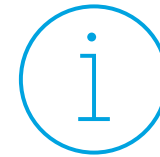


# Digital Twin for Smart Cities

*Ramy Ahmed Fathy*  
*Vice-chairman, ITU-T Study Group 20, ITU*



# Smart City Digital Twin



A digital twin is a digital replica of something in the physical world. It could be a car, a mobile phone, or even a city.

# Digital Twin for Cities

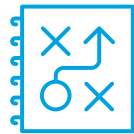
- 1 Improve Operational Efficiency
- 2 Optimize Energy Consumption
- 3 Enhance Disaster Preparation
- 4 Improve Mobility and Transportation
- 5 Improve Urban Design
- 6 Increase Measuring and Monitoring

## Accelerating city transformation using frontier technologies

A U4SSC deliverable



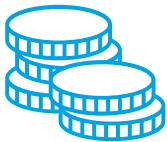
# Digital Twin and Modeling City Wide Scenarios



Situation Analysis



Risk Assessment



Cost Benefit Analysis

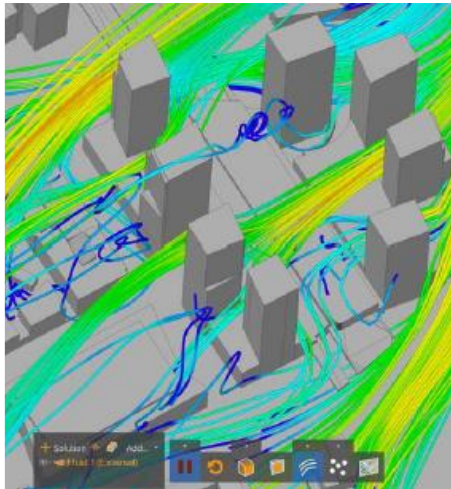


Resilience Planning





# Digital Twin for Urban Solutions



## HELSINKI, FINLAND

Using its digital twin to develop a creative virtual tour of the city to support tourism



## SINGAPORE

Using Virtual Singapore, a dynamic 3-D city model and collaborative data platform to support city stakeholders in driving innovations



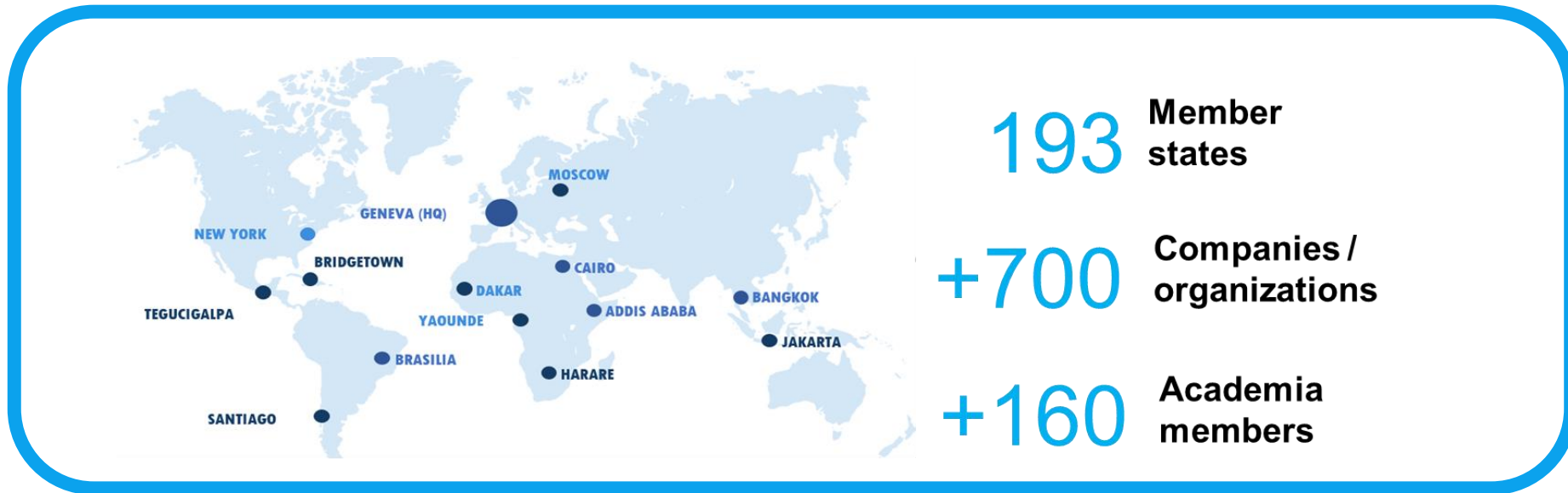
## AMARAVATI, INDIA

Utilizing the digital twin to monitor the city's construction process in real-time; carry out climate change-related simulations and analysis; and create digital twin user IDs

# International Telecommunication Union (ITU)



The [International Telecommunication Union \(ITU\)](#) is the United Nations specialized agency for information and communication technologies (ICTs)



# How ITU Supports Digital Twins



**ITU:**  
International Telecommunication Union –  
the UN specialized agency for ICTs



**U4SSC:**  
United for Smart Sustainable Cities initiative

**Joint IEC-ISO-ITU Smart Cities Task Force**

**JCA-IoT and SC&C:**  
Joint Coordination Activity on IoT and Smart Cities and  
Communities

**ITU-T Study Group 20:**  
ITU Study Group on IoT and Smart Cities and Communities

# ITU-T's Focus on IoT and Smart Sustainable Cities



ITU-T Study Group 20 (SG20) is responsible for:

- 1 Internet of things (IoT) and its applications, and smart cities and communities (SC&C)
- 2 Big data aspects of IoT and SC&C, e-services and smart services for SC&C



# ITU-T Study Group 20 (SG20)

Lead Study Group on

Internet of Things and its applications

Smart cities and communities

IoT Identification

- Q1/20** Interoperability and interworking of IoT and SC&C applications and services
- Q2/20** Requirements, capabilities and architectural frameworks across verticals enhanced by emerging digital technologies
- Q3/20** IoT and SC&C architectures, protocols and QoS/QoE
- Q4/20** Data analytics, sharing, processing and management, including big data aspects, of IoT and SC&C
- Q5/20** Study of emerging digital technologies, terminology and definitions
- Q6/20** Security, privacy, trust and identification for IoT and SC&C
- Q7/20** Evaluation and assessment of Smart Cities and Communities

# ITU-T Study Group 20 Question 1 and Digital Twin



## Q1/20

Interoperability framework of digital twin systems  
in smart cities and communities

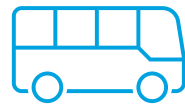


# ITU-T Study Group 20 Question 2 and Digital Twin



**Q2/20**

Requirements and capabilities of a digital twin system for smart cities



**Q2/20**

Requirements and capability framework of digital twin for intelligent transport system



**Q2/20**

Requirements and capability framework of digital twin for smart firefighting



# ITU-T Study Group 20 Question 5 and Digital Twin



## Q5/20

Interaction between physical and digital cities for building smart sustainable city



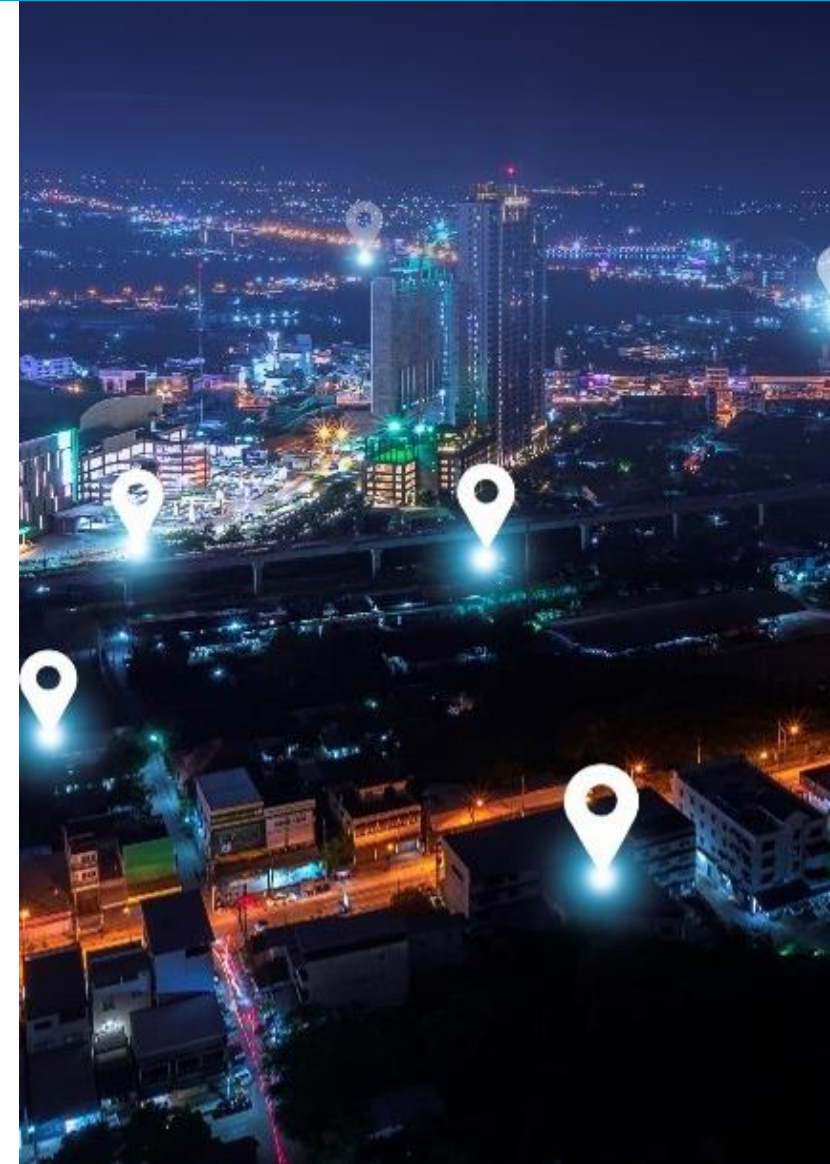


# ITU-T Study Group 20 Question 7 and Digital Twin



**Q7/20**

Concept and use cases of a digital  
twin in smart sustainable cities



# Collaborations



Joint Coordination Activity on Internet of Things and Smart Cities and Communities (JCA-IoT and SC&C)

**tmforum**

- 2 ongoing work items



- 17 new Recommendations approved
- 1 ongoing work item
- 6 Technical Reports agreed



- Organization of World Smart City Forums
- Working team on Smart City Terminology



## Joint IEC-ISO-ITU Smart Cities Task Force

- To build synergies on ongoing work in ITU-T, IEC and ISO related to smart cities and communities;
- To maximize efforts in order to identify new areas of cooperation related to smart cities and communities;
- To develop a holistic view on smart cities and communities taking into consideration the scope, areas of work and expertise of ITU-T, IEC and ISO to support smart cities and communities development.

# United for Smart Sustainable Cities



City Platforms



Economic recovery in cities and urban resilience building in the time of COVID-19



Guiding principles for artificial intelligence in cities



Innovative Financing Instruments for Smart Sustainable Cities



Procurement Guidelines for Smart Sustainable Cities



U4SSC Brochure



# Digital Twin for Smart Cities

Benefits of Digital  
Twin for Cities

Urban Solutions  
from Digital Twin

ITU's Continued  
Role in Digital  
Transformation

Current ITU  
Recommendations

Collaboration is  
Key



# Thank you!

Questions? Interested in learning more?  
Let us know!



**Email**

[u4ssc@itu.int](mailto:u4ssc@itu.int)



**Website**

[ITU-T, Smart Sustainable Cities](#)

# Additional Information

# U4SSC KPIs

Currently implemented in:



U4SSC KPIs Standard

City icons (building silhouettes) are placed to the left of each city name.

- Dubai
- Singapore
- Moscow
- Riyadh
- Valencia

- Wels
- Pully
- Bizerte
- Montevideo
- Krimpen aan den IJssel

**150+ more cities!**



U4SSC KPIs Concept Note

# Applications of the U4SSC KPIs



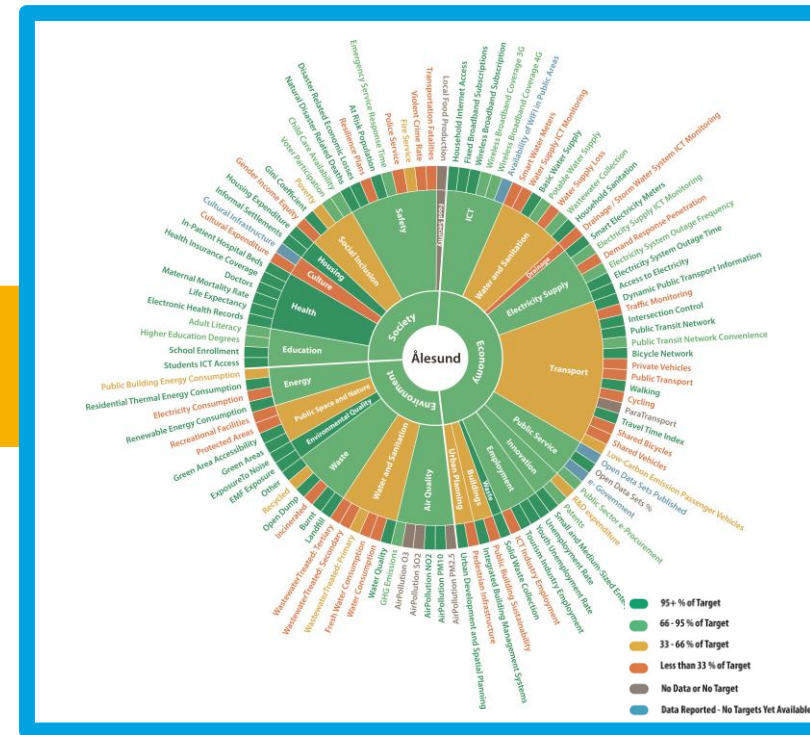
The U4SSC KPIs help cities to:

Track progress

Perform trend analysis

Benchmark performance

Compare results





# Accelerating City Transformation Using Frontier Technologies

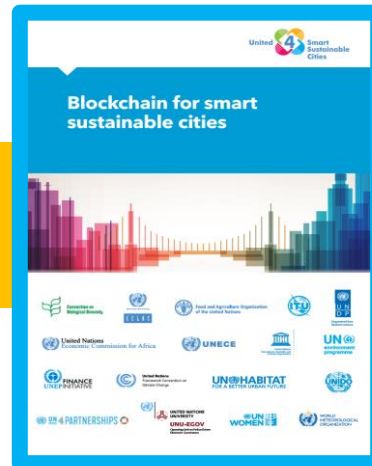


Sheds light on the impact of frontier technologies in cities and on citizens

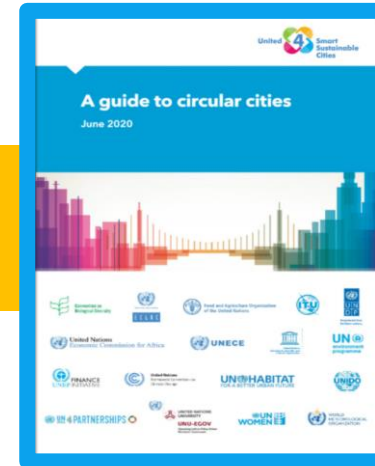
# Other U4SSC Publications



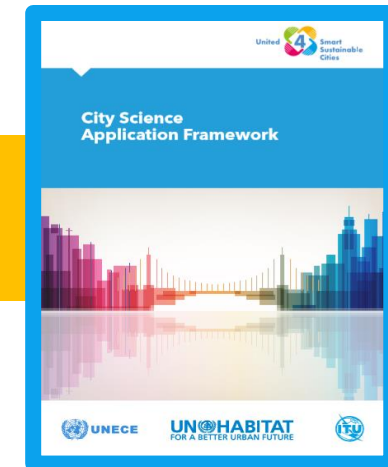
Identifies smart interventions not requiring excessive material or capacity inputs, but helping cities be sustainable



Gives insight into the potential of blockchain technology in building trust within cities



Provides a framework to improve circularity in cities



Offers a four-step methodology to assess, prioritize and boost city applications

# ITU's Global Portal on Environment & Smart Sustainable Cities

[Smart Sustainable Cities](#)

[Cities' Actions to Tackle COVID-19](#)

[Energy Efficient ICTs](#)

[Frontier Technologies](#)

[E-waste and Circular Economy](#)

[Climate Actions](#)



# Examples of ITU-T SG20 standards



## Interoperability

- 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 SCPs'
- Recommendation ITU-T Y.4459: 'Digital entity architecture framework for Internet of things interoperability'
- Recommendation ITU-T Y.4500.13: 'oneM2M – Interoperability testing'
- ITU-T Y Supplement 61: 'Features of application programming interfaces for IoT data in SC&Cs'
- Technical Specification D3.3: 'Framework to support data interoperability in IoT environments'

# Examples of ITU-T SG20 standards



## Data Management & Processing

- Recommendation ITU-T Y.4114: 'Specific requirements and capabilities of the Internet of things for big data'
- Recommendation ITU-T Y.4461: 'Framework of open data in smart cities'
- Recommendation ITU-T Y.4560: 'Blockchain-based data exchange and sharing for supporting Internet of Things and Smart Cities and Communities'
- Recommendation ITU-T Y.4561: 'Blockchain-based data management for supporting IoT and SC&Cs'
- TR D2.1: 'Data process and management framework for IoT and SC&Cs'
- TR D2.3: 'Web based data model on IoT and smart city'
- TR D4.3: 'Overview of technical enablers for trusted data'
- TS D4.4: 'Framework to support IoT data quality management'
- TS D.5: 'Data economy: commercialization, ecosystem, and impact assessment'



# Examples of ITU-T SG20 standards



## Master Plan and Assessment

- ITU-T Series Y Supplement 32: 'A guide for city leaders'
- ITU-T Series Y Supplement 33: 'Master Plan'
- ITU-T Series Y Supplement 68: 'Framework for Internet of things ecosystem master plan'
- Recommendation ITU-T Y.4903/L.1603: 'Key performance indicators for smart sustainable cities to assess the achievement of sustainable development goals'
- Recommendation ITU-T Y.4904: 'Smart sustainable cities maturity model'
- Recommendation ITU-T Y.4905: 'Smart sustainable cities impact assessment'
- Recommendation ITU-T Y.4906: 'Assessment framework for digital transformation of sectors in smart cities'

# Examples of ITU-T SG20 standards



## Emergency Response & Management

- Recommendation ITU-T Y.4102: 'Requirements for IoT devices and operation of IoT applications during disasters'
- Recommendation ITU-T Y.4116: 'Requirements of transportation safety services including use cases and service scenarios'
- Recommendation ITU-T Y.4119: 'Requirements and capability framework for IoT-based automotive emergency response system'
- Recommendation ITU-T Y.4467: 'Minimum set of data structure for automotive emergency response system'
- Recommendation ITU-T Y.4468: 'Minimum set of data transfer protocol for automotive emergency response system'
- Recommendation ITU-T Y.4558: 'Requirements and functional architecture of smart fire smoke detection service'

# Examples of ITU-T SG20 standards



## IoT Security, Trust & Identification

- Recommendation ITU-T Y.4805: 'Identifier service requirements for the interoperability of smart city applications'
- 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'
- Technical Report D4.1: 'Framework for security, privacy, risk and governance in data processing and management'
- Technical Report: 'Cybersecurity, data protection and cyber resilience in smart sustainable cities'

# Examples of ITU-T SG20 standards



## Health and Accessibility

- Recommendation ITU-T Y.4110/Y.2065: 'Service and capability requirements for e-health monitoring services'
- Recommendation ITU-T Y.4117: 'Requirements and capabilities of IoT for support of wearable devices and related services'
- Recommendation ITU-T Y.4204: 'Accessibility requirements for the Internet of things applications and services'
- Recommendation ITU-T Y.4408/Y.2075: 'Capability framework for e-health monitoring services'