

Introduction: The new urban agenda

For the first time in human history more people live in cities than in rural areas. By 2050 it is expected that 7 out of 10 people will be urbanites, with the majority of growth occurring in cities of the global South. Planning for, and managing, urbanization is a critical issue for every region and country of the world.

While cities harness the human and technological resources that result in improved productivity, societal development, innovation and economic growth, they are also often sites of poverty, inequality and environmental degradation. Because of the rapid and unplanned nature of urbanization, these trends can aggravate inequity, through slum formation and unregulated expansion. In addition, despite making up a minority of the world's land area, urban areas are the greatest contributor to greenhouse gas emissions.

Yet, the majority of the world's people still depend on the opportunities which urban centers provide, and cities are perhaps the primary spaces through which a diverse range of people can actively engage, educate and advocate for themselves and their human rights. This makes urban areas critical for global alleviation of poverty and for increasing socioeconomic prosperity and human wellbeing.

With more than 60 per cent of the total area expected to be urban in 2030 still remaining to be built, the world is presented with a huge opportunity to get urbanization right and agree on a new urban agenda. But realizing the potential of cities will require adoption of a multi-sectoral, multi-stakeholder and multi-level approach to sustainable urban development. Two current global processes – the formulation of the Post-2015 development goals in 2015 and the United Nations Conference on Housing and Sustainable Urban Development (Habitat III) in 2016 – present an opportunity to formulate this new urban agenda.

Introduction: ICTs and the urban agenda in the SDGs

As the Millennium Development Goals (MDGs) expire in 2015, an international process is underway to define the Post-2015 Development Agenda. This process involves a wide range of stakeholders, and has spanned several years. The Rio+20 outcome document, *The future we want*, mandated an Open Working Group to develop a set of Sustainable Development Goals (SDGs), as a successor to the MDGs. On 19 July 2014, the Open Working Group published its final proposal which includes 17 proposed goals. During 2015, member states will further refine and define these goals, before finally endorsing the proposal.

The proposed Goal 11: *'Making cities and human settlements inclusive, safe, resilient and sustainable'* is directly linked to sustainable urbanization. An SDG on urbanization is supported by a range of stakeholders and also appears in the UN Secretary General's report as "Meeting the Challenges of Urbanization". As such, it is likely that a Goal on cities will be included in some form in the final draft.

Goal 11 is accompanied by 11 action oriented targets, which aim to be global and universally applicable. The areas covered by the targets include housing and slum upgrading, sustainable transport, human settlements planning, cultural heritage, disaster resilience, environmental impact of cities, public spaces, urban and rural linkages, climate change mitigation and adaptation and sustainable buildings.

Information and Communication Technologies (ICTs) are increasingly recognized as an integral part of the SDG process. Modern technology is widely accepted as a way of enabling and measuring the SDGs and is part of the Open Working Group's Outcome Document in Goal 4 on education, Goal 5 on gender, Goal 9 on infrastructure, and in Goal 17 on technology aiming to *'... enhance the use of enabling*

technologies in particular ICT. In addition, ICTs play a big part in the “data revolution” proposed by the High Level Panel’s post-2015 report and in *A World That Counts*, the report by the Secretary-General’s Expert Advisory Group on the Data Revolution. The report *Means of Transformation: Harnessing Broadband for the Post-2015 Development Agenda*, published by the Task Force on Sustainable Development and the Post 2015 Development Agenda also highlights ten proposed SDGs that could significantly benefit from the enabling potential of broadband, as underlined in previous reports of the Broadband Commission.

The Habitat III Conference

Habitat III, the United Nations Conference on Housing and Sustainable Urban Development will take place in 2016 and aims to reinvigorate the global commitment to sustainable urbanization by focusing on the implementation of a “New Urban Agenda”, building on the Habitat Agenda agreed at the Habitat II conference, held 1996 in Istanbul. Habitat III will bring together relevant stakeholders, including member states, parliamentarians, civil society organizations, regional and local government and municipality representatives, professionals and researchers, academia, foundations, civil society organizations, including women and youth groups, trade unions, and the private sector, as well as organizations of the United Nations system and intergovernmental organizations.

Habitat III will be the first UN global summit after the adoption of the Post-2015 Sustainable Development Agenda. It will offer a unique opportunity to discuss the important challenge of how cities, towns and villages are imagined, planned and managed, in order to fulfil their role as drivers of sustainable development, and shape the implementation of the new global development agenda and climate change goals.

About this paper

This paper provides a discussion of the potential role of ICTs in the forthcoming new urban agenda and post-2015 development agenda. It provides an initial outline for how ICTs could enable the fulfillment and monitor the progress of Sustainable Development Goal 11 on sustainable cities. The paper is intended as an initial guide for policy makers on how to use ICT to better meet the specific targets under Goal 11 and how ICT could be used for monitoring the progress of these targets.

Through an ongoing partnership, the paper has been prepared collaboratively by the United Nations Human Settlements Programme (UN-Habitat) and Ericsson. UN-Habitat is mandated by the UN General Assembly to promote socially and environmentally sustainable towns and cities and is the focal point for all urbanization and human settlements matters within the UN system. Ericsson is the driving force behind the Networked Society and delivers services, software and infrastructure – especially in mobility, broadband and the cloud – to customers in 180 countries. Forty percent of the world’s mobile traffic is carried over Ericsson networks, making Ericsson a leader in technology and services leadership globally.

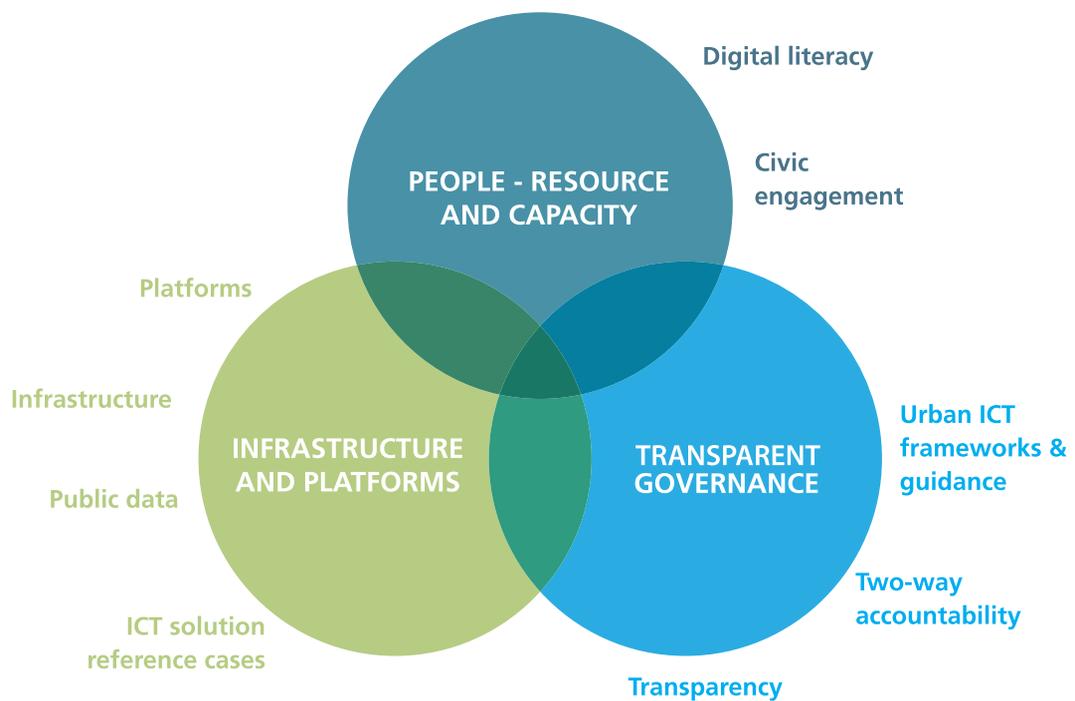
Together, UN-Habitat and Ericsson are working on developing policy guidelines and practical examples of how cities can harness ICTs to solve the social, environmental and economic challenges that they face. By assessing how ICT can be applied to meet the targets under the proposed SDG 11, this paper highlights the importance of integrating ICTs in the post-2015 development agenda and for sustainable urbanization. Parts of the paper are based on previous Ericsson reports and an Expert Group Meeting organized by UN-Habitat and Ericsson at the New Cities Summit in Dallas, June 2014, in which focus was placed on the opportunities of ICTs to support transformative changes in society in addition to simply improving management practices and increasing efficiency.

ICT in sustainable urbanization and the proposed Sustainable Goal 11

To enable transformative change through ICTs across various sectors of the city as well as in policy and governance structures, an enabling environment has to be put in place. Through UN-Habitat and Ericsson's collaboration, as

well as at the Dallas Expert Group Meeting, a number of areas have been recognized as necessary in order to produce an ICT enabling environment for more prosperous cities and to support the fulfillment of Goal 11. These include effective governance systems, the availability of infrastructure and technical platforms and the bridging of digital divides.

FIGURE 1: AN ICT ENABLING ENVIRONMENT



Effective governance systems

Some cities have taken key policy and infrastructure decisions in order to encourage the growth of the ICT sector with the aim of, for example, creating jobs, addressing gaps in the urban fabric, and improving social awareness through education. However, given the growing size of the ICT industry globally and the wide applications of ICT in the urban context, there is a need for the establishment of more comprehensive frameworks to guide

local governments and other urban actors on the necessary arrangements which are needed to create an enabling environment for ICTs in cities. This includes policy measures, guidelines, legal frameworks and guidance for optimal infrastructure development. In addition, there is a need for a global vision and sharing of best practices, as well as frameworks for identifying and designing local applications. Legal frameworks should cover issues such as data management, privacy and security.

ICTs can provide opportunities to strengthen democratic engagement by offering services enabling people to engage in politics, not only in terms of 'top-down' city management, but also to support 'bottom-up' approaches that allow for public participation in decision making processes. The current application of ICT in cities often addresses the management side, for example by enabling citizens to rate the quality of services or report a pothole in a street. There is a profound need to shift the debate to encompass true public participation and involve the urban poor and other marginalized groups in decision making forums. ICT-based mechanisms can be established to encourage interaction and engagement between governments and citizens, based on upward transparency and two-way accountability, not just systems of control, making municipal governments open to crowdsourcing and citizen technologies.

Infrastructure and technical platforms

According to the 2015 Ericsson Mobility Report, the total number of mobile subscriptions in 2014 was around 7.1 billion and during 2014 alone, 800 million new smartphone subscriptions were added worldwide. Mobile infrastructure is rapidly being upgraded to deliver high performing data services and new applications to billions of individuals and users across various sectors of society. This rapid proliferation has only been possible on a global scale through industrial standardization across sectors and governing bodies.

Yet many cities lack the capacity and resources to effectively implement and make use of ICTs. Insufficient ICT infrastructure, systems, platforms, standards, lack of understanding of the potential of technology and poor cross-sector integration often prevent local governments from delivering on ICT visions. Identification of key ICT infrastructure and a focus on implementation of technologies are needed to help local governments undergo a technological transformation.

The creation of diverse platforms and the collection and publishing of city data, provide the opportunity to transform city life by allowing cities and their citizens to create, monitor, and measure progress of their cities in a more informed way. It is especially important that data is used to bridge information and knowledge gaps for the urban poor. Currently, there is a lack of formalized data on urbanization, including city specific data, limiting the ability to determine the relationship between urbanization and sustainable development. Further access to urban data could lead to more informed and empowered citizens as well as help governments make more informed decisions.

People, resources and capacity building

For ICTs to make a significant impact in cities, they must be accessible to the entire population. However, it is important to note that availability does not necessarily mean accessibility. In this sense, ICT products and services may be available in a city, but may not be practically accessible to all segments of the population. In many cases this is due to a lack of affordability, training and education. This may exacerbate the digital divide by increasing the influence of the haves while reducing the influence of the have-nots, thus further worsening urban inequality. ICT-focused capacity building, with a focus on the urban poor and excluded groups, is crucial to the success of ICT implementation in cities. In particular, socio-economic status (education level, employment and income) is closely related to informational use and the acquisition of political knowledge from the Internet. Recent research focuses on what some have termed the 'second-level' digital divide or a usage divide. Such research suggests a conceptual shift of the digital divide from material access to actual use of the Internet and ICTs.

ICTs also have the ability to serve as a continuous and contextual learning tool in urban environments. They can provide educational opportunities for previously neglected segments of the population and enable knowledge

to be shared over geographical and societal distances. Attractive infrastructure and an educated population are needed to encourage business development in cities. Digital literacy, the digital divide and social inclusion are all closely related.

The transformative role of ICTs in meeting urban challenges

The emergence of cloud-based services, more powerful mobile devices, sensors, big data and analytics present a huge opportunity for cities to enter a new phase of technological development and enable new ways to deliver services to citizens. Intelligent sensor networks will become increasingly critical to the basic functioning of cities around the world and present new and sometimes game-changing opportunities in most sectors of society. In the near future we expect to see smart cities with buildings that are net producers of renewable energy, connected and optimized transport systems, electric cars that drive a zero emission economy and a range of e-services such as e-health, e-education, e-commerce, e-governance and teleworking resulting in major changes across society. These examples also highlight areas in which ICTs are expected to have significant impact.

Urban planning

ICTs can promote better informed decision-making by providing city stakeholders with appropriate, up to- date and actionable intelligence. This could improve the efficiency, operation and transparency of physical infrastructure, roads, water, wastewater, emergency and other services. For the collection of data, urban sensors and advanced analytics have the potential of providing city leaders within different departments with access to a rich range of real-time spatial and environmental information about their cities. For example, technologies for monitoring, analysis and automation are valuable when managing the physical infrastructure and operation of different

urban sectors such as traffic management. ICTs also offer new and improved ways of ensuring citizen participation in planning decisions, for example through the use of e-consultations, gamification and engaging virtual communities.

Inclusion

The city of the future will be one that grows, evolves and responds according to the needs of its inhabitants. ICTs can open new opportunities for citizens to more actively shape the future of their cities by sparking new forms of civic participation, increasing social inclusion and accessibility for persons with disabilities, reducing infrastructural barriers, sharing resources, accessing relevant information and enabling a real-time dialogue in which city administrators and citizens can learn from one another. Technology-enabled solutions like e-government and 24-hour government help reduce administration, increase access and improve coordination. This in turn helps free up resources that can be used to increase quality and add value to public services. Mobile banking can improve inclusion by banking the unbanked, and foster social inclusion in informal settlements.

Urban mobility

Urban transportation needs can be addressed through innovative ICT enabled applications that provide more optimized and efficient travel. Some of the benefits of the personal car can be achieved through shared transport and better transportation system integration, making travel across multiple modes of public and private transportation more attractive. This could include ICT optimized transport systems that integrate collective and private modes of transport and deliver public transport to citizens in a more convenient way. Reshaped city spaces tying work, shopping and living areas closer together and use of improved telepresence technology and virtual interactions can limit need for travel.

Health

ICT maturity affects health indirectly through a positive correlation with economic development

and directly through the improvement of efficiency and communication in health care systems, along with the development of e-health services. Health services can be made more efficient through reductions in administration and face-to-face visits through the smart use of ICT. Health risks can be reduced as vital information about epidemics or other emergencies can be quickly collected and disseminated on a large scale.

Education

ICT has long been regarded as an important tool to improve educational outcomes, with the potential to improve the quality of educational systems, extending educational opportunities and increasing individual access to education. ICTs also include transformational tools which, when used appropriately, can promote the shift to a more learner-centered environment. ICTs can enhance the quality of education by increasing learner motivation and engagement, and by facilitating the achievement of basic skills. ICTs have also been used to improve access to and the quality of teacher training and can play an important role in promoting lifelong-learning.

Energy and utilities

ICTs are necessary for including renewable energy in the electricity grid as well as making existing grids more efficient, reducing losses and increasing speed. Through smart electricity grids and smart metering for electricity, water and gas, ICT can reduce the energy consumption of billions of commercial and residential utility service subscribers' worldwide and significantly contribute to reducing associated greenhouse gas emissions. ICT can also help make buildings more energy-efficient through facilities like smart building control.

As ICTs transform cities, they also transform the ways in which companies, industries, governments and citizens innovate. Collaboration is one key enabler to innovation. By putting effort into strengthening collaborative capabilities, cities can be more prepared for collaboration with groups that are focused on responding to social

issues and urban development, thus increasing productivity. By creating a more collaborative ecosystem, cities can achieve both greater efficiency and improved innovation, resulting in increased overall success. This allows for new job opportunities and a more vibrant economy, while realizing efficiency gains that benefit the environment.

Relevant stakeholders

To fully realize the powerful role that ICT can play in the new urban agenda that is now taking shape, it is crucial that a range of stakeholders are included to share resources, catalyse action and address specific problems too complex for any single actor to solve. Each stakeholder contributes differently to realizing the opportunities and overcoming the challenges of ICT in the urban agenda.

Civil society

Through representing citizens' formal and informal interests, civil society can ensure that ICT address societal development goals and priorities. The participation of civil society in ICT implementation and governance can ensure that new forms of ICT-related human rights violations,

related to privacy, censorship, security, access to knowledge and the right to information can be avoided. Civil society should participate in national and local policy processes, including ICT infrastructure implementation and governance issues.

Private sector

With its financial and technical resources, the private sector has a critical role to play in both development and implementation of new technology. In recent years, the private sector has become increasingly interested in urban issues, both seeing the business opportunities while realizing that if social inequalities and environmental degradation, future business will be difficult and increasingly expensive.

Local and national government

National policy frameworks for ICT implementation can provide great momentum, since municipal action is enhanced by national support. This can include both national targets and financial mechanisms and should be connected to global visions and frameworks and support global ICT standardization processes. Directly related to the urban agenda, municipal commitment is a prerequisite for successful application of ICT in cities. Any ICT application in fields such as public

services, infrastructure, and transport must be implemented in partnership with municipalities. Local government also has a potential role to play in tying other stakeholders together and coordinating their activities, through citywide strategic plans.

Intergovernmental organizations

Intergovernmental organizations including, can contribute by coordinating stakeholders and global processes, facilitating the global knowledge transfer, and leveraging capital for investment. With their global network of relevant stakeholders and its legitimacy in the development field, UN agencies can also act as coordinator and initiator of projects.

ICT in SDG Goal 11 and its sub-targets

Within the proposed SDG 11, each target provides underlying ambitions. The table below identifies how ICT could work as an enabler in realizing the targets, and specifies which ICT solutions could provide the function, including both efficiency and management as well as on the more transformative changes required to reach the targets.

GOAL 11: MAKE CITIES AND HUMAN SETTLEMENTS INCLUSIVE, SAFE, RESILIENT AND SUSTAINABLE

Goal 11 targets	ICT contribution
11.1: by 2030, ensure access for all to adequate, safe and affordable housing and basic services, and upgrade slums	<p>Technology-enabled solutions like e-government and 24-hour government help reduce administration, increase access and improve coordination. This in turn helps free up resources that can be used to increase quality and add value to public services.</p> <p>Connected devices, sensors and other ICT solutions can make urban basic services more productive, sustainable and efficient. For example, smart water systems that measure water flow and pressure have the potential to significantly reduce water leakage and loss. ICT-enabled governance systems enable feedback to be delivered to urban authorities, ranging from maintenance requests to gathering views on priorities for improvements in city development programs.</p>

<p>11.2: by 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons</p>	<p>Urban transportation needs of the future will be addressed through innovative applications of broadband, mobility and cloud services. We can anticipate several developments:</p> <ul style="list-style-type: none"> • Smart vehicles and infrastructure – vehicles and roadways will communicate with one another through networks, leading to safer and more efficient travel and transportation and to driverless vehicles. • Transportation as a service – residents will shift from owning vehicles to paying for access to shared vehicles. • Multimodal transportation – the entire transportation system will be knit together, making it possible for individual travelers to optimize their journey through the city across multiple modes of public and private transportation. • Redefined city spaces – reshaping city spaces, reducing distinctions between work/shopping/living areas, and transforming the city itself into a service. • Virtual presence – use of improved telepresence technology that more closely replicates an in person experience, thereby limiting need for certain travel. <p>With the above, urban planning does not have to include as much space for vehicles parking and driving, hence freeing space for organized urban settlements.</p>
<p>11.3: by 2030 enhance inclusive and sustainable urbanization and capacities for participatory, integrated and sustainable human settlement planning and management in all countries</p>	<p>As ICT transforms society, it also has the potential to transform way that participatory planning and management processes are carried out. By putting effort into strengthening collaborative capabilities, cities can be more prepared for collaboration with groups that are focused on responding to social issues and urban development.</p> <p>Virtual communities, gamification, e-petitioning and e-panels provide potential of enhancing and complementing existing community participation processes as well as developing new ways of reaching previously hard-to-reach groups. Collaborative government institutions, citizens, companies and industries can work together to further democracy and human rights and improve urban planning.</p>
<p>11.4: strengthen efforts to protect and safeguard the world's cultural and natural heritage</p>	<p>Information services, open communication platforms, virtual presence and other innovations offer opportunities to better inform of qualities and restrictions as well as increase knowledge about engagement in and collaboration for preserving vital cultural heritage.</p> <p>In addition, as the world becomes increasingly digital, there is also an emerging digital heritage - texts, databases, still and moving images, audio, graphics, software and web pages, among others. Many of these resources have lasting value and significance and should be protected and preserved for current and future generations.</p>
<p>11.5: by 2030 significantly reduce the number of deaths and the number of affected people and decrease by y% the economic losses relative to GDP caused by disasters, including water-related disasters, with the focus on protecting the poor and people in vulnerable situations</p>	<p>ICTs can contribute to the monitoring of for instance water flows and provide more effective early warning systems. They can make humanitarian response actions more efficient, by supporting early responders in time for controlled actions and provide fast deployable, mobile solutions supporting various emergency response functions. In this area, ICTs can be useful for enhanced disaster risk management, for improving city resilience and adaptive capacity and to promote informed adaptation decision making. For example, ICT solutions that integrate hazard data from different sources can automatically calculate hazard impacts and disseminate subscription-based warnings and response recommendations to users, based on their data needs and communication channels.</p>

<p>11.6: by 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality, municipal and other waste management</p>	<p>ICTs have the potential to reduce global carbon emissions with 16% by 2020 according to the SMARTer2020 study. ICTs can help make buildings more energy-efficient through facilities like smart metering and smart building control and they are a prerequisite for including renewable energy into the electricity grid as well as making existing grids more efficient, reducing losses and increasing speed.</p> <p>ICTs further enable better use of resources, for example through more efficient and optimized transport systems. Video and other collaboration tools provide further alternatives to travel and commuting. The use of public transport can be increased by enhancing user experience with better information and improved fleet management. Digitization and electronic distribution, in media, finance and retail instead of physical logistics are further opportunities. ICT are also a vital component of the development of a low carbon agriculture sector.</p> <p>Furthermore, ICT can help raise people’s awareness of their environmental influence and, in turn, help them to make informed choices and adapt their behavior. ICT supports optimized waste management, including the collection, transport, processing, disposal, managing and monitoring of waste materials. ICT can also connect people better and encourage collaborative consumption with shared ownership and re-usage in many different areas.</p>
<p>11.7: by 2030, provide universal access to safe, inclusive and accessible, green and public spaces, particularly for women and children, older persons and persons with disabilities</p>	<p>Technology adaptation and penetration are tools to create a more connected and safe city. ICT can be used in a variety of ways, from advanced security and agreed monitoring systems to public safety information system, to make public spaces safer and more accessible. To promote access to public spaces for online users and bring previously private activities to the public realm, public wireless internet and the use of gaming and augmented reality technologies can be used.</p> <p>Using digital tools can bring new dimensions to public art and encourage interaction between citizens and enrich cultural and urban experiences, for examples by adding layers of digital interaction. Digital projections in public spaces can provide a range of functions – art, education, public information, advocacy and more.</p>
<p>11.a: support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning</p>	<p>Applying multisectorial ICT-based innovation in cities can yield multiplier effects that benefit the entire economy, leading to more interconnected sustainable communities. High-speed broadband will enable connection to green power sources, high-definition video conferencing for remote medical diagnoses, and intelligent transport systems to mention a few examples. Civic engagement through ICT can assist in development planning by tailoring development projects to local needs as well as communication access in rural areas. Mobile banking, transfer systems and other mobile platforms can encourage inclusive socio-economic development.</p>

<p>11.b: by 2020, increase by x% the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, develop and implement in line with the forthcoming Hyogo Framework holistic disaster risk management at all levels</p>	<p>ICT plays a fundamental role in supporting the Hyogo Framework for Action, for example through building a knowledge base on risk and disaster risk management; establishing hazard monitoring programmes including early warning systems, enhancing access to information and an understanding of risk and risk management; involving the media community in risk assessment and risk communication; and organizing and coordinating emergency operations, disaster response and recovery capability. ICT can support more proactive decision-making by providing city leaders with appropriate, up to- date and actionable intelligence. For the collection of data, urban sensors and advanced analytics has the potential of providing cities with access to a rich range of current spatial and environmental information.</p>
<p>11.c: support least developed countries, including through financial and technical assistance, for sustainable and resilient buildings utilizing local materials</p>	<p>Transformative ICT solutions can deliver smart buildings with substantially reduced energy consumption and CO2 emissions while relying on decentralized micro-grids to increase community resilience. ICT can also support multi-stakeholder financing, by reaching out to a stakeholders</p>

Ensuring the sustainability of ICT implementations

As described, ICTs can, if used in an intelligent and inclusive way, help cities and their citizens become more sustainable. However, it is not guaranteed that ICT solutions automatically lead to more sustainable outcomes. Therefore, it is necessary to monitor and evaluate ICT developments as well as specific ICT implementations in order to understand the impact they have on society.

There are many existing indices evaluating the sustainability or prosperity of countries, regions or cities. Some of these, such as the Millennium Development Goals (MDGs), the Global City Indicators and UN-Habitat's City Prosperity Index, include some ICT measurements. Others, such

as Ericsson's Networked Society City Index focus specifically on ICT and development of cities. There is, however, a lack of comprehensive analysis of the impact of ICTs on sustainable development, especially when it comes to providing city level data, although work is ongoing in an ITU focus group on Smart Sustainable Cities to propose key performance indicators on ICT's and sustainable cities.

Measuring the impact of ICTs on cities poses various methodological challenges that need to be solved. These include identifying variables and indicators that can measure the causal impact of specific ICT implementations, lack of comprehensive data and consideration of issues such as uncertainties and so called rebound effects.

Conclusion and recommendations

ICT has great potential to support the sustainable cities of the future. ICTs can reduce administration costs and improve access to key areas such as healthcare, education, banking and provide a platform for inclusion. They can improve the dialogue between city managers and citizens and provide efficiency gains through crowdsourcing, collaboration and innovation. Transformative mobility, broadband and cloud solutions may provide opportunities to construct smart buildings, manage electric cars and support e-government services such as teleworking, distributed health services and online payment solutions. Real-time data monitoring can provide city managers with appropriate and up-to-date intelligence enabling them to make more informed decisions on the management of city services such as roads, electricity, water management and disaster preparedness.

However, in order to fully realize the potential of ICTs for sustainable urban development, an ICT enabling environment has to be created. This includes building susceptible governance models, providing infrastructure and technical platforms as well as focusing heavily on education and capacity building to ensure the potential for all to be included. Crucially, it is important to bridge digital divides and ensure the inclusion of the urban poor in the cities of the global South where the majority of urban growth will take place over the coming years. Finally, more research is needed to further identify specific indicators to measure ICTs direct impact on society.