

Guide for smart and sustainable city leaders: Envisioning sustainable digital transformation



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sustainable city leaders:
Envisioning sustainable
digital transformation**

Acknowledgements

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Table of contents

Abbreviations and acronyms	vi
Executive summary	vii
Forewords.....	viii
Preface	xii
1 Introduction	1
2 Smart sustainable cities: What is the role of digital transformation?	4
2.1 Starting your digital transformation journey	5
3 Conclusion: Cities are our best future	13
4 Bibliography	14

List of figures

Figure 1: Inclusive smart sustainable cities.....	2
Figure 2: Elements of digital transformation.....	5
Figure 3: SSC 8-step transition cycle	6
Figure 4: Building stakeholder nexus for smart sustainable cities for digital transformation.....	9
Figure 5: Smart city standards levels	11

Abbreviations and acronyms

AI	Artificial Intelligence
DPO	Disabled People Organisations
EMF	Electromagnetic Field
GDP	Gross Domestic Product
GEO	Group on Earth Observations
GHG	Greenhouse Gas
ICT	Information and Communication Technology
ICLEI	Local Governments for Sustainability
IoT	Internet of Things
IPCC	Intergovernmental Panel on Climate Change
IUS	Integrated Urban Service
KPI	Key Performance Indicator
NUA	New Urban Agenda
PCSD	Policy Coherence for Sustainable Development
QoL	Quality of Life
RFP	Requests for Proposal
SDG	Sustainable Development Goal
SSC	Smart Sustainable City
SWOT	Strengths, Weaknesses, Opportunities and Threats
U4SSC	United for Smart Sustainable Cities
UNECE	United Nations Economic Commission for Europe
WHO	World Health Organization
WMO	World Meteorological Organization

Executive summary

With the advent of the fourth industrial revolution and global change processes, the world has also embarked on journey of digital transformation by leveraging digital technologies to alter the way economies function. In principle, the process of digital transformation encapsulates the mechanism of initiating intrinsic technological revolutions across different sectors.

In the complex and interconnected urban ecosystems under increasing urbanization and climate change, digital transformation holds the potential to disrupt the organizational capabilities of the different verticals in cities. For initiating digital transformation, the adoption of new and emerging technologies like artificial intelligence, Internet of things, digital twin and metaverse remains one of the central pillars. While deploying these emerging technologies, it is also important to consider how these solutions help address public problems and protect people's rights to support a more inclusive and sustainable urban development process. When driving digital transformation for supporting smart city transitions, it results in the intersection of the virtual and physical environments of a city, which can impact the inhabitants and quality of urban services being delivered. This makes initiating digital transformation in cities a process to be undertaken with the utmost caution. In this context, cities need to ensure an ethical use of technologies by maximizing transparency and inclusion through public participation to ensure that people become contributors of digital solutions deployed to serve them.

This report identifies a broad set of relevant elements constituting digital transformation, while underscoring the organizational capabilities and guidance for the development of smart and sustainable cities through an eight-step cycle - revolving around smart city vision setting, the implementation of international standards, and the monitoring of smart city progress. This report is based on the [Supplement 32 to ITU-T Y.4000 series - Smart sustainable cities - A guide for city leaders](#).



Forewords

International Telecommunication Union (ITU)

The eight-step cycle presented by this guide offers city leaders a framework to drive digital transformation with social purpose, building on international standards and the sustained momentum that results from commitment to continuous evaluation and data-driven decision making.

I would like to thank every expert that has contributed to this guide as well as our partners in its publication, UNEP Copenhagen Climate Centre, United Nations University, and the World Meteorological Organization.

The global ITU membership includes 193 Member States and over 900 companies, universities, and international and regional organizations.

Our members work together on international technical standards that help cities innovate efficiently and at scale. These standards provide cities with essential technical foundations able to support smart city solutions appropriate to a city's particular context. This work is led by ITU-T Study Group 20.

The United for Smart Sustainable Cities (U4SSC) initiative supported by ITU together with another 18 UN bodies has developed a set of Key Performance Indicators based on ITU standards, providing cities a framework to measure their progress towards smarter, more sustainable communities.

International standards represent expert consensus on the building blocks required for digital transformation to deliver meaningful improvements to our quality of life. They help cities to innovate with confidence as part of a global community committed to building a better future for all.

Doreen Bogdan-Martin

Secretary-General
International Telecommunication Union (ITU)

United Nations University

As has been known for some time, many factors and parameters affect how institutions in public and private spheres function. The developments deriving from the rise and varieties in technology continue to transform even the daily transactions of institutions, irrespective of differentiations sourcing from their nature. Thus, information and communication technologies (ICTs) deeply impact structuring, organizing, and interaction concerning all institutions in any context. Thus, urban ecosystems are no exception. Therefore, institutions need guidance and helpful suggestions to successfully implement their digital transformation agenda and integrate these technologies, sometimes in a smooth reconstruction after possible disruptions, for various purposes, including daily functioning.

To initiate digital transformations of cities in their respective urban ecosystems, we evaluate the functionality of employing emerging technologies like digital twins, artificial intelligence, metaverse, the internet of things, big data, and social media analytics. However, embedding stakeholders' input, feedback, and involvement to generate public value is as important as deploying these technologies to achieve public interests. As the cities are undergoing structural and organizational changes due to ICTs, they are also facing crucial challenges due to macro changes like complicated urbanization processes, climate change, complicated processes of economies, and an increase in natural and human-made emergencies/disasters. For these reasons, it is important to have an equilibrium between all processes' supply and demand sides. It is of utmost importance that digital transformation in cities should be initiated and maintained with precautions. The sustainability of digital transformation is as important as the ethical use of technologies.

We hope that the introduction of this Report, identifying a wide set of elements for guiding and supporting the cities in achieving a smart and sustainable city, will help the cities by driving them to accomplish their mission through an eight-step cycle.

Tshilidzi Marwala

Rector of the United Nations University
Under-Secretary-General of the United Nations

UNEP Copenhagen Climate Centre

The recent IPCC's Sixth Assessment Report stated that urban systems have a critical role to play in the decarbonisation of energy and transport systems and in advancing climate-resilient development. But there will be no energy or transport sector transitions without a digital transformation too. Smart technologies will have to be part of the solution if cities are to get on a credible net-zero emissions pathway. From energy management systems in buildings to traffic management or air pollution monitoring, the introduction of digital technologies opens the possibilities for faster adoption of sustainability practices. The integration of climate and energy policies, the adoption of renewable energy technologies, combined with the electrification of more and more energy uses is creating the opportunity for the adoption of digital solutions to support quicker and more bold action. Digital transformation is also a strong ally to energy efficiency at the city level. Energy efficiency is generally the quickest and cheapest option for reducing GHG and other emissions and there are many opportunities to adopt digital technologies to enhance energy efficiency practices in the urban context.

Although smart cities will be key to a more sustainable future, this does not come without challenges. Adopting too few technologies may limit the development in an area, while adopting too many at once may create confusion and be difficult to manage. The right balance and pace need to be found, together with the right local stakeholder engagement. In addition, a digital transformation will depend on skilled professionals for its design and installation, so training and capacity building will be of the essence. Finally, finance and data privacy are matters that also currently constrain digital transformation.

An extra aspect of the digital transformation is that it can provide new opportunities for enhanced transparency of actions, as it comes with the possibility to access and treat large amounts of data, therefore providing new abilities to verify the implementation effectiveness, accountability and correct pathways if needed.

The above issues and concerns form the basis for this Guide, aiming not only to support an informed sustainable transition at the city level but also at paving the way to the creation of standards for best-in-class cities. This Guide is a must-read for planners and politicians at the city level as a quick but comprehensive introduction to what it takes to excel in a sustainable digital transformation at the city level.

John Christensen

Director

UNEP Copenhagen Climate Centre

World Meteorological Organization

The accelerating growth of urban populations, especially in developing countries, has become a driving force of human development. The most recent estimation is, that in less than 30 years approximately 70% of the world population will live in urban areas. Crowded cities are centers of creativity and economic progress but, from polluted air to flooding and other climate impacts, they face major weather, climate, water and environment-related challenges. In addition, the urban water demand is expected to increase by 80% over the next decades. This rise in demand holds the potential to diminish resources and lead to overexploitation of water resources. Increasingly dense, complex and interdependent urban systems leave cities vulnerable: through a domino effect, a single extreme event can lead to a broad breakdown of a city's infrastructure.

The World Meteorological Organization (WMO) is promoting safe, healthy and resilient cities through the development of Urban Integrated Weather, Environment and Climate Services. The aim is to build urban services that meet the special needs of cities through a combination of dense observation networks, high-resolution weather forecasts, multi-hazard early warning systems, disaster-management plans and climate services. This approach gives cities the tools they need to reduce emissions, build thriving and resilient communities and implement the UN Sustainable Development Goals (SDG).

WMO with its urban cross-cutting approach is involved in joint UN urban activities for development of and implementation of the UN New Urban Agenda and SDG 11: "Make cities inclusive, safe, resilient and sustainable" with a number of external partners, e.g. UN-Habitat, WHO, ITU, GEO, C40, ICLEI, International Association for Urban Climate (IAUC), etc. The IUS methodology is integrated into broader Multi-Agency UN system U4SSC: United for Smart Sustainable Cities, led by ITU, and its key performance indicators (KPIs) for smart sustainable cities. In addition, just recently WMO's Executive Council endorsed a new implementation plan for advancing integrated climate and health science and services over the next ten years relevant also for urban areas.

WMO also closely collaborated with ITU on the development of Module 8 on "Smart Water Management" under the Toolkit on Digital Transformation for People-Oriented Cities and Communities. Our joint experience for developing the Urban Integrated Systems and Services demonstrates how important to involve local governments and city leaders into the processes of developing the strategy and tools for building Smart and Sustainable Cities and Envisioning their Sustainable Digital Transformation. Therefore, this *Guide for Smart and Sustainable City leaders: Envisioning Sustainable Digital Transformation* is an important step to help city leaders for their work on this important way to make our cities inclusive, safe, healthy, resilient and sustainable.

Petteri Talaas

Secretary General

World Meteorological Organization

Preface

International Telecommunication Union (ITU)

Cities are home to more than half of the world's people and it is estimated that two-thirds of the global population will live in cities by 2050.

Cities are drivers of economic growth, generating more than 80 per cent of global GDP, but they are also responsible for two-thirds of global energy consumption and more than 70 per cent of global greenhouse gas emissions.

Digital transformation is key to the ambitions of all sectors comprising a city ecosystem, from energy and water to manufacturing, commerce, health, education, and mobility. This transformation has the potential to make cities more efficient and sustainable, transforming the lives of billions of people for the better.

This guide for city leaders outlines practical steps to envisage and build smart sustainable cities with the help of ethical, inclusive applications of new technologies in areas such as artificial intelligence, the Internet of Things, and digital twins.

One of the key messages of this guide is that digital transformation is an all-encompassing process which – in addition to identifying the right technologies – requires holistic vision, planning, leadership and, most importantly, people with the right skills.

The guide also highlights the critical role played by international standards in the creation of smart and sustainable cities, standards that city stakeholders develop collaboratively on the ITU platform to help cities develop and implement citizen-centric, interoperable, and sustainable solutions.

I express my gratitude to all contributors to this guide for their commitment of time and expertise to this important project, and I encourage city leaders to capitalize on this guide and ITU standards as tools to accelerate progress towards the UN Sustainable Development Goals.

Seizo Onoe

Director, Telecommunication Standardization Bureau
International Telecommunication Union (ITU)

1 Introduction

As the epicentre of human activity, cities continue to face socio-economic and environmental pressures that exert pressure on the ageing urban infrastructure.

Currently, nearly 55 per cent of the world's population inhabit urban areas. This percentage is expected to increase to 68 per cent by 2050. Additionally, rural-to-urban migration in search of employment and better living conditions could contribute nearly 2.5 billion more people to urban areas by 2050. (*World Urbanization Prospects, 2018*).

As cities generate more than 80 per cent of global GDP, they are considered to be the main engines of global economic growth. On the flipside, cities also consume two thirds of global energy consumption and account for more than 70 per cent of greenhouse gas emissions (*World Bank, 2020*).

Growing urban populations and depleting resources, along with the negative impact of urban operations on the environment, has brought about the need to upgrade the city infrastructure across verticals including mobility, disability, health care, education, energy, manufacturing and agriculture, among others, with the aim of ensuring an improved quality of life (QoL) for the inhabitants.

In this context, recent advancements in technology have slowly introduced the benefits of utilizing emerging technologies such as the Internet of Things (IoT), artificial intelligence (AI), digital twin, blockchain, and IMT-2020/5G, along with more accessible data management platforms to create a reliable, accessible, robust and resilient smart ecosystem, which can serve as an interface for government-to-inhabitants interactions and support the seamless operation of basic services.

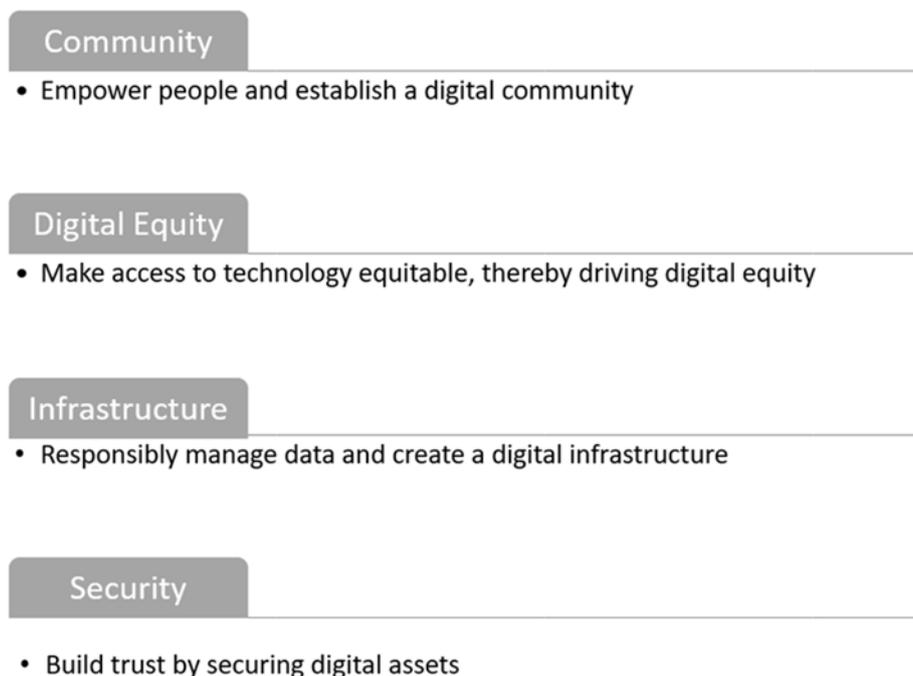
Regarding the use of digital tools within cities, it should be acknowledged that many projects apply technology uncritically, and do not take a crucial human-centred approach into enough consideration. Indeed, many smart cities initiatives miss their goals of human development by focusing on digitalization instead of its people's real needs and uses.

Leveraging these emerging technologies has the potential to help cities to align their urban planning strategies to the Sustainable Development Goals (SDGs) and drive digital transformation. By enhancing the infrastructure for the provision of urban services, the process of digital transformation is able to create an atmosphere in cities that is favourable to supporting data collection, the adoption of new and emerging technologies across sections and the adoption of new business models to create a new socio-economic climate that is eco-friendly and sustainable, so minimizing the impact on the environment.

However, when leveraging data, technologies and digital services for sustainable urban development, cities should consider existing gaps in accessibility and digital literacies to mitigate the risks of deepening inequalities in access and the use of digital services, especially by marginalized communities. This implies shifting the focus onto technology, and ensuring that people living in cities benefit from, and become active contributors of, digital solutions. The digital divide must be a priority within cities as it is one of the main obstacles faced by more potentially vulnerable groups such as women or old people.

The roll-out of technologies in cities should henceforth be aimed at addressing specific needs and anticipating requirements and challenges. In this context, digital transformation requires clear goals to enhance transparency and adapt to local requirements and inhabitants' needs. To overcome urban challenges while undergoing digital transformation, the establishment of smart cities must foresee integrated actions related to the adoption of emerging technologies for safety, mobility, health, education, sanitation and housing, leveraging open data to boost accountability and facilitate monitoring, thereby creating value-based services and products. To effectively create a smart and sustainable city through digital transformation, it is essential to have a well-defined action plan with targets, along with a funding framework to make decisions today that are in line with a city's vision for tomorrow. Some key characteristics for inclusive SSC are given in Figure 1.

Figure 1: Inclusive smart sustainable cities



This report is intended for city decision makers and strategists, whose decisions have a significant impact on the way their city functions, as well as on its future development trajectory and digital transformation. Accordingly, this high-level policy document helps identify practical steps based upon which urban decision makers can envisage and build a smart sustainable city (SSC) through the process of digital transformation.



2 Smart sustainable cities: What is the role of digital transformation?

The digital revolution is supporting the transition of cities into smart and sustainable cities, as emerging technologies such as IoT, artificial intelligence, blockchain and big data analytics, are rapidly disrupting every sector and have the potential to transform city operations if deployed, managed and governed appropriately. On the other hand, digital transformation in cities is not just about digitizing new records or automating processes using digital technologies, it also involves decommissioning legacy systems and migrating data to new systems, as well as culture change. It is about automating processes and interactions and delivering services virtually.

Digital Transformation has been viewed as a key process that can be facilitated through the implementation of information and communication technologies (ICTs) to support countries in becoming smarter and more sustainable.

However, the establishment of smart sustainable cities in alignment with digital transformation should not be limited to the adoption of technologies to solve operational problems. Echoing the SDG 11, before embarking on a smart city transition, it is pertinent to develop a vision, which would allow cities to leverage digital technologies to respond to the needs of all inhabitants, across all verticals. Therefore, the responsible use of emerging technologies has the potential to improve the quality and quantity of urban services, while reducing costs and delivering value for all. Through the exploitation of identification, data capture, processing and communication capabilities, technologies such as IoT can offer services to all kinds of applications, whilst ensuring that security and privacy requirements are fulfilled.



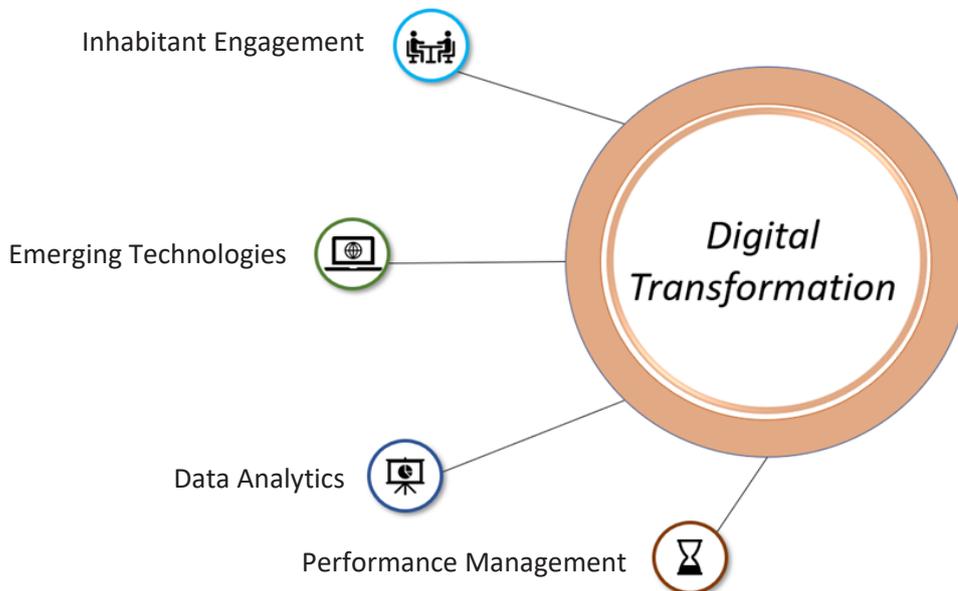
2.1 Starting your digital transformation journey

For cities wishing to initiate their digital transformation journeys as a means to becoming smart and sustainable, it is important to understand that there is no one-size-fits-all model as each city has to start from a different baseline for its transition. Additionally, each city varies in terms of demographics, resources and development challenges. The transition to smart sustainable cities has to be viewed as a reiterative process, of implementation planning and reviewing of outcomes and feedback. However, it is important to understand that SSC means embracing a continuous journey for driving digital transformation and cannot be considered to be the final destination.

This report intends to assist city decision-makers (including municipal and government representatives) by re-defining the way in which the city's infrastructure is built, digital technologies are implemented, services are offered, inhabitants are engaged and systems linked, with the aim of transforming cities into inclusive, sustainable, reliable, robust, resilient and smart living environments.

Given that the establishment of a SSC is a long-term process and cannot be achieved overnight, it is essential that a series of generic steps are laid out that would not only allow for monitoring progress but would also promote sustainable development and digital transformation. In addition, with each city must be able to quantify improvements over time in line with the SDGs, as well as with the city's individual targets. The main elements related to digital transformation are depicted in Figure 2.

Figure 2: Elements of digital transformation



In this context a series of basic steps for developing smart cities in the context of digital transformation have been envisioned.

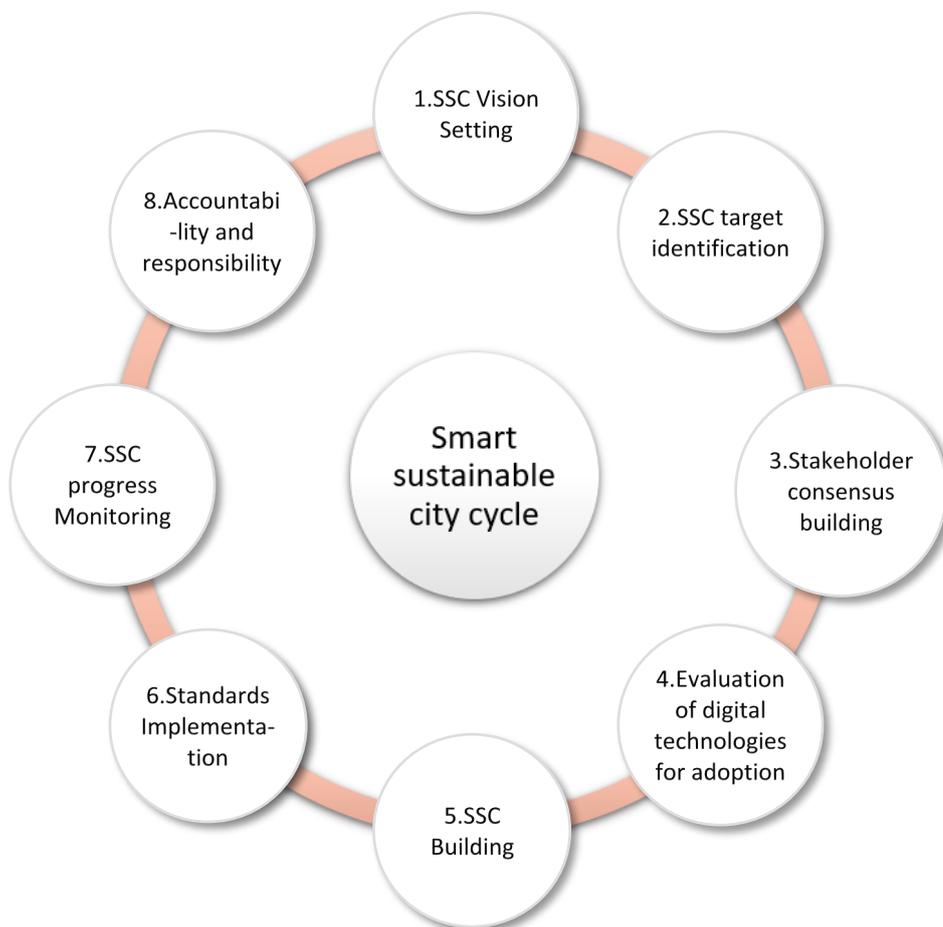
Each of these steps described in this document are required when commencing the digital transformation process for supporting smart sustainable cities.

These can help formulate an action strategy oriented towards:

- i. consensus building among varied stakeholders including inhabitants;
- ii. governance mechanisms;
- iii. financing mechanisms;
- iv. adoption of digital technologies;
- v. implementation of international standards;
- vi. monitoring mechanisms; and
- vii. learning among SSC stakeholders.

Figure 3 gives an overview of the steps to becoming a SSC leveraging digital transformation.

Figure 3: SSC 8-step transition cycle



(Adapted from ICLEI, 2014)

Step 0 - Smart city readiness assessment

A smart city readiness assessment is an important step to evaluate the readiness of your city and administration to design, implement and utilize smart city technologies and data to become efficient, sustainable and better serve city residents and improve their quality of life. This step is to be undertaken prior to the commencement of the cycle.

The readiness assessment should focus on:

- i. Needs (is there a need for transitioning to a SSC?)

- ii. Capacity (do you have the capacity - both competencies and capabilities?)
- iii. Legal (do you have the regulatory frameworks to support SSC implementation?)
- iv. Skill-level (do urban stakeholders have the required skill-set or know-how for the development of a SSC?)
- v. Enablers for success (do you have an enabling environment, e.g., connectivity?)

The assessment should consider the following:

Needs: The first thing to consider is whether there is a need for smart city solutions in the city. This includes evaluating the current state of the city's infrastructure and services, and identifying areas where improvements can be made. It is important to understand the specific needs and concerns of the community, as well as to ensure that the assessment is inclusive and considers the perspectives of all stakeholders.

Capacity: The second factor to consider is whether the city has the capacity, in terms of competencies and capabilities, to implement and oversee smart city solutions. This includes evaluating the city's technical capacity, as well as assessing the availability of human resources such as skilled personnel and technical experts. Capacity is needed to manage smart city services, evaluate digital technologies, engage the public, assess technological acceptance among residents, and deploy digital solutions.

Legal: The third factor to consider is whether the city has the necessary legal and regulatory frameworks in place to support the implementation of smart city solutions. This includes evaluating the city's laws, regulations and policies related to data protection, privacy, cybersecurity, and other aspects of smart city implementation.

Enablers for success: The fourth and final factor to consider is whether the city has an enabling environment for the implementation of smart city solutions. This includes evaluating the availability and quality of infrastructure such as connectivity and energy, as well as assessing the city's willingness and ability to collaborate with various stakeholders, including government, private sector and inhabitants.

Step 1 - Set the vision for your SSC venture

Local governments should increasingly take on a more central role in such development initiatives related to smart city transitions for driving digital transformation. This begins with defining the SSC vision, and assessing local capacities and risks. They should assist in identifying a specific SSC vision and in assessing the city's current situation in order to establish the relevance and feasibility of becoming a smart sustainable city. This step includes the following aspects:

- a) Take a strategic and leadership approach to smart city development by charting a flexible and dynamic roadmap that acts as a living document to ensure that established course of actions can be adjusted and updated promptly in response to fast-changing technological landscapes.
- b) Adopt a people-centred approach to smart cities to make sure that deployment of technology and innovation is used to ensure sustainability, inclusivity, prosperity and human rights in cities.
- c) Identifying an SSC vision in line with the city's identity, population growth, cultural affiliation and heritage, political priorities, and long-term development strategy.
- d) Gathering relevant data on the status of the urban infrastructure and the use and accessibility of existing and emerging technologies at the city-level, current assets,

performance and associated operational costs, as well as the level of user demand and existing digital gaps by age, gender, ethnicity and location.

- e) Identifying the SSC stakeholders.
- f) Identifying the existing governance and organisational mechanisms that would allow the efficient and effective creation, management and delivery of SSC solutions.
- g) Identifying mechanisms for multistakeholder involvement, inhabitant engagement, communication and information sharing throughout the SSC process to ensure inclusion and equitable access, development and use of digital technologies.

The SSC should envision its strategies in support of ensuring Policy Cohesion for Sustainable Development as indicated under Targets 17.14 and 17.17 within SDG 17.

Policy Coherence for Sustainable Development (PCSD) is an approach to integrate the dimensions of sustainable development throughout domestic and international policy-making. This approach can also be adopted at the local government level for SSC projects. The objectives in the context of the 2030 Agenda are to advance the integrated implementation of the 2030 Agenda by:

- fostering synergies and maximising benefits across economic, social and environmental policy areas;
- balancing domestic policy objectives with internationally recognized sustainable development goals; and
- addressing the transboundary and long-term impacts of policies, including those likely to affect developing countries.

This step can be facilitated through a basic SSC strengths, weaknesses, opportunities and threats (SWOT) analysis for each city. This will assist in framing a city specific strategy and goals.

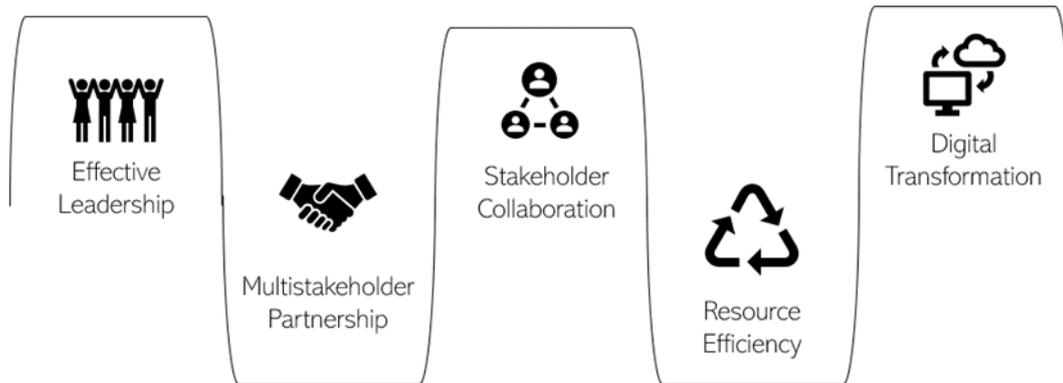
Step 2 - Identify your SSC targets

Local governments should work in close collaboration with the various SSC stakeholders to design the overall master plan for the SSC's implementation. This should include broad agreement on objectives, priorities, initiatives, and actions needed in the short, medium and long term. Consideration should be accorded to setting measurable SSC targets and timeframes for their achievement. This step involves, among others, the identification of SSC targets in regard to:

- a) developing accessible SSC infrastructure predicated on technologies;
- b) identifying the needs of inhabitants through inclusive engagement processes;
- c) identifying and developing key SSC services in keeping with the needs of inhabitants;
- d) identifying relevant international instruments such as the 2030 Agenda for Sustainable Development and the New Urban Agenda (NUA) and aligning plans;
- e) defining SSC key performance indicators (KPIs) and their weights;
- f) educating the stakeholders on the advantages of SSCs and overarching digital transformation; and
- g) associated technical expertise required throughout the project life-cycle.

Step 3 - Build stakeholder consensus

Figure 4: Building stakeholder nexus for smart sustainable cities for digital transformation



Engagement with key stakeholders and stakeholder groups is imperative. Effective leadership and engagement of key stakeholders is, therefore, necessary to ensure stakeholder buy-in, coherence in plans, as well as to avoid a duplication of efforts. In addition, the engagement of inhabitants at the grassroots level is equally important for resource allocation and efficiency. Strategic objectives for the SSC should be built upon participative consultation processes and substantial community support.

For initiating digital transformation with the purpose of establishing a smart and sustainable city effective leadership is essential. As urban development is a transdisciplinary topic, multisectoral partnerships are needed to address various challenges in cities, including the diverse range of sectors. As cities need to be inhabitant centric, ensuring engagement¹ at the grassroots level is required for enhancing resource efficiency. In this context, local governments should obtain the necessary key stakeholder buy-in and backing to ensure that the SSC strategic programme aligned with digital transformation is pursued. This includes the adoption of the SSC programme/targets through consensus. In order to gain key stakeholder buy-in, persons with disabilities or specific accessibility needs must be anticipated. This can only be achieved by proactive planning with those stakeholders with disabilities. This will provide the basis for an agreed document that has widespread support and will serve as a reference for the strategic planning by the local authority. For additional information on stakeholder mapping for smart and sustainable cities, please see [Y.Sup34 : ITU-T Y.4000 series - Smart sustainable cities - Setting the stage for stakeholders' engagement](#).

Step 4 - Evaluation of digital technologies for adoption

Advanced digital technologies hold the potential for creating opportunities for the delivery of services and products to improve the operational performance of the city ecosystem and enhance transparency, while limiting the negative environmental impact. Furthermore, they

¹ In many cases, inhabitants belonging to socially marginalized groups, including persons with disabilities, are often not recognized as stakeholders or are not in a position to properly express their opinions. Therefore, in the process of identifying stakeholders, it is important to discover proper potential stakeholders and encourage their participation.

have the potential to improve accountability and mitigate specific environmental risks. However, issues relating to the governance and adoption of digital technologies in the context of, to cite just a few examples, cost, mismanagement, security and privacy within the smart city domain continue to persist.

In addition, an assessment should also be undertaken on how each type of technology guarantees adequate access and interoperability with assistive technologies for inhabitants with specific needs. Appropriate alternatives should be considered if accessibility is not feasible.

As physical and digital spaces are increasingly interlinked, the potential of technology to serve people and communities is directly connected to ensuring that human rights are protected when accessing and using digital technologies. This is essential for equitable service delivery and responsible and ethical use of technologies in cities, and to include residents and communities safely. When adopting digital technologies, SSCs need to assess existing gaps in accessibility and use, mitigate potential harmful impacts of technology and maximizing transparency and inclusion through public participation and representation, offline and online, to understand local needs and requirements to develop solutions that serve people and communities.

Therefore, before implementing digital technologies for initiating a smart city transition, it is essential to keep certain aspects in mind, including proper procurement, inclusivity, resilience and accountability. Certain frontier technologies such as artificial intelligence are not neutral and require context consideration, due diligence and appropriate governance mechanisms to ensure responsible use and that ethical risks and concerns are addressed. In addition, it is important to be aware that frontier technologies are a panacea for addressing sustainability challenges in urban areas and must be adopted whilst integrating human-centred approaches and robust business processes.

Additionally, prior to commencing the smart city expedition, requests for proposals (RFPs) relating to the procurement of digital technologies should outline:

- a) infrastructural requirements for their adoption;
- b) budget;
- c) the sectors in which it will be implemented;
- d) accessibility requirements;
- e) interoperability with assistive devices; and
- f) desired outcomes of adoption.

Step 5 - Build your SSC

Using the key stakeholder buy-in and stakeholder engagement methods highlighted in Step 2 along with the outline for the adoption of appropriate digital technologies (as underscored in Step 4), local governments should lead the way to actually initiating the establishment of their smart sustainable city. For this step, the existing traditional infrastructure may need to be improved upon significantly by integrating the required digital technologies for the upgrade to SSC. The stakeholders may also choose to build a new infrastructure from scratch, in line with their digital transformation targets.

For either of the aforementioned scenarios, the following features are pertinent:

- a) Framing of a feasible master plan for your SSC journey.
- b) Investigating and selecting appropriate construction models (e.g., public-private partnerships in various SSC programmes).

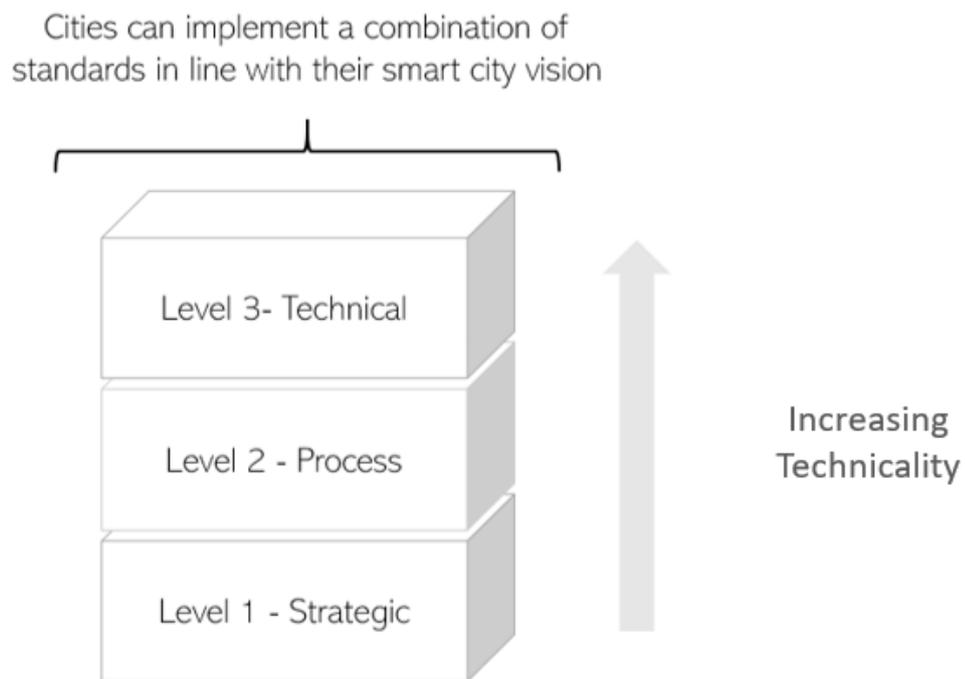
- c) Ensuring long-term services via good operation and maintenance after the infrastructure is in place.

Step 6 - Standards Implementation and digital governance

International standardization can play a key role in developing an effective marketplace for smart city development and procurement of services. Hence, before a city commences its smart and sustainable city journey, it should have an overview of the different types of smart-city-related standards in order to anticipate its implementation. In this context, smart city standards can be divided into three levels:

- Level 1 - Strategic: These standards deliver guidance to urban stakeholders on developing a transparent and effective smart city strategy along with a timeline for the transition.
- Level 2 - Process: These standards are oriented towards procuring and managing cross-sectoral smart city projects, including best practices, frameworks and guidelines.
- Level 3 - Technical: These standards include technical specifications for the implementation of smart city products and services in line with digital transformation and smart city targets elucidated in the smart city strategy.

Figure 5: Smart city standards levels



(Redrawn from BSI)

In addition to the implementation of standards, digital governance mechanisms are required to steer the implementation and maintenance of smart city solutions. At the heart of the digital governance for smart cities are the questions of whether or not the smart city solutions are fit for purpose and if they continue to serve the community in the ways in which they were designed. This involves limiting or avoiding scope creep, data leakages, and misuse of digital solutions and data.

Step 7 - Measure your city progress

The step consists of monitoring and evaluating the smart city work programme required to achieve the targets. This stage involves close coordination and collaboration among SSC stakeholders, as well as an assessment on the basis of relevant KPIs. [ITU-T Study Group 20 "Internet of Things and Smart Cities & Communities"](#) has developed a useful set of KPIs for SSCs, including [Recommendation ITU-T Y.4903 "Key performance indicators for smart sustainable cities to assess the achievement of sustainable development goals"](#) that can be utilized for this specific step. These KPIs have been further streamlined within the United for Smart Sustainable Cities initiative ([U4SSC](#)), a UN initiative coordinated by ITU, UNECE and UN-HABITAT, and supported by other 16 other United Nations agencies and programmes, based on the feedback received from cities which have implemented the KPIs. More than 150 cities worldwide have adopted these KPIs, thus far. These KPIs form an excellent baseline for city decision makers, as they map their city's progress of their overall SSC journey, but can also be modified by cities to suit their own specific circumstances. Within, this step, it would also be beneficial to plan for data aggregation and discovery, which would facilitate downstream evaluation.

Step 8 - Ensure accountability and responsibility

The last step is focused on evaluating, reporting and learning from the SSC process and related experiences. This involves an assessment of the implementation of the work programme and an analysis of reflections about strengths and shortcomings. Such an evaluation contributes to informing the decision-making process of the local council, as well as to informing the preparation of future baseline reviews to deepen SSC master plans and strengthen the digital transformation process.

Better decisions are reached if they emerge out of a process of knowledge sharing and dialogue between stakeholders, in particular the Disabled People Organisations (DPO). The reflective process of evaluation will feed into a process of continuous learning, which, in turn, will influence and inform the development of the future vision and strategy for the SSC.

Cities need to review and learn from each stage of the SSC process. For this they can implement a series of reflections on progress, document lessons learned and steps to improve on future iterations of the SSC journey. Consequently, cities must be accountable for continuous improvement to strengthen the effectiveness of future SSC strategies. To do this, city leaders must be flexible and able to adapt to the dynamic, evolving and complex nature of the SSC and be able to continuously update the vision as required.

3 Conclusion: Cities are our best future

While sustainability challenges of cities are significant, urban areas also hold the key to achieving many global sustainability goals. Cities are home to the majority of humanity and sustainable development and digital transformation cannot be initiated without significantly altering the way we build and manage our urban spaces.

The infusion of digital technologies into key processes is pertinent to achieving SDGs. Emerging technologies such as IoT, AI, blockchain and digital twin can assist with the establishment of SSCs through innovation and redesign of existing processes. This can include new applications, technologies and systems for access to communication, smart energy, smart mobility, intelligent sustainable buildings, smart water management and smart government.

As digital technologies provide an integrated strategic approach to sustainability in SSCs, they are key enablers of urban development, making digital transformation also vital to the achievement of the SDGs.

Cities do not have the option to continue functioning as they have done in the past. Hence, city decision-makers have to decide on a maintainable urban process, which promotes economic progress, as well as environmental protection. Here, the SSC vision and the cycle elucidated in this report not only provides the benefit for sustained economic growth but also ensures a high quality of life for the inhabitants along with environmental sustainability and digital transformation.



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