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21 – SMART CITIES

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ISSUE PAPER ON SMART CITIES

KEY WORDS

"e-"(-government, -services, -waste), green growth, green buildings, "smart_" (_government, _grids _urbanization, _urban model), resource efficiency, information and communication technologies (ICTs), quality of life, rights, social inclusion, urban resilience.

MAIN CONCEPTS

- Smart city: Many definitions of "smart city" exist, and "smart" approaches have been understood differently by different people and sectors. Some definitions note that smart cities are those cities with "smart (intelligent) physical, social, institutional and economic infrastructure while ensuring centrality of citizens in a sustainable environment;"[1] refer to key characteristics defined by distinct factors (e.g., smart economy, smart mobility, smart people, smart environment, smart living, smart governance); [2] and focus on the strategic use of new technology and innovative approaches to enhance the efficiencies and competitiveness of cities.[3] A definition by the International Telecommunication Union (ITU)'s Focus Group on Smart Sustainable Cities (FG-SSC) reads: "A smart sustainable city is an innovative city that uses ICTs and other means to improve the quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects." The UK Department of Business, Innovation and Skills considers smart cities a process rather than as a static outcome, through which citizen engagement, hard infrastructure, social capital and digital technologies "make cities more livable and resilient and, hence, able to respond quicker to new challenges."[4] Accenture defines smart city as a city that delivers services to citizen and businesses in an integrated and resource efficient way and enables innovative collaborations to improve inhabitants' quality of life and support the growth of the local and national economy.[5]

- Smart City Planning and Design: An approach leveraging new knowledge and tools to promote urban planning and design that address evolving needs and challenges of urbanization.

- "Smart"/"e"-approaches: Often used to refer to efforts that are innovative and/or utilize technology, particularly information and communications technologies (ICTs) to enhance the efficiencies of urban systems, increase

[1] http://indiansmartcities.in/downloads/CONCEPT_NOTE_-3.12.2014__REVISED_AND_LATEST_.pdf
[2] http://www.smart-cities.eu/download/smart_cities_final_report.pdf
[3] Please see, for examples, definitions from the the European Commission (https://eu-smartcities.eu/) and from the private sector (http://www.ibm.com/smarterplanet/us/en/smarter_cities/overview/; http://www.cisco.com/web/strategy/smart_connected_communities.htm).
[4] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/246019/bis-13-1209-smart-cities-background-paper-digital.pdf
[5] http://www.accenture.com/SiteCollectionDocuments/PDF/Accenture%20PoV%20How%20Smart%20are%20Smart%20Cities%20FINAL.pdf

the quality and effective delivery of services, empower citizens, address environmental challenges and disaster risks (e.g., smart grids, smart transport, smart energy, e-participation, e-services, e-government, etc.).

FIGURES AND KEY FACTS

- Urbanization since 1996 when Habitat II was convened had been rapid. More people now live in cities, and global urban population at 54% in 2014 is projected to rise to 70% by 2050. Also, new cities have emerged, and hundreds are expected to be built in coming years. These upward trends are expected to be significant particularly in developing countries, where 90% of the additional 2.5 billion urban inhabitants and where much of the growth of secondary and tertiary cities by 2050 are projected.[6]

- Cities are engines of economic growth, accounting for 80% of the global GDP. But they also consume around 75% of global primary energy and responsible for 70% of the global greenhouse gas (GHG) emissions.[7] All sectors associated with urbanization (transport, building construction and maintenance, housing, waste management, energy, etc.) are registering trends that raise sustainability issues.

- Rapid and unplanned urbanization has led to growth of slums, sprawl, housing and infrastructure shortages, social segregation, and exclusion. Accompanied by motorization, it has caused congestion and hazardous air pollution. Cities are where inequalities are most acute (one-third of urban dwellers in the developing world, for example, live in slums), where threats to culture and heritage are rising, and where the heavy concentration of people and assets poses high level of challenges and disaster risks (please see Issue Papers on urban planning, urban land, housing, municipal finance, and urban governance).

- Urbanization trends pose a need for strategic and innovative approaches to urban design, planning, management and governance. The accompanying trends in ICTs play a significant role in 21st Century urbanization as ICTs increasingly support business functions, city logistics and grids, transport, delivery of basic services, environmental management systems, government operations, data-driven industries like finance, and people-to-people interactions.[8]

- Today, there are more than 7 billion mobile subscriptions worldwide, up from 738 million in 2000. Globally, 3.2 billion people are using the Internet, of which two billion live in developing countries. Mobile broadband penetration globally is close to 47 per cent in 2015, a value that increased 12-fold since 2007. In 2015, 69 per cent of the global population will be covered by 3G mobile broadband, up from 45 per cent in 2011[9].

- Most aspects relevant to the new urban agenda reference the role and potential of ICTs to advance goals and address challenges (please see all Issue Papers for Habitat III), presenting new opportunities and smart approaches for the global community to make cities inclusive, safe, resilient, and sustainable.

[6] UN World Urbanization Prospect: The 2014 Revision
[7] UN-Habitat 2011. *Hot cities battleground for climate change*
[8] ITU ICT Facts and Figures 2014
[9] ITU ICT Facts and Figures 2015

ISSUE SUMMARY

- The role of ICTs in networked urbanization and the dynamism of cities in the 21st century is becoming increasingly understood. ICTs have ushered significant and irrevocable changes in the way people live, boosted social prosperity, and had significant impact on the growth and competitiveness of economies and cities.[10] There is also growing recognition of ICTs' potential to achieve desired outcomes in urban development: high-quality public spaces, well-connected grids, well-designed density, increased resource efficiency, improved quality of life, growth with reduced carbon emissions, and knowledge creation and management that address emerging needs and risks --- the contours of cities that are smart and sustainable.

Smart Cities: A viable option for the future

- ICTs in 21st Century urbanization enable digital platforms that support the creation of information and knowledge networks. These networks make aggregation of information and data possible, not only for the purpose of data analysis but also to enhance understanding of how cities function (e.g., resource consumption, service delivery, mobility patterns, etc.) as well as help inform policy and decision-making processes.

- The multiple infrastructure systems in cities are in fact a "system of systems," or a network of systems that support interlocking operations or functions. They have become more integrated using ICTs, leading to the "Internet of things" (IoT)[11] and enabling integrated management of operations. Harnessing the potential of these networks for sustainable urbanization is a crucial feature of a smart city.[12] There are various viewpoints on what a smart City is. Table 1 below gives a summary of the various attributes, themes and infrastructure requirements assigned to the concept:

Table 1: Distinctive aspects of a smart city that is sustainable

Attributes	• Sustainability: Related to city infrastructure and governance, energy and climate change, pollution, waste, and social, economics and health. • Quality of life (QoL): Improving QoL in terms of emotional and financial well-being. • Urban aspects: Includes technology and infrastructure, sustainability, governance and economics.

[10] See The Conference Board 2011 Report, The Linked World: How ICT Is Transforming Societies, Cultures, and Economies and the World Economic Forum, Global Information Technology Report 2014. Various other reports have noted and projected the positive impact of ICTs on the economy, in society, and in efforts to achieve development goals, as well as framed the challenges and potential risks they pose: The Human Development Report 2001, the first HDR released after the Millennium Development Goals were adopted in 2000, focused on the potential of ICTs for development; the World Bank has released a series focused on the range of issues in this area, as have other UN agencies and international organizations (UNCTAD, including the ECOSOC Report on the subject, ITU, UNESCO, the World Economic Forum; the Broadband Commission; and UNDP). All have relevance to issues around cities and urbanization.

[11] All of these systems comprise of sub-systems, components and devices, which have nodes, end points and behave like a network in terms of their end use characteristics and interactivity with other nodes.

[12] ITU-T Focus Group on Smart Sustainable Cities: An Overview of Smart Sustainable Cities and the Role of Information and Communication Technologies (ICTs)

	• Intelligence or smartness: Commonly quoted aspects of smartness include smart economy, smart people, smart governance, smart mobility, smart living and smart environment.
Themes	• Society: The city is for its inhabitants. • Economy: The city must be able to thrive – jobs, economic growth and finance, etc. • Environment: The city must be sustainable in its functioning for the present as well as future generations. • Governance: The city must be robust in its ability for administrating policies.
Infrastructure	• Physical infrastructure includes buildings, train tracks, roads, electric lines, gas pipelines, water, factories, etc. • The ICT infrastructure acts as the "glue" which integrates all the other elements of the smartness of the city acting as a foundational platform. ICT infrastructure functions as the nerve centre, orchestrating all the different interactions between the various core elements. [13]

- Smart City approach requires a combination of smart efforts to improve inhabitants' quality of life, promote economic growth, and protect the environment from degradation. Key systems of smart and sustainable cities include: smart energy, smart buildings, smart transportation, smart water, smart waste, smart physical safety and security, smart health care, and smart education. ICT based concepts such as big data, open data, Internet of Things (IoT), data accessibility and management, data security, mobile broadband, ubiquitous sensor networks are essential in smart and sustainable cities and are predicated on an ICT infrastructure to improve QoL and promote overall sustainability.[14]

Need for new model of urban planning and design

- One aspect of a smart city is the way it approaches spatial management, particularly in the context of rapid urbanization and leaning on lessons learned from urbanization since 1996 when Habitat II convened. During the 20th Century, prevalent models of urban development turned cities and neighborhoods into fragmented zones with low density sprawl and high density disconnected residential areas. As a result of urban sprawl, public transportation and service delivery were inefficient. All this had strong social impact in terms of livability, cultural diversity, adaptability of the urban pattern, and housing options.

- There emerged in the 21st century the need to promote compactness through mixed land use, maximize land efficiency, as well as to promote sustainable, diversified, socially equal and thriving communities which should focus on following key areas:

    1. High quality streets and public spaces. Well-planned streets and public spaces that shape the urban structure help support local economy, connectivity, culture, creativity, and future developments. A good street network works well for vehicles and public transport as well as for pedestrians and cyclists. At least 50% of the land to be used for public space; 30% to be allocated to streets for building well connected

[13] ITU-FG-SSC 2014. Technical Report on Smart sustainable cities: An analysis of definitions
[14] ITU-TFG-SSC 2014. An overview of smart sustainable cities and the role of information and communication technologies.

grid and 20% to squares, parks and open spaces.

2. Proper and well-designed density. To meet the challenge of rapid urbanization and benefit from the economies of scale and to promote sustainable urban extension, it is important to have proper and well designed density of at least 150 people/ha.

3. Mixed Urban Uses and limited land-use specialization: Mixed land-use planning helps create local jobs, promote the local economy, reduce car dependency and commute, encourage pedestrian, cyclist and other non-motorised transport , reduce landscape fragmentation and green-house gas emissions, provide closer public services, support mixed communities and local economies, promote safer communities and create attractive neighborhoods.

4. Connectivity: The purpose of increasing connectivity is to create access to jobs and services for all and to boost local economies. This encourages walking, public transport, and ICT-accessibility.

5. Mixed social structure: This principle aims to promote cohesion and interaction between different social classes in the same neighbourhood and ensuring accessibility to equitable urban opportunities by providing different types of housing.

6. Urban resilience: Resilience requires policies, disaster preparedness strategies, frameworks, plans and designs that promote both, the adaptation to climate change and mitigation of GHG emissions.

7. Energy and Resource Efficiency: This requires managing growth addressing consumption and resource exhaustion, through strategic planning, policies and measures focused on buildings, appliances, transport and agricultural, industrial and services industries. By using resources in a sustainable manner, assisted by smart technologies cities can minimize impacts on the environment and be responsive to the needs of the poor and vulnerable.

8. Practical and enforceable norms and rules: to cope up with the rapid urban growth that cities are experiencing, it is critical to provide policies, plans, norms and rules that respond to the current needs of municipalities. The norms and rules should be developed with a participatory approach based on the principles of equity and social cohesion.

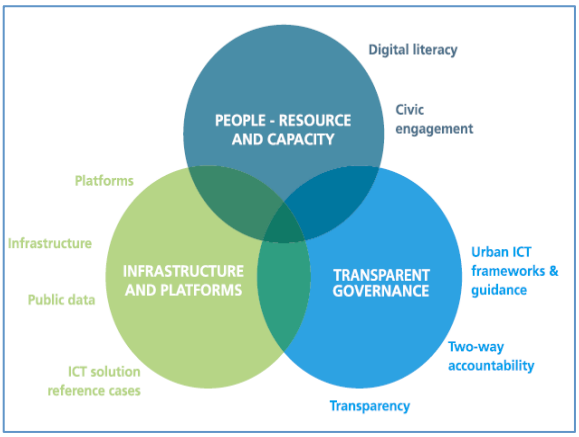


Figure 1: An ICT Enabling Environment for Cities

Smart City governance

- "Smart" efforts are expected not only to enhance the efficiencies of complex urban systems but also to increase the quality and efficient delivery of basic services through a variety of e-solutions; empower citizens through access to knowledge and opportunities; and, to address environmental challenges and disaster risks

through measures enabled by new technology. In this context, "smart" approaches can help achieve the Sustainable Development Goals (SDGs) on making cities and humans settlements inclusive, safe, resilient and sustainable. These efforts focus on elements depicted in Figure 1 (please see Annex for examples).

- Many experts however call attention to the immediate and prevailing focus on cutting-edge technology in smart city approaches, and caution against the view that investments in this area will automatically translate to outcomes associated with smartness (often seen as quick pathway to economic growth) and sustainability.

- There is also a need for 21st century urban models that fit the unique needs of developing countries where urbanization is projected to be at its most rapid pace in the coming decades. Many have inadequate infrastructure that will require enormous investments to retrofit to standards. New cities require huge investments that developing countries need to balance with other priorities. Already facing increasing pressures to deliver more and better basic services to a growing urban population, countries will need support in exploring approaches that fit local contexts. Models responsive to their needs will contribute significantly to the sustainable urban agenda. Emerging now are needs to ensure that ICT based city investments do not neglect, among others, the following:

    - Preservation of cultural authenticity and the protection of vibrancy of the informal sector: The standardized planning and design privileged by smart city approaches need to be attuned to local cultural dimensions. One way to ensure the accommodation of local identities and protection of vulnerable populations is to enable public engagement.

    - Balance between public needs and economic considerations: Governments around the world are under increasing pressure to deliver more and better services and to be responsive and accountable to citizens who are more able to mobilize and demand action using ICTs, while ensuring economic growth through cities' competitiveness.

    - The changing environment that governments face, in governing in the age of new media and increasing connectedness: ICT-assisted approaches can support and strengthen government in part by enhancing transparency through open data and by improving citizens' access to services through online platforms. Governments' use of technology however, including smart cities that lean on e-solutions, need to be mindful of the risks and challenges of digital divides that can be exacerbated by approaches.

    - Need for integrated planning: A 21st century urban model harnessing the potential of ICTs is understood as able to plan its development trajectory in a way that minimizes its carbon footprint, put in place systems and mechanisms that address increasing disaster risks and potential climate impact, enhance quality of life and strengthen local economies.

- To be inclusive, smart city approaches need to be anchored in Human Rights Based Approach to Development Cooperation (HRBA). Use of new technology to enhance public participation, advance accountability, and

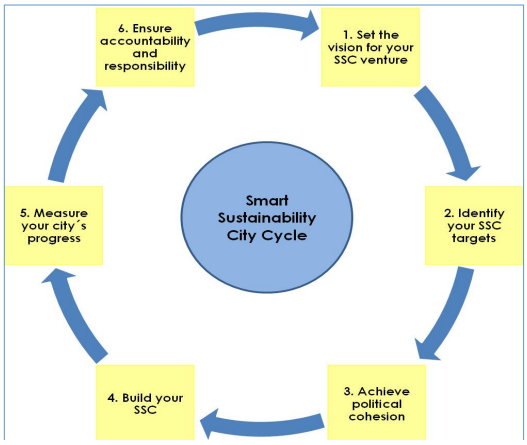
enable development of performance indicators - including human rights indicators - to monitor progress in the realization of inhabitants' rights should be considered in the development of every city.

- Smart cities do not exist in a vacuum; they depend on smart territories that recognize the complementary assets of urban and rural areas, ensure integration between them, and advances effective rural-urban partnerships to ensure positive socio-economic outcomes throughout the rural-urban continuum. There is a need for greater understanding of smart cities also as a vision of cities where, through the strategic use of new or old ICTs, the voices of the marginalized and the poor are heard, the wellbeing of the informal sector and the vibrancy of informal activities are recognized, and the needs of women, youth and the elderly receive attention. It is after all on the social fabric, not only on economic competitiveness and cutting-edge infrastructure, that resilient and sustainable cities are built.

KEY DRIVERS FOR ACTION

- Strategic policies, legislations, rules and regulations: Smart and sustainable cities have to be planned, designed, implemented, and managed effectively. Also, the benefits of smart cities are not automatic. These require strategic policies and innovative thinking about 21st century technological advancements in the sustainable urbanization agenda. More, it is important that the development of a smart city is understood not as the final aim of city administrators, but as a way to reduce costs of public services, enhance access to and quality of these services, enhance regulatory compliance, and help enhance the transparency and accountability of public agencies. All these require smart governance that recognize complementary assets and linkages of urban and rural areas, advance partnerships and bottom up approaches inclusive of stakeholders.

- Innovative, responsive urban planning and design: Planning and design from the planned city extension perspective focuses on: public space layout that minimizes transport needs and service delivery costs while optimizing the use of land; street patterns that enhance mobility and space for civic and economic activities; open spaces that provide areas for recreation and social interaction enhancing quality of life; and, block typology that facilitates private investment in defined and serviced areas. There is a need to re-evaluate existing approaches and instruments, identify good practices suited to local contexts, ensure alignment with international standards, and promote integrated approaches across government ministries and sectors (transportation and communication networks, green buildings, inclusive and efficient human settlements and service delivery systems, improved air and water quality, disaster preparedness and response toward urban resilience).



- Robust financial planning: Smart city approaches require robust financial planning and investments, thus need to be informed by knowledge anchored in local context. This requires inclusive governance marked by stakeholder

engagement -- harmonizing public and private sector priorities and ensuring civil society participation, including marginalized and vulnerable groups, in local public decision-making processes. Financial models also need to be well designed, focused on cost-effective and sustainable solutions and conducive to foreign investment. This aspect focuses on developing a realistic and implementable financial plan that is crucial to the successful implementation of planned city extensions and infill (PCE/I).

- Coherence: There is need for international consensus on what "smart and sustainable city" means, and deeper understanding of how approaches labeled as "smart" advance the new urban agenda. The assumption that the application of ICTs in planning, design and management of urbanization and cities will automatically result in improved outcomes needs to be addressed. This is a long term process and cannot be achieved overnight. Transitioning or building a city into a smarter, more resilient, more sustainable city is a journey and every city is likely to have different pathways. This is a long term process of actions that would not only allow for comparability but would also promote sustainable development along with each city being able to quantify improvements. Cities are accountable for continuous improvement to strengthen its effectiveness for the future. Therefore the process should be able to adapt to the dynamic, evolving and complex nature of cities and be able to continuously update the vision as required.[15]

Figure 3: Shaping your city journey

Set the vision for the city venture:	Identify the targets:	Achieve political commitment	Build the city you want	Measure the city's progress	Ensure accountability and responsibility
Identifying -- a city vision that is in line with the city's identity and long-term development strategy; relevant stakeholders and mechanisms for multi-stakeholder involvement; the existing governance and organizational mechanisms for city solutions.	Developing city infrastructure (e.g.; Internet of Things); Identifying and developing smart and sustainable city services.	Local governments should obtain the necessary political approval and backing to ensure that the strategic programme is pursued. This includes the adoption of the programme/targets through consensus.	The existing traditional infrastructure may be improved on by integrating ICT applications or a new infrastructure must be built from scratch; developing an action plan; establish Public Private Partnerships programmes; ensuring long-term services via good operation and maintenance.	Consists of monitoring and evaluating a work programme required to achieve the targets. Internationally approved KPIs can be utilized to help city administrators map their city's progress.	Involves evaluating, reporting and learning from city process and related experiences. 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 smart and sustainable cities.

[15] ITU-T FG-SSC 2015. Smart Sustainable Cities: A Guide for City Leaders.

PLATFORMS AND PROJECTS

- The European Innovation Partnership for Smart Cities (https://eu-smartcities.eu/)
- ICLEI The Global Cities Network (http://www.iclei.org/)
- ITU-T Focus Group on Smart Sustainable Cities (FG-SSC) acts as an open platform for smart city stakeholders including municipalities, academic and research institutes, non-governmental organizations (NGOs), and ICT sector, industry forums and consortia to exchange knowledge in the interests of identifying the standardized frameworks needed to support the integration of ICT services in smart sustainable cities. It has developed an internationally agreed definition for smart sustainable cities (see Coherence section above) and established a series of KPIs for smart sustainable cities for city leaders. (http://www.itu.int/en/ITU-T/focusgroups/ssc/Pages/default.aspx)
- ITU-T Study Group 5 on Environment and Climate Change (http://www.itu.int/net/ITU-T/lists/rgmdetails.aspx?id=1009&Group=5)
- UNECE-United Smart Cities (http://www.unece.org/housing/smartcities.html), the project portal www.unitedsmartcities.com (to be opened end of May 2015)
- UN-Habitat (www.unhabitat.org)
    - Urban Patterns for a Green Economy: Optimizing Infrastructure- UN-Habitat
    - Urban Patterns for a Green Economy: Working with Nature - UN-Habitat
    - Urban Patterns for a Green Economy: Leveraging Density - UN-Habitat
    - Urban Patterns for a Green Economy: Clustering for Competitiveness
    - Promoting Local Economic Development through Strategic Planning: Local Economic Development (LED) series Volume 1
    - Urban Solutions. United Nations Human Settlements Programme, Nairobi 2015
- United Nations Development Programme (UNDP, www.undp.org): Various research and efforts on sustainable development, climate change, sustainable energy, disaster risk reduction, governance and peacebuilding.

Annex

Table 1: Smart approaches to Targets of Sustainable Development Goal 11
(From UN Habitat: The role of ICT in the proposed urban Sustainable Development Goal and the new urban agenda)

Proposed SDG 11 Targets	ICT-enabled approaches
11.1 on adequate, safe and affordable housing and basic services	e-government solutions help reduce administration costs, increase access and improve coordination: smart water systems that measure water flow and pressure, systems to capture and track maintenance requests and actions
11.2 on safe, affordable, accessible and sustainable transport systems for all	Smart urban transportation enabled by innovative applications of broadband, mobility and cloud services: smart vehicles and infrastructure, multimodal transportation, redefined city spaces
11.3 on inclusive and sustainable urbanization and capacities for participatory … planning and management	ICT transforms society and has potential to transform urban planning and management: e-petitioning and e-panels to enhance community participation
11.4: on protecting and safeguarding the world's cultural and natural heritage	Digitation can help preserve local heritage. Information services and open communication platforms help increase knowledge, engagement and collaboration on heritage preservation
11.5: on impact of disasters	ICT-enabled monitoring of water flows, early warning systems; ICT-assisted humanitarian response for fast deployable mobile solutions; enhance access to information to assist disaster risk management, promote adaptation decision making
11.6: on environmental impact (air quality, municipal and other waste management)	ICTs can help reduce global carbon emissions by 16% by 2020; ICTs can help make buildings more energy efficient through smart metering and smart building control; make grids more efficient, reduce losses and increase speed; ICT-assisted waste management including collection, transport, processing, disposal, and monitoring
11.7: on safe, inclusive and accessible green and public spaces	ICTs enhance security and agreed monitoring systems, access to public safety information, and enrich cultural and urban experience
11.a: on urban-rural links	ICTs assist development planning; broadband enable connection to green power sources, high-definition video links enable remote medical diagnoses
11.b: on resource efficiency, mitigation and adaptation to climate change	Building knowledge base on risk and disaster risk management, hazard monitoring and early wanting systems, access to information on risks, coordination of emergency response and operations
11.c: on assistance to LDCs	smart buildings can reduce energy consumption and CO_2 emissions, micro-grids to increase resilience

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