

Building a people-centered digital future for cities and communities



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Foreword

Close to 70 per cent of the world's population is expected to live in cities by 2050.

At the same time, cities all over the world are undergoing a rapid digitalization process.

Digital transformation offers cities the tools they need to address the challenges and opportunities that define this century - from climate change to social and economic inequality.

But urban digital transformation must also be sustainable, resilient, and inclusive – and it is our responsibility to make that happen.

Making cities smarter and more sustainable goes beyond upgrading existing urban systems. It is a long-term journey that implies not only technological innovation and deployment, but also implementing effective policies and adequate financing mechanisms that ensure initiatives consider local contexts and requirements.

While cutting-edge technologies are central to digital transformation strategies, cities that take a holistic approach that considers socio-demographic and financial implications are technologically advanced and socially and environmentally responsible.

In this publication, you will learn about ITU's different activities aimed at driving the overall development and standardization of smart sustainable cities and communities. Each initiative seeks to ensure that the benefits of digital transformation reach every segment of society and leave no one behind.

I hope aspiring smart cities everywhere will use it as a launchpad for their digital transformation journey.



**Doreen
Bogdan-Martin**

ITU Secretary-General

Foreword

Increasingly, digital transformation is becoming a focus of strategic thinking and planning for governments, cities and industries. It is about putting the emphasis on how digital services and applications will change and “transform” inhabitants’ experiences and the way they live, work and play in cities, and how this will lead to improvements in quality of life and wellbeing, and lead to the attainment of the United Nations Sustainable Development Goals (SDG). Smart cities and communities rely on digital technologies and information and communication technologies (ICTs) to offer innovative and integrated services and solutions to their residents. Digital transformation is, therefore, the way forward to meet global goals and targets, and to create the cities and communities of tomorrow.

This brochure shares insights into how ITU standardization work and supporting collaboration initiatives are enabling shared progress towards digital transformation, especially in the context of cities.

ITU is the United Nations specialized agency for information and communication technology (ICT). Within the ITU ecosystem, policymakers, urban planners, industry, academia and civil society are working together to develop ITU standards capable of helping cities to innovate efficiently and at scale. These standards support the development of master plans for the transition to smart sustainable cities, for promoting interoperability among city systems, for enhancing efficient data processing and management, and much more.

ITU founded the United for Smart Sustainable Cities (U4SSC), a global initiative supported by 19 United Nations partners with the aim of achieving SDG11: Make cities inclusive, safe, resilient and sustainable.

Given the advances in technologies in the digital age, successful digital transformation will demand that technological evolution follows a course aligned with universal human values. ITU provides a neutral platform upon which to build this collaboration and accelerate progress towards the SDGs. We welcome you to join our work to create a more sustainable and resilient future for all.



Seizo Onoe

Director

ITU Telecommunication
Standardization Bureau



The future of our cities and communities depends on people-centric digital transformation.



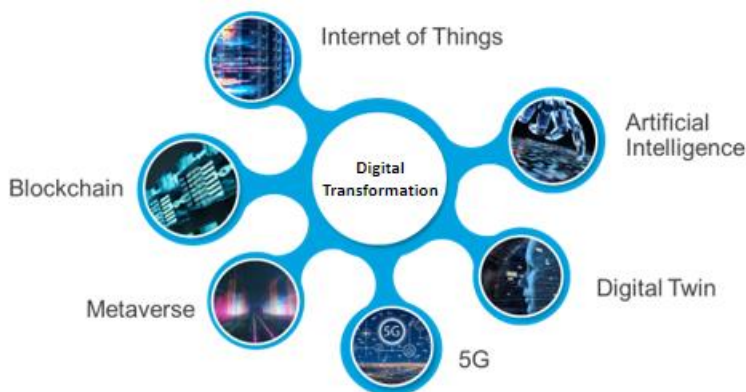
How digital transformation is shaping the cities of today

As urbanization accelerates and environmental pressures mount, cities around the globe are looking to digital technologies to revolutionize living.

Cities are taking action and embracing cutting-edge solutions such as artificial intelligence (AI), 5G, digital twin, Internet of Things (IoT) and the metaverse to digitize and automate city operations. Digital technologies are at the forefront of creating smart sustainable cities that promote efficiency, economic development and improved quality of life for inhabitants.

By leveraging technology and data, cities have seen tremendous improvements in areas such as clean energy, transportation, and health. The result? Smart cities that are thriving, sustainable, resilient and future proof.

Join the smart cities dialogue and be a part of the innovation in cities and communities!



By 2050...



70% of the world's population will be residing in cities,



accounting for a staggering 80% of the world GDP



and 90% of worldwide pollution.



How is ITU leading this transformation?

The [International Telecommunication Union \(ITU\)](#) is the United Nations specialized agency for information and communication technologies (ICTs). Within the United Nations ecosystem, ITU serves a dual role as it also functions as an international standard developing organization (SDO).

A vital part of ITU's work is the development of technical standards that ensure that networks and technologies interconnect seamlessly. ITU also strives to improve access to digital technologies and ICTs to underserved cities and communities worldwide in line with the United Nations Sustainable Development Goals (SDGs).

ITU members come from all over the globe from Member States, private sector entities and academia to work together to shape future digital technologies and the ICT policy and regulatory environment, set standards, and formulate best practices to enhance the overall technological ecosystem.



Key ITU Activities Enabling Digital Transformation

1

Standards for Industry and Governance

2

Fostering Digital Innovation

3

Forward-Looking Perspectives

4

International Cooperation



1

Standards for Industry and Governance



Why Standards
are the Key to
Success



ITU-T Study
Group 20 -
Internet of things
and smart cities
and communities



Standards and
Practical
Guidance for
Cities



Why standards are the key to success?

The process of digital transformation burst on the scene as a means to ease integration of technologies and ICTs into the urban ecosystem for streamlining operations, facilitating decision-making and delivering a better quality of life to inhabitants.

International standards can provide crucial guidance, and technical and policy recommendations that urban stakeholders can use to set their city's priorities, navigate global challenges and implement innovative solutions to accelerate digital transformation and make cities and communities, and ultimately countries, smarter and more sustainable.

Standards can accelerate digital transformation for more people-centered cities that are inclusive for all citizens in terms of, for example, gender, age and disability.



Community

Empowering
People



Digital Equity

Making access to
technology
equitable



Infrastructure

Responsibility
managing data
and digital
infrastructure



Security

Building trust by
securing digital
assets



Capacity


Building multi-
stakeholder
capacity



ITU-T Study Group-20 - Internet of things (IoT) and smart cities and communities

[ITU-T Study Group 20 \(ITU-T SG20\)](#) develops international standards (known as [ITU-T Recommendations](#)), providing commonly agreed guidance for implementing the Internet of Things (IoT) and its applications, as well as smart cities and communities. Its work supports digital transformation in both urban and rural areas, enabled by solutions in fields such as IoT, digital twins, and Artificial Intelligence. SG20 standards set the requirements for IoT deployment, while helping smart cities and communities to improve the efficiency of IoT systems and smart city platforms, breaking down data silos, facilitating seamless data sharing among various verticals, and enhancing data processing and management capacity.

11 SUSTAINABLE CITIES AND COMMUNITIES



As a core part of its standardization work, SG20 also seeks to guide stakeholders in enabling cities and communities to reach the targets stipulated in Sustainable Development Goal 11.

ITU-T Study Group 20 is chaired by Dr Hyung Jun Kim (Electronics and Telecommunications Research Institute, Republic of Korea), supported by several Vice-chairmen, Working Groups Chairmen and Rapporteurs.

Interested in taking part?

ITU regularly offers fellowships to delegates from developing countries to attend and actively participate in ITU-T SG20.

To ensure that no one is left behind...

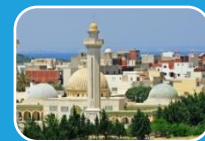
ITU-T Study Group 20 has five regional groups for Africa, Asia and Pacific, Arab Region, Latin America, and Eastern Europe, Central Asia and Transcaucasia, which help ensure that different perspectives can be duly reflected in ITU standards work.



Africa Region



Latin America Region



Arab Region



EECAT Region



Asia and the Pacific



ITU standards and practical guidance for cities & communities

Planning and Assessment

Smart sustainable city planning, and development enables the provision of quality and innovative services to inhabitants, together with the creation of a safe, prosperous and inclusive environment.

As development of a smart sustainable city (SSC) coupled with digital transformation from the ground-up is complex, ITU offers cities and communities a methodical approach to SSC planning and development through a series of standards and guidance frameworks.



Don't miss these key ITU standards and publications!

- Recommendation ITU-T Y.4904: "Smart sustainable cities maturity model"
- Recommendation ITU-T Y.4905: "Smart sustainable city impact assessment"
- Guide for Smart and Sustainable City leaders: Envisioning Sustainable Digital Transformation
- Master Plan - Enabling Digital Transformation in Smart Cities
- ITU-T Series Y Sup.34: "Setting the stage for stakeholder engagement"
- U4SSC publication: "Enhancing innovation and participation in smart sustainable cities"

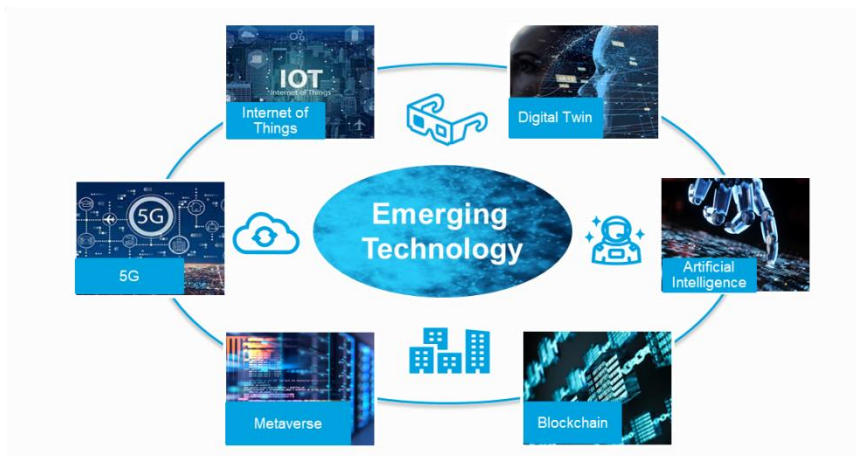


ITU standards and practical guidance for cities & communities

Requirements and capabilities

The ever-increasing number of Internet of Things (IoT) services and applications has brought upon the need for underscore requirements, capabilities, and architectural frameworks for IoT and Smart Cities and Communities (SC&C).

Emerging IoT and SC&C services and applications are placing more and more requirements on networks and the provisioning of new services, resulting in the need to make networks more and more intelligent with the provisioning of new capabilities.



Don't miss these key industry standards!

- Recommendation ITU-T Y.4600: "Requirements and capabilities of a digital twin system for smart cities"
- Recommendation ITU-T Y.4601: "Requirements and capability framework of a digital twin for smart firefighting"
- Recommendation ITU-T Y.4208: "Internet of things requirements for support of edge computing"
- Recommendation ITU-T Y.4214: "Requirements of IoT-based civil engineering infrastructure health monitoring system"

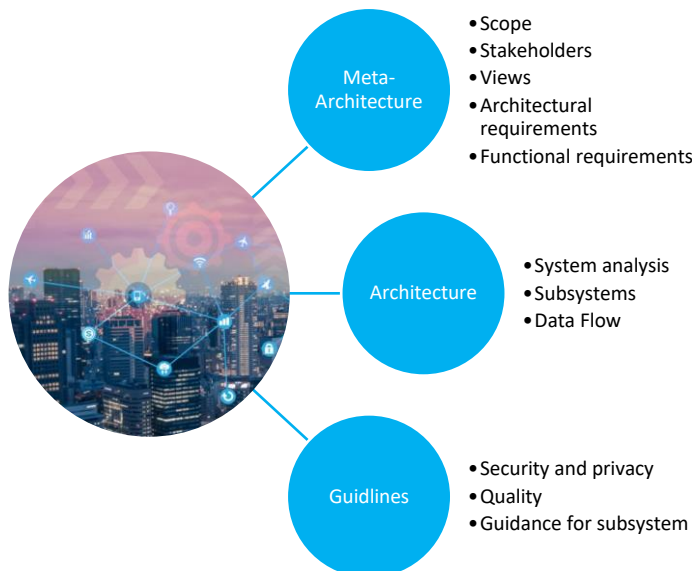


ITU standards and practical guidance for cities & communities

Smart architecture

Smart architecture in SSC requires ensuring interoperability, scalability, flexibility, fault tolerance, availability, manageability, resilience, and vendor independence. These factors are essential when putting in place or integrating ICTs into a city's existing architectural framework to meet the functional requirements including security, privacy, integrated management, service delivery and information flow.

By 2025, nearly 50 billion IoT-based devices will be connected to the network, generating 79.4 ZB of data, and this will only continue to grow in the decades to come. Standards can help cities implement smart architecture practices.



Don't miss these key industry standards!

- ITU-T Series Y Supplement 27: "Setting the framework for an ICT architecture"
- ITU-T Series Y Supplement 53: "Internet of Things use cases"
- Recommendation ITU-T Y.4500.1: "oneM2M - Functional architecture"
- Recommendation ITU-T Y.4205: "Requirements and reference model of IoT-related crowd sourced systems"
- Recommendation ITU-T Y.4470: "Reference architecture of artificial intelligence service exposure for smart sustainable cities"



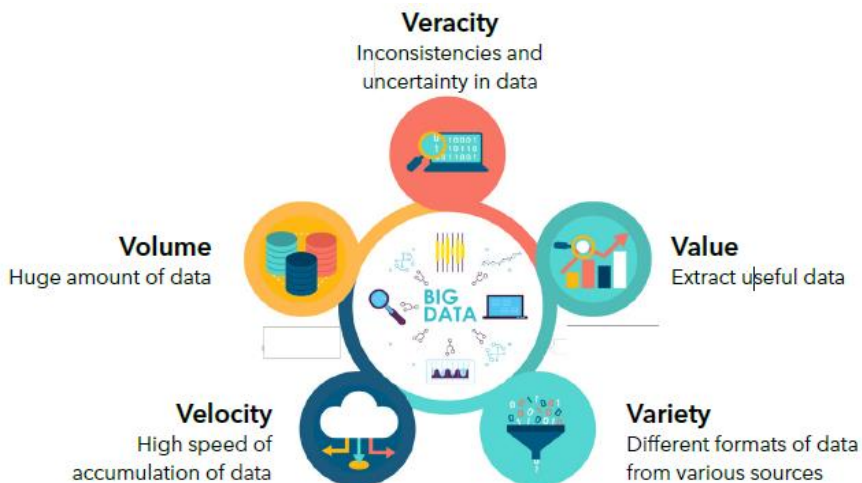
ITU standards and practical guidance for cities & communities

Data analytics, sharing, processing and management

Deriving value from data is central to the evolution of smart sustainable cities to foster better decision-making and gain insights into how different sectors are leveraging ICTs. The data challenge in SSCs stems from the massive amounts of data that must be constantly collected, analysed and shared. For cities to be truly smart and sustainable, the network coverage requirements, security and privacy concerns, and reservations linked with data analysis and regulatory necessities, should always be considered.

Don't miss these key industry standards!

- Recommendation ITU-T Y.4461: "Framework of open data in smart cities"
- Recommendation ITU-T Y.4464: "Framework of blockchain of things as decentralized service platform"
- Recommendation ITU-T Y.4467: "Minimum set of data structure for automotive emergency response system"
- Recommendation ITU-T Y.4472: "Open data application programming interfaces (APIs) for IoT data in smart cities and communities"



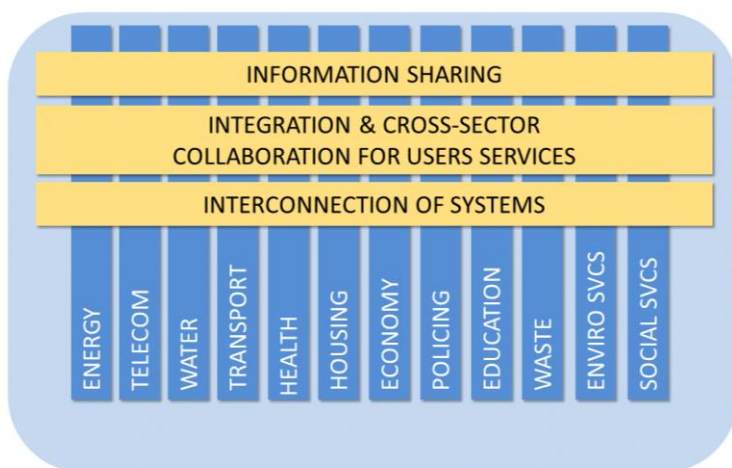


ITU standards and practical guidance for cities & communities

Interoperability

Cities are an interconnection of different cyber-physical systems. Cities and communities need to increase the efficiency in which they operate and use their resources to respond to the challenges posed by this rapid urbanization. The efficiency improvements can be achieved by interconnecting individual systems within cities and communities such as water, electricity, waste management and transportation and sharing the data from various silos within cities.

Interoperability between these systems and the technologies upon which they are based allows for an increase in the number of services provided along with their quality, ensuring maximum efficiency, scalability and simple integration.



Don't miss these key industry standards!

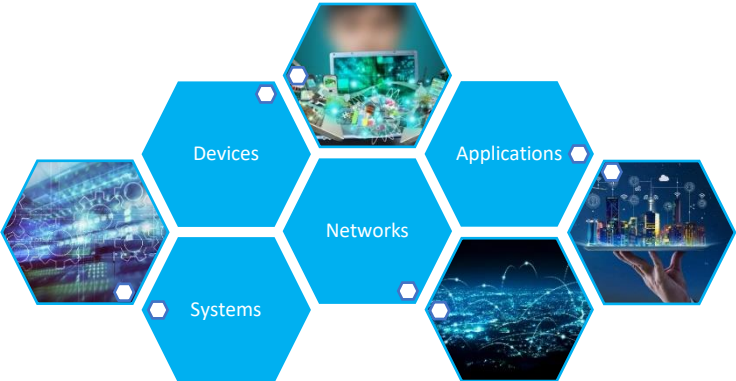
- Recommendation ITU-T Y.4200: "Requirements for the interoperability of smart city platforms"
- Recommendation ITU-T Y.4201: "High-level requirements and reference framework of smart city platforms"
- Recommendation ITU-T Y.4459: "Digital entity architecture framework for Internet of things interoperability"
- Recommendation ITU-T Y.4805: "Identifier service requirements for the interoperability of smart city applications"



ITU standards and practical guidance for cities & communities

Security, privacy and trust

Digital transformation in cities involves the integration of technology in various aspects of life. While the benefits of these technologies are numerous, it also raises concerns about security, privacy and trust. Security is essential to protect against cyberattacks, which can compromise critical infrastructure, disrupt services, and compromise personal information. Privacy is also a critical issue, as the use of technology in cities can lead to the collection and storage of vast amounts of personal data. Trust is therefore crucial for the successful adoption of digital technologies in cities. International standards can help cities can ensure that the benefits of digital transformation are realized, while also protecting the rights and interests of the inhabitants in alignment with data protection requirements, ensuring overall data security and prevention of data theft.



Don't miss these key industry standards!

- Recommendation ITU-T Y.4806: "Security capabilities supporting safety of the Internet of things"
- Recommendation ITU-T Y.4807: "Agility by design for telecommunication / ICT systems security used in the IoT"
- Recommendation ITU-T Y.4808: "Digital entity architecture framework to combat counterfeiting in Internet of things"
- Recommendation ITU-T Y.4809: "Unified Internet of things identifiers for intelligent transport systems"
- Recommendation ITU-T Y.4811: "Reference framework of converged service for identification and authentication for IoT devices in decentralized environment"



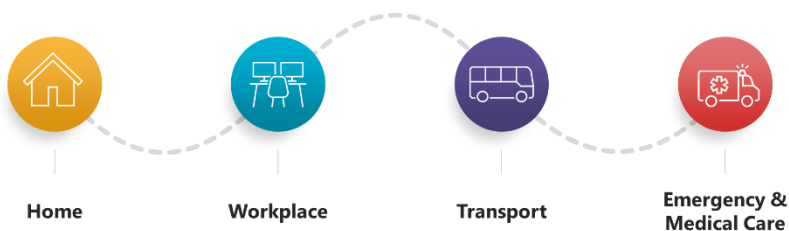
ITU standards and practical guidance for cities & communities

Accessibility

Accessibility is the fulcrum for driving digital transformation in cities. By prioritizing accessibility, cities can ensure that digital solutions are inclusive, equitable and resilient and provide equal access to services and information for all inhabitants, including persons with disabilities and elderly individuals.

Digital technologies can help to reduce barriers and increase accessibility by providing digital solutions that can accommodate all inhabitants. Accessible technology can also improve access to public services and information, making it easier for inhabitants to stay informed, engage with their local government and participate in civic life. This can help to reduce social and economic inequalities, bridge the digital divide and ensure that all inhabitants have equal access to the benefits of digital transformation across sectors.

Use Cases for IoT Accessibility



Don't miss these key industry standards!

- Recommendation ITU-T Y.4204: "Accessibility requirements for the internet of things applications and services"
- Recommendation ITU-T Y.4211: "Accessibility requirements for smart public transport services"



2

Fostering Digital Innovation



United for Smart Sustainable Cities



U4SSC Key Performance Indicators



U4SSC National Hub



Toolkit for Digital Transformation



Building the cities of the future with the U4SSC



Coordinated by ITU, UNECE, and UN-HABITAT and supported by 19 other United Nations entities, the [United for Smart Sustainable Cities \(U4SSC\)](#) is dedicated to achieving Sustainable Development Goal 11 - Making cities and human settlements inclusive, safe, resilient, and sustainable.

The U4SSC provides city stakeholders with access to invaluable guidance and frameworks that can facilitate the use of digital technologies to accelerate digital transformation. Through U4SSC, cities and communities can harness the power of technology to achieve sustainability, economic growth, and social well-being.

The U4SSC also serves as a platform for knowledge-sharing and international cooperation, bringing together cities, governments, academia and industry organizations to tackle common challenges, share best practices and develop innovative solutions that will shape the future of cities.

Join the movement and transform your city with U4SSC!



Check the innovative work done by U4SSC Thematic Groups

The U4SSC thematic groups are dedicated to developing innovative solutions to make cities smarter, more sustainable, and more people-centred.

With action plans, technical specifications, case studies, guidelines and policy guidance, U4SSC offers everything cities need to accelerate their digital transformation and become smarter and more sustainable. Join us today and unlock the full potential of your city!

Click [here](#) to access these essential resources!





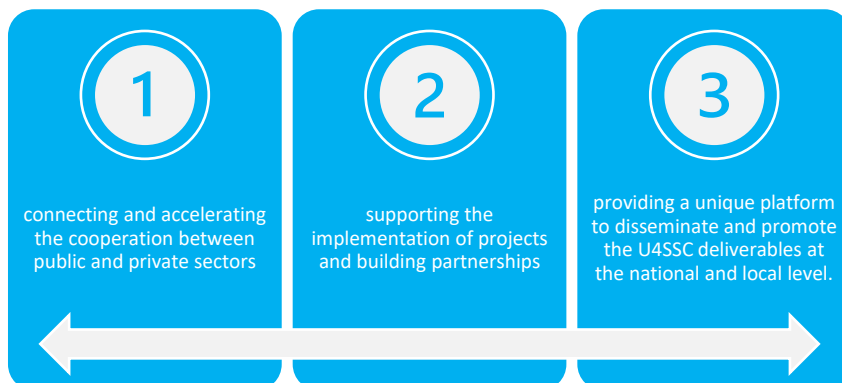
A one-of-a-kind platform for accelerating digital transformation in cities

The [U4SSC Austrian Country Hub](#) is a unique platform that brings together public and private sectors, universities, and research institutions to drive innovation and facilitate technology transfer. The U4SSC Austrian Hub is hosted by the Austrian Economics Center and chaired by Dr. Barbara Kolm.

The Hub helps to disseminate the U4SSC deliverables, and support the implementation of the U4SSC Key Performance Indicators, which enable cities and communities worldwide in evaluating the role and contribution of digital technologies in enabling smartness and sustainability, and provides cities with the tools for self-assessment to achieve the UN SDGs.

The U4SSC Austrian is building a community that is truly one of a kind, and is working to create a smarter, more sustainable future for all.

The U4SSC Austrian Hub is central to:



H.E. Ms Karoline Edstadler, Federal Minister for the EU and Constitution, Austria launched the U4SSC Austrian Country Hub on 28 February 2022.



Unlock the potential of cities with the U4SSC key performance indicators

The [U4SSC KPIs](#) are the essential policy tool for achieving the UN Sustainable Development Goals. They provide cities and communities around the world with the means to evaluate the impact of ICTs and digital technologies on their journey towards sustainability and smartness.

These KPIs are based on an international standard, [Recommendation ITU-T Y.4903: "Key performance indicators for smart sustainable cities to assess the achievement of sustainable development goals"](#). With expert-developed KPIs, gain valuable insights into city's progress and have the tools needed for self-assessments and informed decision-making.



REPORT

Publish key areas of analysis, important lessons learned, establish actionable outcomes and other key city insights



BENCHMARK

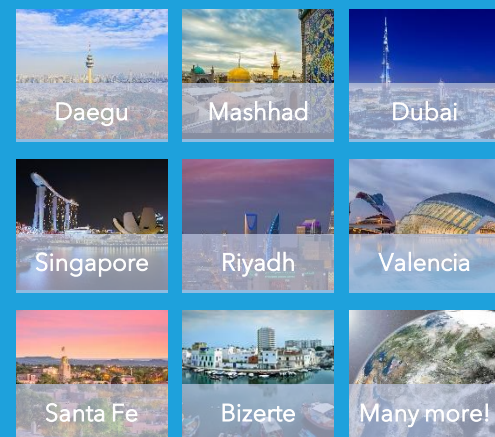
Track year over year progress, perform longer term trend analysis and benchmark performance



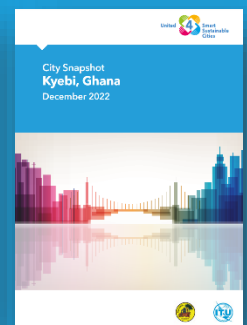
MAP

Provide a powerful visual representing the areas where city action is required

More than 150 cities have implemented the U4SSC KPIs!



Don't miss out on what other cities are doing to maximise digital transformation.





Empowering cities and communities through the Digital Transformation Toolkit

The International Telecommunication Union (ITU) has partnered with 11 other UN entities to develop a ground-breaking [Toolkit](#) that empowers decision-makers to plan and strategize for a sustainable, inclusive and resilient digital future for all.

Packed with essential resources, the Toolkit draws on international standards, cutting-edge research and expert reports to provide a comprehensive guide to the digital transformation of cities and communities. Whether you are a local government leader, urban planner or city official, this invaluable resource offers the tools you need to navigate the complex challenges of digital transformation and unlock the full potential of your community.

What sets this Toolkit apart is its universal applicability. It doesn't matter if you're a thriving metropolis or a small rural community, a developed country or a developing one - the insights and guidance contained within will help you chart a path towards a brighter digital future.



Check out the Toolkit Modules!

<p>Digital Transformation of Cities and Communities</p>	<p>Developing a Digital Transformation Strategy</p>
<p>Accessibility and Digital Inclusion</p>	<p>Reduce the Environmental Impact of Cities</p>
<p>Emergency Management</p>	<p>4IR and Smart Manufacturing</p>
<p>Data Processing and Management</p>	<p>Connectivity, Digital Divide and Digital Inclusion</p>
<p>Smart Energy Management</p>	<p>Smart Water Management</p>
<p>Smart Sustainable City Governance</p>	



3

Forward-Looking Perspectives



Focus Groups



Digital Transformation Resource Hub



Digital Transformation Webinars



Tackling ground-breaking topics through Focus Groups

Every so often ITU comes across a niche topic, which requires additional study or background research before standards are developed in that domain. ITU-T Focus Groups are leveraged for this purpose to create an alternative working environment for the quick development of specifications in chosen areas.



[ITU-T Focus Group on metaverse \(FG-MV\)](#)

As the newest Focus Group on the block, FG-MV is tasked with delving into the technical requirements of the metaverse, which is anticipated to have path-breaking impacts on all sectors as it blurs the line between our physical and digital environments.



[ITU-T Focus Group on "Artificial Intelligence \(AI\) and Internet of Things \(IoT\) for Digital Agriculture" \(FG-AI4A\)](#)

FG-AI4A, established in collaboration with FAO, explores how AI and IoT can support data acquisition and handling, improve modeling by leveraging agricultural and geospatial data, while delivering interventions for the optimization of agricultural production processes.



Facilitating knowledge exchange with the Digital Transformation Resource Hub

A one-stop place for accessing a treasure trove of information, the [Digital Transformation Resource Hub](#) was launched in 2023. It provides a wide range of quality publications on a range of digital transformation topics, including smart sustainable cities, cities' actions to tackle COVID-19, artificial intelligence, Internet of Things, blockchain, digital twin, metaverse and digital transformation trends. All resources are freely available.



Smart sustainable cities



Cities' actions to tackle Covid-19



Artificial intelligence



Internet of things



Blockchain



Digital twin



Metaverse



Digital transformation trends



Learn from key experts - join the Digital Transformation Webinars

ITU launched the [Digital Transformation Webinar Series](#), with the aim of driving global discourse on the adoption of digital technologies across sectors and facilitating collaboration with global stakeholders to bring new knowledge to the table for standardization and the attainment of the targets embedded in the Sustainable Development Goals (SDGs).

With more than 20 Webinars and 3000 participants, various topics, including digital twin, digital agriculture, earth observation, digital water management, smart tourism and AI for digital transformation have been covered in close collaboration with other UN agencies and other key partners.

Interested in exploring the facets of digital transformation? Host a webinar with us!

Stay on top of industry trends. Don't miss episodes on critical topics such as:

- Digital Agriculture: Driving Digital Transformation for Food Security
- Tourism in smart cities: Reimagining the road to digital tourism
- Cities in the age of artificial intelligence: How to leverage technology for digital transformation
- Emergency responses in smart cities: Driving resilience in the post-pandemic era
- And many more!





4

International Cooperation



Industry
Collaboration



Collaboration
with SDOs



Buildings
Synergies



Powering Innovation Through Industry Collaboration

oneM2M

ITU and oneM2M collaborate on the development and adoption of IoT standards. oneM2M developed a set of technical specifications for a common M2M service layer that can be readily embedded within various hardware and software, and relied upon to connect the myriad of devices in the field with M2M application servers worldwide.

IEEE

The IEEE and ITU collaboration will develop a “Global Observatory for Urban Intelligence” (GOUI), based on the wealth of crowd-sourcing city stakeholders from government, industry and academic experts and students on a global scale.

LoRa Alliance

ITU and LoRa Alliance have joined forces to develop vital international standards recognized by the low-power, wide-area networks (LPWAN) community for IoT. This collaboration grows the agenda forward for the industry and accelerates digital transformation across economies. Building these synergies enhances the standardization efforts in order to better support the Internet of Things and smart cities and communities.





Harnessing the collective power of SDOs

IEC-ISO-ITU Joint Smart Cities Task Force

IEC, ISO and ITU have established a Joint Smart Cities Task Force (J-SCTF) to coordinate international standardization for smart cities. The Joint Task Force aims to engage stakeholders to identify standardization demands, and provides leadership in guiding the supporting collaboration of ITU, ISO and IEC and the broader standardization ecosystem.

The J-SCTF is chaired by:

- IEC - Mr Michael Mulquin (Chair, IEC SyC Smart Cities)
- ISO - Mr Bernard Gindroz (Chair, ISO/TC 268)
- ITU - Mr Hyoung Jun Kim (Chair, ITU-T Study Group 20)

Joint Coordination Activity on IoT and SC&C

The Joint Coordination Activity on IoT and Smart Cities and Communities (JCA-IoT and SC&C) provides a visible contact point for IoT and smart cities and communities (SC&C) activities. The JCA-IoT and SC&C helps to coordinate with relevant Standards Development Organizations and Forums.

The JCA-IoT and SC&C is chaired by Dr Fabio Bigi (Italy) and Dr Toru Yamada (Japan).





Achieving breakthrough partnerships

Collaboration is key among industry, UN agencies, member states, academia, foundations, and SDOs to achieve the shared goal of building a better world through digital transformation. By working together, we can leverage each other's strengths, expertise and resources to make a more significant impact than we could individually - teamwork makes the dream work!





Get involved!

Together, we can make a real difference and build a more sustainable, equitable and prosperous future for all.

Get involved in ITU's activities to accelerate digital transformation in cities and communities.

For more information

please contact:

Website: <https://www.itu.int/cities/>

Contact us at: digitaltransformation@itu.int

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