drive innovation across sectors. These labs can actively encourage the inclusion of input from affected groups, facilitating the co-creation of innovative, context-specific solutions that contribute to systemic change for sustainable

urban development (Rao, 2023; The Hindu Bureau, 2023). These labs/centres can also support cities in prototype testing, training, skill-building, certification of Urban Digital Specialists and facilitate cascading of knowledge, investment, and technologies to the people at the local level for addressing on-ground contextual challenges. The box below gives a snapshot of a model adopted by European cities that leverage's ICT to catalyse urban regeneration.

Integrated Urban Regeneration and Smart Solutions

REMOURBAN is an urban regeneration model that harnesses the synergies between energy, mobility, and information and communication technology (ICT) to catalyse the transformation of European cities into Smart Cities. It is a comprehensive guide that outlines technical and non-technical innovations to promote smarter and more sustainable cities, encompassing various aspects such as citizen and stakeholder involvement, management and governance, business models, and financial instruments. It acts as a roadmap to support local authorities by assisting in goal-setting, progress monitoring, process streamlining, and the exploration of innovative solutions and business models for urban revitalization (Urban Regeneration Model, 2020).

More information is available at <http://www.remourban.eu/technical-insights/best-practices-e-book/best-practices-e-book.kl>

04/

Key takeaways & way forward

As urbanisation continues rapidly, cities face the dual challenges of meeting the aspirations and demands of their citizens while ensuring a sustainable future. Technology has always played a transformative role in society and presently digital technology is revolutionising the way people live their lives. This paper recommends placing the digital imperative at the centre of city

governance to leverage this transformative potential. The concept of "smart cities" emphasises digital innovation for sustainable urban development. Integrated city operations, enabled by interconnected systems and data-driven platforms facilitate seamless connectivity that transforms cities into networks, promoting learning, innovation, ease of living and ease of doing business.

01.

Facilitate international cooperation on technological diffusion and creation of collaborative global protocols for digital governance

- Promoting peer-to-peer learning environments globally, leveraging open databases
- Creating collaborative guidelines for data and digitalisation
- Ensuring global policies on digital human rights

02.

Create favourable governance ecosystems at the national and local levels to enable digital transformation

- Reforming financing frameworks and procurement processes for digital infrastructure
- Provisioning and maintaining digital infrastructure through eco-system approach
- Building appropriate capacities and digital skills of government functionaries

03.

Enable digitalisation policies, strategies and frameworks

- Formulating National Digital Policies
- Creating contextual policies and regulations at sub-national and local levels
- Strategising data management at national, sub-national and local levels

04.

Ensure inclusive digitalisation to empower all

- Reinforcing legal provisions for digital safety and security
- Promoting digital inclusion such that benefits of the digital economy are shared by all
- Balancing ethical considerations with innovations

05.

Enhance ability and agility to adopt emerging technologies

- Creating positions and units for in-house digital expertise in all government agencies
- Increasing risk-appetite to experiment with and employ new digital technologies
- Learning from peers to save costs and time on unsuitable technologies

06.

Formulate and implement a Digital Strategy at city level

- Creating a culture of leveraging data responsibly and building trust
- Encouraging urban innovation by providing space and resources for innovators and start-ups
- Optimising resources and streamlining workflows among departments through interoperability

While digital urban futures offer tremendous potential, there are barriers to overcome. It is imperative to address universal connectivity gaps; establish effective data management and governance frameworks, strengthen cybersecurity measures, tackle the "infodemic", bridge the digital divide, address institutional barriers and, uphold digital human rights. These barriers require strategic planning, policy reforms, and concerted efforts to ensure equitable and inclusive digital transformation. As cities build effective digital ecosystems, it is equally essential to increase their risk appetite to experiment with emerging technologies and adopt open-source technologies. Moreover, cities have to foster a culture of continuous skill development, learning, and adaptation to thrive in the digital era.

Acknowledging these gaps, the White Paper puts forth actionable takeaways that can be tailored to specific contexts, recognizing that the digital transformation journey is unique for every city and country. As an overarching idea, the paper also recommends making the most of global interconnectedness and create avenues to encourage peer-to-peer learning among cities across the world, allowing for knowledge sharing and insights from each other's experiences in implementing digital innovations. The six key enablers of urban digital transformation are:

Cities have to embrace digitalisation and technology as 'enablers' that can enhance the people-government connect and complement city operations rather than as a panacea. As cities use the instrument of digitalisation to become more efficient systems, it is critical to take an ecosystem approach and focus on open architecture while developing digital infrastructure to make provision for interoperability and future expansion. Additionally, cities must take into account risks such as cybercrime, exacerbating inequality, rebound effects, technology dependence etc., and establishing appropriate regulatory frameworks to monitor and guard against these. All actors of the quadruple helix i.e., government, industry, civil society and academia, must work together to harness the full potential of digital technologies and ensure inclusivity. By doing so, cities can unlock new opportunities for innovation and sustainable development.

Digitalisation, if employed smartly, can potentially become the most crucial catalyst for equitable, sustainable and holistic development. It makes systems and services more efficient and allows for reduction in consumption of resources, saving of time and money and enables predictive planning and preparedness. Leveraging technology for convergence and streamlining of actions can enhance the impacts of all efforts to achieve the SDGs and climate targets, as well as ensure accessibility and inclusion.

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