

Question 1/2

Creating the smart society: Social and economic development through ICT applications

6th Study Period
2014-2017



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smart society: Social and
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through ICT applications

Final Report

Preface

ITU Telecommunication Development Sector (ITU-D) study groups provide a neutral contribution-driven platform where experts from governments, industry and academia gather to produce practical tools, useful guidelines and resources to address development issues. Through the work of the ITU-D study groups, ITU-D members study and analyse specific task-oriented telecommunication/ICT questions with an aim to accelerate progress on national development priorities.

Study groups provide an opportunity for all ITU-D members to share experiences, present ideas, exchange views and achieve consensus on appropriate strategies to address telecommunication/ICT priorities. ITU-D study groups are responsible for developing reports, guidelines and recommendations based on inputs or contributions received from the membership. Information, which is gathered through surveys, contributions and case studies, is made available for easy access by the membership using content-management and web-publication tools. Their work is linked to the various ITU-D programmes and initiatives to create synergies that benefit the membership in terms of resources and expertise. Collaboration with other groups and organizations conducting work on related topics is essential.

The topics for study by the ITU-D study groups are decided every four years at the World Telecommunication Development Conferences (WTDCs), which establish work programmes and guidelines for defining telecommunication/ICT development questions and priorities for the next four years.

The scope of work for **ITU-D Study Group 1** is to study “**Enabling environment for the development of telecommunications/ICTs**”, and of **ITU-D Study Group 2** to study “**ICT applications, cybersecurity, emergency telecommunications and climate-change adaptation**”.

During the 2014-2017 study period **ITU-D Study Group 2** was led by the Chairman, Ahmad Reza Sharafat (Islamic Republic of Iran), and Vice-Chairmen representing the six regions: Aminata Kaba-Camara (Republic of Guinea), Christopher Kemei (Republic of Kenya), Celina Delgado (Nicaragua), Nasser Al Marzouqi (United Arab Emirates), Nadir Ahmed Gaylani (Republic of the Sudan), Ke Wang (People’s Republic of China), Ananda Raj Khanal (Republic of Nepal), Evgeny Bondarenko (Russian Federation), Henadz Asipovich (Republic of Belarus), and Petko Kantchev (Republic of Bulgaria).

Final report

This final report in response to **Question 1/2: “Creating the smart society: Social and economic development through ICT applications”** has been developed under the leadership of its Rapporteur: James Ngary Njeru (Kenya) and ten Vice-Rapporteurs: Richard Anago (Burkina Faso), Evgeny Bondarenko (Intervale, Russian Federation), Cheung-Moon Cho (Republic of Korea), Romain Ciza Mweze (D.R. of the Congo), Seydou Diarra (Mali), Turhan Muluk (Intel Corporation, United States of America), Jean-David Rodney (Haiti), Dominic Vergine (ARM Holdings Plc., United Kingdom), Xing Xin (People’s Republic of China) and Joëlle G. Zopani Yassengou (Central African Republic). They have also been assisted by ITU-D focal points and the ITU-D Study Groups Secretariat.

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Executive summary

Background

The society is progressing to 'Smart' such as 'Smart car', 'Smart home', and 'Smart agriculture'. Information and Communication Technology (ICT) is an engine for the implement of 'smart'. In recognition of the important role ICT in the society today, the 2014 World Telecommunication Development Conference (WTDC-14) approved this study Question "Creating the Smart Society: Social and economic development through ICT applications". This report is the culmination of three years of work with the highest number of contributions from ITU members.

Outcomes of this report

Chapter 1 describes the concept of a Smart Society. The technological pillars and components of the Smart Society are illustrated in **Figure 1** below. This report also presents the characteristics of 'smartness' of those components.

Figure 1: Pillars and components of the Smart Society



Chapter 2 analyzes the foundational principles for ICT to create the Smart Society such as ICT resource management and efficiency, data openness, user-centric strategies, Internet of Things (IoT), rural-urban digital gaps, and assessing ICT projects.

Chapter 3 provides useful case studies of smart society in the field of health, learning, energy, agriculture, resource management – water and waste, commerce, and smart transport networks and road safety.

Chapter 4 presents challenges and way forward for achieving a Smart Society in developing countries from the viewpoints of ICT policy and regulation, budgets, standardization, and human capital.

Future of the Question

The Smart Society contains a variety of characters and areas. Based on the outcomes of the Question, it is revealed that a deeper understanding of the role of ICT applications in the Smart Society and clear guides for the Members about their contributions are imperative. Therefore, considering priorities for achievement of Smart Society and avoiding duplication with other Questions, it is proposed that the focus of the revised Question should be tailored towards the principle of the Sustainable Development Goals (SDGs) while focusing on the following four SDG targets:

- SDG 2 (End hunger, achieve food security and improved nutrition and promote sustainable agriculture).
- SDG 4 (Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all).
- SDG 7 (Ensure access to affordable, reliable, sustainable and modern energy for all).

- SDG 11 (Make cities and human settlements inclusive, safe, resilient and sustainable).

i. Introduction

ICT systems and services have become important ingredients in the development of many facets of life – in one way or another future advancement on society culture, education, health, agriculture, transport and trade – is made through ICT systems and services. Today, ICTs play a key role in the protection of property and persons; smart management of motor vehicle traffic; saving electrical energy; measuring the effects of environmental pollution; improving agricultural yield; management of healthcare and education; management and control of drinking water supplies; and solving the problems facing cities and rural areas. Thus, the world is slowly progressing to a ‘Smart Society’. Delivering the promise of the smart society relies on three technological pillars – connectivity, smart devices and software – and on sustainable development principles.

In recognition of the important role ICT is playing in the society today, WTDC-14, on the basis of Question 17-3/2 (Progress on e-government activities and identification of areas of application of e-government for the benefit of developing countries) for the 2010-2014 study period, and proposals from the Asia-Pacific Telecommunity, Arab States, Member States of the African Telecommunications Union, the United States, Algérie Télécom Spa (Algeria), Intervale (Russian Federation) and the A.S. Popov Odessa National Academy of Telecommunications (Ukraine), approved the new Question to focus on the creation of Smart Societies.

The targeted audience and beneficiaries of this report includes relevant policy makers, regulators and participants in the telecommunication/ICT and multimedia sectors.

ii. Objectives

The Question or issue for study is to focus on:

- a) Discussion of and assistance in raising awareness of methods of improving connectivity to support the smart society, including connectivity to support smart grids, smart cities and e environment and e health applications.
- b) Examination of best practices for fostering and enabling deployment and use of smart devices, including mobile devices, the importance of the application of such devices having been highlighted by BDT's m-Powering Development Initiative, launched at ITU TELECOM World 2012 in Dubai, with an emphasis on successful examples from rural areas in developing countries.
- c) Survey of methods and examples of how software, both open-source and/or proprietary, enables connectivity of smart devices, thereby supporting smart services and smart societies.
- d) Definition of a measurement and performance benchmark for quality-of-life indicators in smart cities, and possible regulation and communication mechanisms that can be followed for good urban governance.
- e) The experiences of developed countries that have built smart cities.
- f) Creation of a national ecosystem that will include all stakeholders involved in defining national road-safety policy.
- g) Definition of a regional cooperation and coordination framework in the area of intelligent transport on cross border networks.

The output expected from this Question will include:

- a) Case studies on how to enable use of telecommunications and other means of connectivity, including Machine-to-Machine (M2M) communications, and access to ICT applications to support sustainable development and foster smart societies in developing countries.

- b) Increasing awareness among relevant participants regarding the adoption of open-source strategies for enabling access to telecommunications, and studying the drivers for increasing the degree of preparedness to use and develop open-source software to support telecommunications in developing countries, as well as creating opportunities for cooperation between ITU members by reviewing successful partnerships.
- c) Analysis of factors affecting the efficient roll-out of connectivity to support ICT applications that enable e government applications in smart cities and rural areas.
- d) Sharing of best practices in the use of ICT networks to enable road safety.
- e) Annual progress reports and detailed final report containing analysis, information and best practices, as well as any practical experience acquired in the areas of use of telecommunications and other means of enabling ICT applications and connecting devices for development of the smart society.

iii. Methodology

The study Question relied on contributions from Member States, Sector Members, Associates, Academia, other United Nations agencies, regional groups, groups in the other ITU sectors, the ITU General Secretariat and BDT coordinators.

Additional contributions and expert opinions were generated during a cybercafé forum and using ITU's co-create platform.

The Rapporteur Group reviewed all the contributions and information documents, progress on BDT initiatives with other United Nations organizations and the private sector on using ICT applications for development of the smart society, and progress on any other relevant activity carried out by the ITU.

1 CHAPTER 1 – What is a Smart Society?

Smart society or Smart nation is widely used as slogan for showing the vision of nation or region's future plan to achieve an advanced information society, such as Smart Japan ICT Strategy,¹ Smart Thailand 2020,² and Smart Africa Initiative.³ Most of these reports describe the smart society or nation as the state where the quality of citizens and efficiency, productivity and competitiveness of society get dramatically improved via a widespread use of advanced ICT such as mobile, sensing, artificial technologies. In this sense, the Smart Africa Initiative identifies policy, access, e-government, private sector/entrepreneurship, and sustainable development as five pillars, which are required to use and adopt, advanced ICT.

Smart society is composed by 'smart' and 'society', thus defining smart society require us to understand the nature of 'smart' or 'smartness', and scope or characteristics of 'society'. Therefore, this chapter will try to point out what is 'smartness' and what should be included in the boundary of society. This chapter provides a guide on the scope and services currently associated with a smart society, the characteristics of attributable to those society geared towards smart production and delivery of services.

1.1 Scope and service of a Smart Society

The word 'Smart' is very widely used as in 'Smart phone', 'Smart car', 'Smart home', 'Smart building', 'Smart agriculture', 'Smart school (learning)', 'Smart city' and 'Smart society'. In the case of the words, 'Smart car', 'Smart home', 'Smart building' and 'Smart agriculture'. 'Smart' means that the car, home, building, and agricultural facility fulfill their functions autonomously via the use of sensing or artificial intelligence technologies without the manual manipulation of the owner. On the other hands, in the case of 'Smart school (learning)', the subject that performs an autonomous function is not a thing but a person (a student) and therefore it means that students learn by themselves through the help of smart devices in the 'Smart school' environment.

In contrast to devices or services/activities such as 'Phone', 'Car', 'Home', 'Building', 'Agriculture' and 'School (learning)', the words, 'City' and 'Society', are composed of sub-elements including 'Governance', 'Citizens', and 'Way of Life', etc. Therefore, in order for a city or society to be called 'Smart', its Governance, Citizens, and Way of Life should be smart.

In that sense, four characteristics of smartness can be identified namely:

- Adoption of autonomous operation via a sensing technology;
- Adoption of artificial intelligence via a machine learning technology;
- Delivering ubiquitous services at any time and any places via mobile technology; and,
- Providing users-centric services via a constant communication between providers and consumers.

Among these four elements, the last one – Providing users-centric services via a constant communication between providers and consumers, seems most crucial for endowing the society with a title or adjective of 'Smartness'.

¹ http://www.soumu.go.jp/main_content/000301884.pdf.

² <http://www.mict.go.th/assets/portals/10/files/e-Publication/Executive%20Summary%20ICT2020.pdf>.

³ <http://www.smartafrica.org/?-Smartafrica-Overview>.

The ITU-T Focus Group on Smart Sustainable Cities (FG SSC), which was established by ITU-T Study Group 5, has provided the following definition of a “Smart Sustainable City”:

*“A smart sustainable city (SSC) is an innovative city that uses information and communication technologies (ICTs) and other means to improve 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”.*¹

However, this definition does not clearly indicate what the characteristics of the smartness of ‘Governance’, ‘Citizens’ and ‘Way of Life’ are.

¹ https://www.itu.int/en/ITU-T/focusgroups/ssc/Documents/Approved_Deliverables/TR-Definitions.docx.

A smart society is one that leverages on the power and the potential of technology to make human beings more productive; to allow us to focus our resources on activities and relationships that matter; and ultimately to improve health, wellbeing and the quality of life.

A cluster of technological advances is changing how people live, work and play. Physical and virtual areas of our lives are increasingly becoming intertwined. More and more of our interactions are mediated by machines. The Internet of Things (IoT), M2M (Machine-to-Machine), hyper-connectivity, wearable technology, intelligent living and ubiquitous computing are all increasingly important areas. The common underlying agenda is to develop new forms of connectivity, new types of digital relationships, and anchor opportunities presented by the greater integration of connected technologies into everyday lives.

Thus a smart society can be described as “One that successfully harnesses the potential of digital technology and connected devices and the use of digital networks to improve people’s lives”.⁴

Pillars of a Smart Society:

- a) Connectivity encompasses networks (mobile, fixed, satellite, and cable) as well as new technologies most often reliant on radio spectrum. Connectivity is a key enabler and component of Machine-to-Machine (M2M) and resulting applications and services such as e government, traffic management and road safety.
- b) Smart devices are the things that are connected that create smart societies. Cars, traffic lights and cameras, water pumps, electricity grids, home appliances, street lights and health monitors are all examples of things that need to become smart, connected devices so that they can deliver significant advancements in sustainability and economic and social developments. This is especially important in developing countries.
- c) Software development connects and enables the first two pillars that, all working together, support new services that would never have been possible before. These new services are transforming everything from energy efficiency to environmental improvements, road safety, food and water safety, manufacturing and basic government services.

Enablers towards development of a Smart Society:

The Big Innovation Centre has identify five enablers which will underpin the ongoing development of the United Kingdom’s smart society, emphasizing what is needed to get the United Kingdom there: a data friendly culture; empowered, digitally literate citizens; empowering public institutions offering smart leadership; enabling infrastructures; and open platforms and markets. These are the things

⁴ Smart society as defined by The Big Innovation Centre, United Kingdom.

one needs to focus on to make the most of the possibilities coming from the next wave of smart society development.

The Smart Africa initiative is built around five (5) pillars which reflect the five (5) principles of the Smart Africa Manifesto. These pillars are: (i) Policy, (ii) Access, (iii) e-Government, (iv) Private Sector/ Entrepreneurship, and (v) Sustainable Development.

The pillars are embedded in four, cross-cutting enablers that will support the implementation of Smart Africa. These enablers are (i) Innovation; (ii) Communications and Advocacy; (iii) Capacity Building; and (iv) Resource Mobilization.

Creating a smart society is reliant on the extent of development of digital technologies. Smart technologies are improving our lives through three broad routes – (a) nowadays virtually all things or activities are carried out more efficiently and effectively, (b) digital technologies are changing the norms of relationships, making new types of relationships possible, and broadening and strengthening our ties with each other, and (c) unlocking new types of business models that create, deliver and capture value through increased efficiency and effectiveness, new forms and norms of relationships, and novel and complementary products or services.

The Internet is having a big impact on how enterprises do business and interact with one another, too. Cloud-based data storage, integrated procurement systems, and “enterprise social networks” that facilitate communication within and among organizations in real time are helping nations improve the lives of their citizens. Thus, smart and digital technologies potentially lead to smart society.

1.2 Characteristics of the Smart Society

A Society contains Politics, Public Administration/Service, Industry/Economic Activity, Knowledge Production (Education), Culture (Attitude and life style) and Citizens, and therefore, characteristics of ‘smartness’ can be described for each component of society as in the following table.

Table 1: Requirements for characteristics of the Smart Society

Category	Characteristics or features required to be called ‘Smart’
Politics	Active participation of citizens on politics (law and policy making process). Openness of laws/policy making processes.
Public administration/ service	Active participation of citizens on public administration process and service delivery. Openness of public administration process and public service delivery. Transforming from public servant centered to citizen centered public administration and service delivery.
Industry/ Economic activities	Development of products and services which do an autonomous operation/ function via sensing and artificial intelligence technologies. Realization of citizen’s demand and interest on industry/economic activities.
Knowledge production (Education)	Active participation of ordinary citizens on knowledge production process such as collective intelligence. Realization of student driven-learning in the schools.
Culture (Attitude and life style)	Cultivating the culture to encourage innovative and citizen driven ways of life Realizing the harmonization of diverse life styles and values/attitudes through non-discriminative treatment of all citizens regardless of their status such as race, gender, age, income, region etc.

Category	Characteristics or features required to be called 'Smart'
Citizens	Cultivating all citizens' capacity to participate in information production and public activities.

In considering the above discussions, the smart society might also be described, as “A smart society where politics, public administration/service, industry/economic activities, knowledge production (education), culture (attitude and life style) and citizens operate and function with strong citizens’ participation through not only the use of advanced ICT but also facilitated by the change of laws and systems of the society”.

1.3 Smart Society and sustainable development

The characteristics of the smart society suggested above enable the creation of a favorable environment for the achievement of Sustainable Development Goals (SDGs)⁵ at all fronts.

Achieving different SDGs requires a society that is implementing smart ways to develop itself, that is keen on providing rights to people and achieving an open government that understands demands and needs of people, that is inclusive and where citizens enjoy a 21st century education, in which Individuals are not only consumers but also producers of knowledge and wealth. A society that cares about the environment and leverage new ways of improving energy efficiency, transportation, dematerialization and the digitalization of goods and services to help drive the transition to a low carbon economy, while better adapting to the effects of climate change and where people have a safe, healthy and happier life.

This smart society vision can be achieved by: integrating ICT innovations as a key component of government policy; developing national e-strategies in coherence with public development goals; empowering citizens to innovate through new educational approaches; allowing for building a wider range of skills needed for innovation; and providing appropriate financing for ICT innovation.

⁵ See list of SDGs at: <https://sustainabledevelopment.un.org/?menu=1300>.

2 CHAPTER 2 – Foundational principles for ICT to create the Smart Society

2.1 Situational analysis

Innovation in ICTs is a key ingredient in the transformation of services for greater development impact – strengthening accountability and governance, improving public services, and enabling more inclusive private delivery of services. A society that embraces the advancement of ICTs becomes more competitiveness and accelerates innovation across the economy while improving productivity. Smart societies embrace ICT-driven policy reforms and private and public-private ventures to catalyze investment in broadband infrastructure and expand access to broadband services, including for the rural areas.

The ultimate impact of ICT on sustainable development depends crucially on the diffusion and use of these technologies for productive purposes, for the extension of services, and for more efficient governance. On the supply side, diffusion and use in other sectors depends on the emergence of actors that can produce and develop the applications and the content and adapt it to local needs and capacities. On the demand side, positive impact depends on local circumstances, capacity, and complementary investment or assistance to ensure adoption and use of ICT. ICT is only one input in achieving desired development outcomes, and the adequacy of its use and effectiveness depends on the quality of complementary conditions, such as local capacity and skills, infrastructure, and other factors.

This chapter looks at foundational principles that are key to embrace to leverage at maximum what ICT can do to enable a Smart Society that ensures sustainable development. This includes resource management and efficiency; information management and sharing; user-centric strategies and; reducing the digital divide. The chapter also highlights some possible indicators to assess ICT projects in relation to the emergence of the Smart Society.

2.2 ICT resource management and efficiency

Achieving sustainable development through a smart use of ICT requires efficient use of expensive IT resources without duplication and waste of existing IT resources. However, it is a commonly recognized problem that many nations have not utilized IT resources efficiently in developing information system due to the lack of proper resources management tool. In order to solve these problems, many nations have enacted laws such as Information Management Act or e-Government Act to legalize the adoption and operation of an information management tool like Enterprise Architecture. In the Republic of Korea, the use of Government wide Enterprise Architecture (GEA) has become mandatory by e-Government act, thus all ministries and public agencies have to register all IT resources they have owned in running information system into Government EA Portal⁶ Duplication of information systems or waste of information resources shall be prevented by the real time monitoring provided by GEA.

The United States' IT dashboard⁷ does a similar function in enabling Federal agencies and the public to have the ability to view details of Federal Information Technology (IT) investments online and to track their progress over time. In addition, all hardware required for running information system are managed by a single site called Government Information Data Center (GIDC).⁸ Shared procurement and management of all hardware by GIDC has enabled the efficient, secure, economical management of IT resources. E-Government Standard Framework is another tool to ensure efficient management of IT resources. All ministries and public agencies are recommended to use standard framework which was developed by the Republic of Korea Government in order to achieve interoperability and

⁶ <http://www.geap.go.kr>.

⁷ <http://www.itdashboard.gov>.

⁸ <http://korea.ncis.go.kr/eng/index.jsp>.

reusability of information system.⁹ Standard framework enable module based development of information system, therefore, individual Ministries do not need to develop all components of information system by themselves, since many key modules are already made and available by the standard framework. Increased interoperability and reusability of information system through the standard framework has reduced the cost to build information system as well as working time to complete the information system. It is strongly required to adopt various strong measures to ensure efficient management of information system for ensuring the use of ICT in a sustainable manner.

Box 1: Enterprise related articles in e-Government Act of the Republic of Korea

Article 45 (Formulation, etc. of Master Plan for Enterprise architecture)¹

The Minister of Public Administration and Security shall formulate a master plan to systematically introduce and disseminate an enterprise architecture (hereinafter referred to as the “Master Plan”) in consultation with the heads of related administrative agencies, etc. and shall report it to the National Informatization Strategy Committee.

The Minister of Public Administration and Security shall formulate pan-Governmental enterprise architecture in compliance with the Master Plan, subject to deliberation by the National Informatization Strategy Committee.

The Minister of Public Administration and Security shall establish and publish guidelines for the introduction and operation of enterprise architecture as well as the construction and operation of an information system and the head of each administrative agency, etc. shall comply with such guidelines.

The Minister of Public Administration and Security shall establish policies for interlinking an enterprise architecture with related systems, such as budgets and performance, and for developing them in consultation with the heads of related central administrative agencies, and the head of each administrative agency, etc. shall endeavor to reflect such policies in any work under his/her jurisdiction, except in exceptional circumstances.

Article 46 (Introduction and Operation of Enterprise Architecture for each Agency)

The head of each administrative agency, etc. prescribed by Presidential Decree (hereinafter referred to as “agency to introduce an architecture”) shall formulate a plan to introduce an enterprise architecture and submit it to the Minister of Public Administration and Security, as prescribed by Presidential Decree.

The head of each agency to introduce an architecture shall introduce and operate the enterprise architecture in accordance with the introduction plan under paragraph (1) and maintain and develop the architecture, to ensure the efficient work processing and facilitation of informatization in the relevant agency.

Article 47 (Facilitating Introduction and Operation of Enterprise Architecture)

In order to facilitate the introduction and operation of an enterprise architecture, the Minister of Public Administration and Security may develop and disseminate a reference model for enterprise architecture jointly utilizable by administrative agencies, etc. (referring

¹ Document 2/359, Republic of Korea.

⁹ http://www.egovframe.go.kr/EgovAdtView_Eng.jsp.

to a model for securing consistency, compatibility, etc. by defining the constituents of an enterprise architecture in line with the standardized classification system and format; hereinafter the same shall apply).

The Minister of Public Administration and Security may provide administrative agencies, etc. seeking to introduce and operate an enterprise architecture, with technology relating to the introduction and operation of such architecture, education and training, and other necessary assistance, as prescribed by Presidential Decree.

In order to make information relating to an enterprise architecture available to every administrative agency, etc., the Minister of Public Administration and Security shall establish and operate a system for managing and providing information relating to the reference model, pan-Governmental enterprise architecture, the current status of implementation and operation of the enterprise architecture for each agency, and other relevant matters.

The Minister of Public Administration and Security may recommend the private sector in close relationship with an administrative agency, etc., which establishes or operates an information system in connection with the information system of the administrative agency, etc., to implement and operate enterprise architecture.

Box 2: Transforming public service delivery through creation of Huduma Centers in Kenya

The Huduma model of integrated service delivery was introduced to drive government efficiency and transparency, reflecting the priorities of Kenya's economic blue print known as Vision 2030, which emphasizes building a citizen-focused and result-oriented public service system. Huduma Kenya is a 'one stop shop' approach in reforming service delivery in Kenya. It involves amalgamating related services within one building, possibly on the same floor, effectively making it possible for service seekers to access it conveniently. This means that citizens apply and receive birth certificates, national identity cards, passports, registration of business names, and applications for marriage certificates, drivers' licenses, and police abstract among other services in one place¹.

There 40 centers are located, among other places, in Nairobi (GPO, Nairobi City square, Makadara, Eastleigh, Kibra) GPO Mombasa, Bungoma, Siaya, Kitui, Embu, Kisumu, Kisii, Kakamega, Kajiado, Machakos, Meru, Isiolo, Wajir, Turkana, Nyeri, Nakuru, Eldoret, Kwale, Makueni, Nyamira and Thika.

Among the changes that are being introduced in the public service delivery include introduction of one stop Huduma Service Centres to provide customer services to citizens from a single location, online e-Huduma web portal to provide integrated services offered by various government ministries, departments and agencies and a unified and integrated channel payment gateway to facilitate ease of payment for government services. The citizens access services such as government tenders and job vacancies using their mobile phones and/or via a call center that provide customer service using a single dialing prefix. Users will also be able to directly post their comments and complaints regarding government services.

¹ Document 2/337, "Transforming Public Service Delivery through creation of Huduma Centres in Kenya", Republic of Kenya.

Box 3: Case study on municipal-level Internet public legal service platform in the People's Republic of China

In China, the municipal-level Internet public legal service platform has been introduced to enhance the public legal service capabilities and effectiveness¹. From the technical point of view, this system is consisted of 4 layers; (1) Presentation layer, (2) Application layer, (3) Data support layer, and (4) Basic support layer.

This system is made up of nine (9) subsystems; (1) Rule-of-law resource query subsystem, (2) Legal consultation subsystem, (3) "One-stop-shop" legal service subsystem, (4) Judicial examination service subsystem, (5) Lawyer special column subsystem, (6) Special column for rule-of-law promotion, (7) Personal center, (8) Public legal service application backend operating system, and (9) System supporting platform.

The system is expected to improve the availability and sharing of public legal service resources in the society.

¹ Document 2/429, "Case study on municipal-level Internet public legal service platform", People's Republic of China.

2.3 Information management and sharing towards data openness

Major concerns in the early stage of ICT adoption had been the digitalization of data or documents, however, nowadays it has moved to maximum and full utilization of digitalized documents or data. Especially, utilization of public data has been more restricted than private data since the public sectors are reluctant to open their public data to citizens. However, the new paradigm of public administrative services requires close cooperation between public and private sectors in providing public services to the citizens. In order for the private sector to participate in the public service delivery, the access and use of public data is crucial. In this sense, many nations have enacted an Open Data Act to ensure the open of public data to the citizens.

In order to promote the open and use of public data owned by Government, OECD (2015)¹⁰ conducts a survey on the status of OECD member states' openness of government data. The survey consists of four indicators namely (1) the existence of a National Strategy or National Open Government Data (OGD) portal, (2) Regular consultation of user's need on open data, (3) Support and promotion of open data through training or campaign, and (4) Ensuring data accessibility through the release of data in a machine readable format, provision of metadata, notification to citizens when new data-sets are added and etc. These indicators could be a good benchmarking guideline for initiating Open Government Policies in many nations.

The success of Open Government Data relies not only on the openness of data, it will require a paradigm shift of Government policy in delivering government service such as change of government centric to citizen centric, application and diffusion of new values such as openness, sharing, communication, collaboration, innovation in government administration process, and the provision of customized public services to citizens.

2.4 Paradigm shift to user-centric strategies

An obvious way to make public services more efficient is to allow for personalization, targeting and integration of government data sets. The increasing use of data, digital services and automation provides

¹⁰ OECD (2015), "Open government data", in *Government at a Glance 2015*, OECD Publishing, Paris.

citizens with a significant opportunity – if managed correctly. The explosion of citizen generated data gives governments the chance to improve the services they provide by making them more efficient, accurate and suited to citizens' needs. Essentially, data helps governments to better serve citizens. For example, social media posts about sickness in the local area can be used to predict where a virus might next strike ahead of medical lab reports.

Patient Generated Data (PGD), as an example, can be used at the population level to create complex modelling of how certain health determinants affect patient populations. The adoption of Internet of Things (IoT) can help discover not only what patients are most at risk in the long term but also how to personalize care as patients achieve their wellness goals; taking in factors not usually identified in a clinical encounter that most impact patients' health. This is primarily done by the creation of sensory, mobile, online and other data, which healthcare organizations can then aggregate and analyze to discern trends and patterns of behavior and create more informed and nuanced clinical guidelines and policy.

As noted during the sixth ITU World Telecommunication Development Conference (WTDC-14), telecommunications and information and communication technologies, plays an essential role of in the world's economic, social and cultural development. The adoption of new technologies has led to great improvement in user-centric service delivery across all the sectors in the economies. In the People's Republic of China, the adoption of active RFID and GIS-based integrated management personnel and asset management systems has led ticketing and management of library collections in Shenzhen University. In Kenya, the introduction of automated water dispensing machines has improved service delivery to the people living the underserved areas within the informal settlements by ensuring quality, clean and affordable water. In Rwanda and Ghana, the adoption of health management information systems has led to efficient delivery of healthcare services, information and education to specific targeted groups like pregnant women and mothers geographically separated in remote areas. In the education sector, the introduction of smart learning in schools and universities through digitization of books and curriculums, has transformed the tradition teaching methodologies in the United Arab Emirates (UAE) and the Republic of Korea.

2.5 Internet of Things

Internet of Things (IoT) services can be delivered using a range of technologies (e.g, mobile, Wi-Fi, fixed, satellite) and policies need to be applied in a technology-neutral manner. Indeed, market players should be allowed to choose the technology that is most appropriate to support the full range of capabilities of the IoT. For instance, different IoT devices may require operators to use licensed and/or unlicensed spectrum to deploy services covering short and long distances, indoor and outdoor locations, and static and mobile applications. Whereas technology neutrality is important, the availability of next generation networks comes with many benefits. Additionally, satellite is an alternative solution for the provision of convergent telecommunication services (voice, data and audiovisual) to rural/isolated areas and areas with specific requirements.¹¹

The technical progress of IoT has paved the way for the upgrade and enhanced the competitiveness of agriculture as a whole. In the People's Republic of China, a smart agriculture solution using Wireless Sensor Network (WSN) employs an architecture of three layers, namely a sensing layer, transmission layer and application layer. The application of IoT application in the agriculture in China has significantly improved the efficiency of agricultural production.¹²

¹¹ Document 2/378, "Supportive policy for the development of the Internet of Things and the Smart Society", AT&T (United States of America); Document 2/286, "Consideration of the satellite option as a development alternative for the universal service and other development-oriented services", Senegal.

¹² Document 2/301, "Research on the application of IoT in agriculture", People's Republic of China.

However, IoT with its promising technologies still has a long way to go before getting ready for prevalent application. Thus, there is a need for huge investment in the IoT research and development in the future and develop more applications for fishing, poultry, forestry and other agricultural industries.

2.6 Reduce rural-urban digital gaps

2.6.1 Digital divide

Information and Communication Technologies (ICTs) are developing at a tremendous pace in our constantly evolving world. The ways in which they are used reveals a major difference between developed and developing countries: in the former they keep up with technological development, whereas in the latter they lag behind it. Whence the term “digital divide”, although that divide is also to be found within populations. It is a disparity that is just as marked between urban and rural areas as it is between richer and poorer countries.

Indicators such as number of Internet users, number of connected computers as a proportion of the population and use of mobile phones form the basis for such observations. New technologies are the driver of a country’s economic development. The digital divide represents only a small part of development inequality in all its manifestations.

This inequality in terms of access to information, knowledge and networks is crucial, and each State must develop strategies to reduce the digital divide in the interests of boosting the development of all social, political, administrative and cultural strata.

2.6.2 Constraints highlighting the digital divide between rural and urban areas

ICTs are an excellent support for transforming our lives, changing our daily habits, informing and educating ourselves, communicating, taking care of ourselves, and so on. But also, and above all, they are an effective means for deriving the best from our natural and cultural resources. For this to be the case, we must have adequate infrastructures.

Unfortunately, a significant utilization gap is to be observed between rural and urban areas, with the former suffering far more from inadequate or non-existent infrastructure than the latter. This gap is to be seen in the following:

– Infrastructures

States must foster and facilitate access to computers and Internet connectivity. Operators provide Internet access with constantly evolving technologies (2G, 3G, 4G, IMT-2020 (5G),¹³ VSAT, High-Throughput Satellite (HTS), etc.), the problem being that some technologies do not cover all parts of the territory.

– Services and content

The use of ICTs, the main components of which are the telephone and Internet, is crucial for a country’s socio-economic development. Unfortunately, however, the computer is still a luxury item in sub-Saharan Africa and the cost of Internet access remains high. Consequently, the development of web content is still an unknown area for the public at large.

¹³ IMT-2020 refers to the 5G standardization work at ITU.

2.6.3 Strategies for reducing the digital divide between urban and rural areas

In order to work towards reducing the digital divide between urban and rural areas the following measures, among others, should be considered:

- Ensure that ICT tools are accessible in rural areas. A poorly developed road infrastructure in a given country can hamper the deployment of those tools to such areas. At the same time, the policy for deployment of the electricity infrastructure must go hand-in-hand with ICT deployment;
- Promote the use of ICTs in the public administration to enhance the performance of public services. Rural administrations are still using archaic communication methods, resulting in invariably lengthy processing times. Corresponding with urban centers by letter post takes a very long time;
- Promote the use of ICTs in education. In this century, the illiterate are those who do not use ICT tools for communicating. Introducing people to ICT usage, even in rural areas, will help to reduce the digital divide;
- Amend each country's laws such as to favor the importation of telecommunication and IT equipment;
- Encourage content development: the posting of content, including the online marketing of agricultural produce, mining products or other natural resources, is conducive to the use of ICT tools in rural areas.

2.6.4 Implementation of a project in support of digital inclusion

The use of new ICTs, and particularly the Internet, can have a positive impact on economic and social development. The ADEN (Fostering Digital Inclusion) Fund¹⁴ supports projects for the production and development of local Internet usages and applications in twelve ADEN countries: Angola, Burkina Faso, Burundi, Cameroon, Guinea, Mali, Mozambique, Nigeria, Central African Republic, Democratic Republic of the Congo, Senegal, and Tanzania. The fund seeks to foster the production and development of IT applications and of content that can be published via the Internet. Further, the Fund forms part of the French strategy for protecting and fostering cultural diversity, having helped, by financing the creation of online African content, to enrich cultural diversity on the internet.

It is within this context that the ADEN project has prioritized the mass Internet access model through a programme of support for the establishment of six access points in the Central African Republic, a landlocked country in central Africa. The access points, known as ADEN centers, have been set up in public places and local associations in six of the country's prefectural towns. The ADEN centers were set up to introduce the Internet and provide training in its uses (consultations, communication, content production), thereby providing logistical support to local associations. In addition to providing support in terms of equipment and connectivity, the project has consolidated the centers' management by training managers, leaders and trainers.

Another their roles was to support the emergence of micro-initiatives through the ADEN centers and using new ICTs for the benefit of local development, by:

- Supporting at least one micro development project in each locality hosting an ADEN center (training, health, links with families in the diaspora, trade, literacy, facilitating the lives of constituents);
- Facilitating the exchange of experience and sharing of information between ADEN center managers and managers of French public access points through meetings and through the <http://www.africaden.net> website, containing tools for work and communication.

¹⁴ http://www.diplomatie.gouv.fr/en/IMG/pdf/ADEN_Fund_-_Regulations.pdf.

All of this has resulted in:

- Greater involvement of local communities in the ADEN center activities;
- Consolidation of the economic viability of the centers;
- The transfer and exchange of skills in the areas of Internet access point management and development of Internet usages and services;
- The establishment within Africa of a network of public Internet access point managers as a veritable pool of experts with the potential for becoming an association that could serve as an intermediary for telecommunication operators and donors.

2.7 Assessing ICT projects in relation to the emergence of the Smart Society

The success of ICT projects requires not only availability of resources such as infrastructure, finance, human capacity and technology but also policy coordination among related stakeholders and institutional support of project owner. The realization of the Smart Society through ICT in developing countries may require considering the special situations developing countries are in. Most of the ICT projects conducted in developing countries utilize foreign funds and technologies and, in many cases, developing countries do not have locally available competent professionals and policy coordination capabilities in implementing ICT projects. Therefore, ICT projects of developing countries need a more cautious approach to ensure the sustainability of those ICT projects.

To ensure the sustainability of ICT projects, the development of local human capacity, appropriateness of adopted ICT technology, appropriateness of financial burden to society and citizens, and consideration on diverse needs of social groups could be suggested. The detailed descriptions of these four dimensions and potential indicators to measure these dimensions are provided in the following sub-sections.

2.7.1 Development of local human capacity

ICT projects should be able to provide new employment opportunities for the young people of developing nations. Employment opportunities shall induce not only an economic benefit but also a motivation to cultivate skills. The utilization of local human capacity should take place not only in the low-level skill areas but also in the high-level skill ones. If a hosting country of ICT projects does not have skilled personnel to lead those ICT projects, the training program for local personnel should be included as a crucial part of the ICT projects.

Potential indicators

- The proportion of the local personnel to the total personnel participated in the ICT project.
- The proportion of the training program budget out of the total budget expenditure of the project.
- The proportion of the work volume of training program out of the total work volume of the project.

2.7.2 Appropriateness of used ICT technology

In order for developing nations to properly maintain their ICT projects, appropriate technologies, which may not be the most advanced technologies, should be utilized in implementing ICT projects. If a technology adopted for an ICT project is far beyond the capacity or resources of the developing nation, it would cause problems in the maintenance, modification or expansion of the technology after the initial completion of the project. Thus, adopted technologies in ICT projects, which fail to correspond with the level of technology development of developing nations, may deepen the technology dependency of developing nations in running ICT projects and services. Similarly, technology choices should be made in consideration of characteristics of developing nations, including environment, topography, and climate, among others.

Potential indicators

- Does the hosting country have sufficient personnel to handle the technology adopted by an ICT project?
- Considering the stage of the hosting country's technology development, is the adopted technology for an ICT project appropriate?

2.7.3 Appropriateness of financial burden to society and citizens

Big ICT projects may entail a financial burden to developing nations, thus most of developing nations utilize a foreign fund generated by a loan or a grant. For this reason, developing nations must figure out whether the finance cost entailed by an ICT project is manageable or not. If the cost of an ICT project is beyond the affordability of the society, it should be reduced or modified to meet the financial situation of the hosting country by replacing high-performing and expensive equipment to moderate-performing but reasonably priced equipment or by switching expensive foreign professionals to local talents.

Potential indicators

- The proportion of the budget of an ICT project to the total budget of the hosting organization.
- Expected savings in delivering public service after the completion of the ICT project.
- The ratio of expected benefits to the cost of the project.

2.7.4 Consideration on diverse needs of social groups

Since most of citizens in developing nations are still lagging behind in terms of the access and use of ICTs, ICT application projects such as e-Government often target younger generations or urban middle class. However, these social groups are likely to already be the major economic and social beneficiaries of developing countries and, therefore, ICT application projects may deepen the existing divide between ICT users and ICT non-users. In this regard, ICT projects should be planned in a way to provide service to a wider range of the population.

Potential indicators

- The number of the beneficiaries of the ICT project.
- The scope/range of the beneficiaries of the ICT project.
- The proportion of the number of the socially marginalized beneficiaries out of the total beneficiaries of the ICT project.

2.7.5 Measurement and performance of Quality-of-Life indicators

The ITU-T Study Group 5 (SG5) Focus Group on Smart Sustainable Cities (FG SSC) identified three indicators as for measuring quality of life: education, health, and Safety/Security of public places.

Potential indicators

- Healthy life expectancy: Number of remaining years that a person of a certain age is expected to live without disability.
- Disaster and emergencies alert accuracy: Proportion of disasters and emergencies with timely alerts.
- Students ICT availability: Proportion of students/pupils with access to ICT capabilities in school.

3 CHAPTER 3 – Use of ICTs, including M2M communications, within Smart Societies

3.1 ICT applications for smart societies – Case for Smart Cities

Modern cities have experienced unprecedented socio-economic growth and environmental crises since the latter half of the 20th century and the beginning of the 21st century. As a result, there is an increasing pressure on existing natural resources such as water, land and fossil fuels. Additionally, there are growing concerns regarding existing transportation infrastructure, provision of adequate healthcare, access to education and overall safety for the growing population of urban residents.

This section reviews the reports generated by the ITU-T Focus Group on Smart Sustainable Cities (FG SSC) that was created by Telecommunication Standardization Bureau in 2013 to assess the role of ICTs in providing smart and sustainable solutions to modern cities.¹⁵ As a result of its activity, FG SSC agreed on the definition of a Smart Sustainable City as “*an innovative city that uses information and communication technologies (ICTs) and other means to improve 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, environmental as well as cultural aspects*”.

The FG SSC concluded its work in May 2015 by approving 21 Technical Specifications and Reports.¹⁶ In summary, three key dimensions have been identified for a city along with key attributes:

- Environment and sustainability;
- City level services; and,
- Quality of life.

The above dimensions can be reclassified into four overarching pillars incorporating the different attributes: Economy, Governance, Environment, and Society.

As noted in the FG SSC technical report, infrastructure is a pivotal aspect of a smart sustainable city. Traditionally, there have been two types of infrastructure: physical (buildings, roads, transportation, power plants) and digital (information technology and communication infrastructure). There is also the concept of a service infrastructure which provides services which run on top of the physical infrastructure (education, healthcare, e-government, mass transit). The digital infrastructure provides the glue to enable the smart sustainable city to operate efficiently and in an optimal manner. Common physical and service infrastructures include (1) Smart Energy, (2) Smart Buildings, (3) Smart Transportation (4) Smart Water, (5) Smart Waste, (6) Smart Physical Safety and Security, (7) Smart Healthcare and (8) Smart Education. Therefore, a smart sustainable city has an end goal to achieve an economically sustainable environment without sacrificing the comfort and convenience/quality of life of citizenry. It strives to create a sustainable living environment for all its citizens through the use of ICTs.

ICT has a crucial role in the smart sustainable city since it acts as the platform to aggregate information and data to help enable an improved understanding on how the city is functioning in terms of resource consumption, services, and lifestyles. Examples of what ICT can achieve include: (1) ICT-enabled information and knowledge sharing (2) ICT-enabled forecasts and (3) ICT-enabled integration. Data prediction, analytics, big data, open data, Internet of things (IoT), data accessibility and management, data security, mobile broadband, ubiquitous sensor networks, all become essential in the smart sustainable city and are predicated on a solid ICT infrastructure.

¹⁵ <http://www.itu.int/en/ITU-T/focusgroups/ssc/Pages/default.aspx>.

¹⁶ http://www.itu.int/en/ITU-T/focusgroups/ssc/Documents/website/web-fg-ssc-0029-r14-overview_role_of_ICT.docx.

The FG SSC technical report “Intelligent sustainable buildings for smart sustainable cities”¹⁷ describes systems of access control and security, elevators and escalators, lighting, signage, building condition monitoring and so on. Examples include the following:

1. Canadian Forces Station (CFS) Alert, which is the most northerly, permanently inhabited location in the world, located only 817 kilometers from the geographic North Pole. CFS Eureka is an intelligent building that advises the Canadian Department of Defense Headquarters in Ottawa, Canada when it is in use and automatically compiles its resupply and repair requirements for each season deployment to the High Arctic.
2. The Molson Centre, is a 20,000+ seat capacity arena located in Montreal, Canada. In this facility the inactive building can be safely managed and monitored by two individuals. Monitoring the screen with the ability to occasionally dispatch the second individual to validate, verify or to address a situation should it arise. The integration of the systems includes access control, intrusion, surveillance, hold up alarms, elevators, fire alarm system, paging system, television displays throughout the building, emergency evacuation systems/address systems, ice surface management, voice, data and restaurant systems, beer dispensing systems, food storage and kitchen systems, parking systems, water leakage systems, electronic photoflash systems and systems for the hard of hearing or simultaneous translation.
3. San Francisco Public Utilities Commission (SFPUC) Building engages a highly efficient exterior building enclosure with exterior sunshades for daylighting, glare management, and to minimize heat gain. Daylight is also harvested for the use of the building, as facilitated by the light shelves integrated into the window walls for increased efficiency. The installation of workstation task lighting reduced the power needed for additional lighting. Energy is also generated through the wind turbines that are installed along the façade of the SFPUC building, and three roof top solar platforms that collect solar energy. Both of these have metering devices attached for data collection and analysis to allow for changes can be made in meeting the building’s energy demand. The IBMS monitors and manages the data with analysis and control, and regarding energy management, it monitors and manages these various systems: elevators, lighting, HVAC, power monitoring, solar energy collector metering, wind energy power generator metering, interior and exterior shade control. Rainwater harvesting system is in place in the SFPUC in a form of a 25,000-gallon cistern used to capture rainwater from the roof and children day care center’s play area. This water is treated and distributed to irrigation areas around the building. The use of water-efficient landscaping allows the captured rainwater to meet all of the irrigation needs. The usage of IBMS in this building has had huge positive impacts on the building. The IBMS also controls additional areas such as demand response, building performance analytics, alarm management and public information and education. The data in the IBMS is transformed onto dashboards. Visualization of the data is paramount and there are over 450 dashboards being developed to provide the facilities team, building operators and even the public, with information that are specifically catered to their needs.

Spain has become a reference model for other countries, because of initiatives implemented under the National Smart Cities Plan, improvements in ICT infrastructure and advances in governance under the Plan and in the standardization of smart cities.¹⁸ Aid for smart city projects and smart destinations has made possible the development of innovative strategies for providing public services. The model of organization and collaboration developed by the Spanish Network of Smart Cities (RECI) has facilitated an exchange of experience among municipalities and cooperation with the private sector.

In accordance with the huge role of ICTs in solving problems of building smart cities and more than that – smart societies, it is important to emphasize the important role of ICT software applications, used for implementation of the relevant services.

¹⁷ <http://www.itu.int/en/ITU-T/focusgroups/ssc/Documents/website/web-fg-ssc-0136-r6-smart-buildings.docx>.

¹⁸ Document 2/408, “The smart cities ecosystem in Spain: A successful model to be continued”, Spain.

Criteria for these ICT applications include:

- Purposefulness;
- Reliability;
- Security;
- Privacy; and,
- Usability.

Despite the fact that the FG SCC identified the city as an area of application of smart services, discussed issues went beyond the city and belong to a wider area, which can be defined as a smart society. The examples are climate change, agriculture, medicine, constraints in water resources and others.

3.2 Health

In the era of globalization and information age, healthcare industries are intensely promoting and adopting ICT to improve patient care. When more and more patients as health consumers seek and prioritize quality in their lives through enhanced healthcare treatments and services, it places great demands on the health care industry's information-handling abilities and infrastructure (Bodenheimer, 1999).¹⁹ As early as 2006, the World Bank in its report²⁰ on "Connecting People, Improving Health: the Role of ICTs in the Health Sector of Developing Countries" observed that reliable information and effective communication are crucial elements in public health practices. The use of appropriate technologies can increase the quality and the reach of both information and communication.

As an example, Rwanda as adopted ICT applications in the Health sector and the percentage of health facilities and access with functional infrastructure (computers and broadband Internet to health centers) has reached 93.8 per cent.²¹ This allows the health facilities to timely access health information systems and medical records. The following are significant ICT applications built by the Government of Rwanda to promote healthcare in Rwanda:

- Telemedicine: System used to deliver health and healthcare services, information and education to geographically separated parties;
- Health Management Information Systems (HMIS): Systems that integrate data collection processing, reporting, and use of the information for programmatic decision-making in Rwanda;
- OpenMRS: An open-source Medical Records System that tracks patient-level data
- TracPlus and TRACnet: It is a system designed by TRAC (Treatment and Research AIDS Centre) in Rwanda for monthly monitoring of infectious diseases including HIV/AIDS, TB, and Malaria;
- CAMERWA: Drug and medical supply management system designed by CAMERWA (Central Drug Purchasing Agency in Rwanda);
- mHealth: It is an application to track pregnant women and newborns, promote early detection of life-threatening emergencies, and facilitate reporting on community-level indicators relevant to Millennium Development Goals.
- Drone Medical Delivery System:²² In the health sector of Rwanda, drones are being used to deliver medical supplies in a pilot project launched late last year 2016 under a public-private partnership, hope to address these challenges by delivering live-saving blood and medicines to

¹⁹ Bodenheimer, T. (1999) The American health care system: The movement for improved quality in health care. *New England Journal of Medicine*, 340:488–92.

²⁰ World Bank (2006) *Connecting People, Improving Health: the Role of ICTs in the Health Sector of Developing Countries*, pp.5-6.

²¹ Document 2/205, "ICT for development vision in Rwanda", Republic of Rwanda.

²² Document 2/412, "ICTs for the Nation's transformation into a Smart Society", Republic of Rwanda

far-flung parts of the country in a faster and more efficient manner. Fifteen drones are expected to make up to 150 on-demand emergency deliveries per day to 21 hospitals located in the western half of the country but the service will be rolled out to the rest of the country by early 2017. As shown in Table 1 of the original document, this initiative allows the Rwandan government to instantly deliver life-saving transfusions to any citizen in the country in 15 to 30 minutes.

For the case of Ghana, many impoverished rural communities in rural areas are lacking the most basic medical services.²³ Furthermore, these communities do not have access to critical information that could prevent diseases, malnourishment, and ultimately deaths. Innovative, low-cost, mobile technology based on smart chips, is being successfully used in Ghana to provide information that improve the lives and opportunities of the most vulnerable people.

Through these mobile devices or ‘talking books’, pregnant woman and mothers of young children in Ghana’s most remote villages receive life-saving health information on topics such as Ebola and cholera prevention and treatment options; treatment of diarrhea in children using oral rehydration therapy; and the importance of a healthy breastfeeding in the early months of a baby’s life.

In small villages across India and Bangladesh, a unique health wearable – it’s a brightly colored bangle – with a tiny built-in carbon monoxide (CO) sensor is piloting. When the sensor detects carbon monoxide at a dangerous level, a red LED flashes. The bangle also produces a voice warning, customized to the wearer’s language, to open windows, open doors or get outside. The aim is to use technology to warn of carbon monoxide (visual and spoken alerts).²⁴

Because of their ubiquity, resiliency, and versatility, satellite communications often are key to delivering e-health applications to remote communities. An initiative launched in Benin uses Mobile Satellite Service (MSS) connectivity to bring remote healthcare for the benefit of around 1,346 children and their families. Charity SOS Children’s Villages Benin works with clinics in the Abomey and Dassa-Zoumé regions, gathering patients’ medical information on smart tablets, and sending it in real time via satellite mobile broadband data service to a secure server allowing urban doctors to monitor and evaluate the villagers’ health and to bring medical attention to individuals sooner than otherwise would be possible.

3.3 Learning

Integration of ICT technology and smart learning in education system are key factors for the creation of smart society. There is need to integrate modern ICT based education systems in primary schools, secondary schools, universities and everywhere in the society. People cannot benefit from smart applications, smart services (such as e-government services in smart cities and rural areas) without educating them. Therefore, we need to integrate ICT technologies in all fields of education. Digital literacy programs are also very important to learn the usage of smart services and transformation into smart society.

In order to achieve digital literacy, a big pool of ICT experts with special skills for the development of smart networks, applications, services and transformation into smart society (such as smart cities, smart roads, smart water management, smart learning, smart agriculture etc.) are needed. Integration of modern ICT technologies in education systems will also accelerate the number of necessary skilled workforce in this area.

In recognition of the importance of digital literacy, during the ITU WTDC-14, the Arab Regional Initiative on Smart Learning was adopted as the model for Smart Learning.

²³ Document 2/223, “The benefits of smart chip technology for the advancement of smart societies in developing countries”, ARM Holdings (United Kingdom).

²⁴ Document 2/374, “Women’s health wearable for the developing world” Intel Corporation (United States of America). More information can be found at: <http://www.grameen-intel.com>.

Box 4: Arab Regional Initiative on Smart Learning

The following are the objective and expected results to be achieved in the period 2015-2018 for the Arab Regional Initiative on Smart Learning:

Objective:

To bring about a shift from traditional methods of teaching in schools and universities using books and paper-based sources to smart learning with the use of tablet computers the latest software and modern telecommunication/ICT techniques to provide access to a range of academic information resources and subject matters.

Expected results:

1. Eradication of digital illiteracy in the Arab region;
2. Finding smart and low-cost computing devices, either with the support of Arab governments or by concluding agreements with manufacturers to provide such devices;
3. Development of Arab educational e-content for schools and universities in the Arab region.

ITU Regional Arab Office organized an online training workshop together with Intel on Universal Service Policy for Broadband and Smart Learning Implementation, 10-11 March 2015.²⁵ This was followed by ITU/ALECSO Smart Learning Forum, Dubai-UAE (14-16 December 2015)²⁶ that developed the “Guidelines Report on Formulating National Strategies on Smart Learning”. The outcomes of initiative in 2015 and actions for 2016 were published in document TDAG16-21/4 and subsequent recommendations are:

- Develop National ICT/Broadband plan (with a measurable implementation plan) and this plan should include the usage of ICT based smart teaching in education for the creation of smart society.
- Develop awareness and training programs for smart society and smart applications;
- Start with a pilot project and scale at national level (pilot projects are also very important to show the benefit and get political support);
- Educate all government employees on smart applications and services;
- Provide digital literacy programs for the people and educate them on the usage of smart applications and services;
- Get top level support from Presidents/Prime Ministers;
- Provide coordination between different Ministries and government organizations (Ministries of ICT, Education, Regulatory Authority etc.).

The sub-section that follows presents two case studies of Smart Learning Programs being implemented in the United Arabs Emirates (UAE) and the Republic of Korea.

²⁵ <http://www.itu.int/en/ITU-D/Regional-Presence/ArabStates/Pages/Events/2015/COE/US4BASL/US4BASL.aspx>.

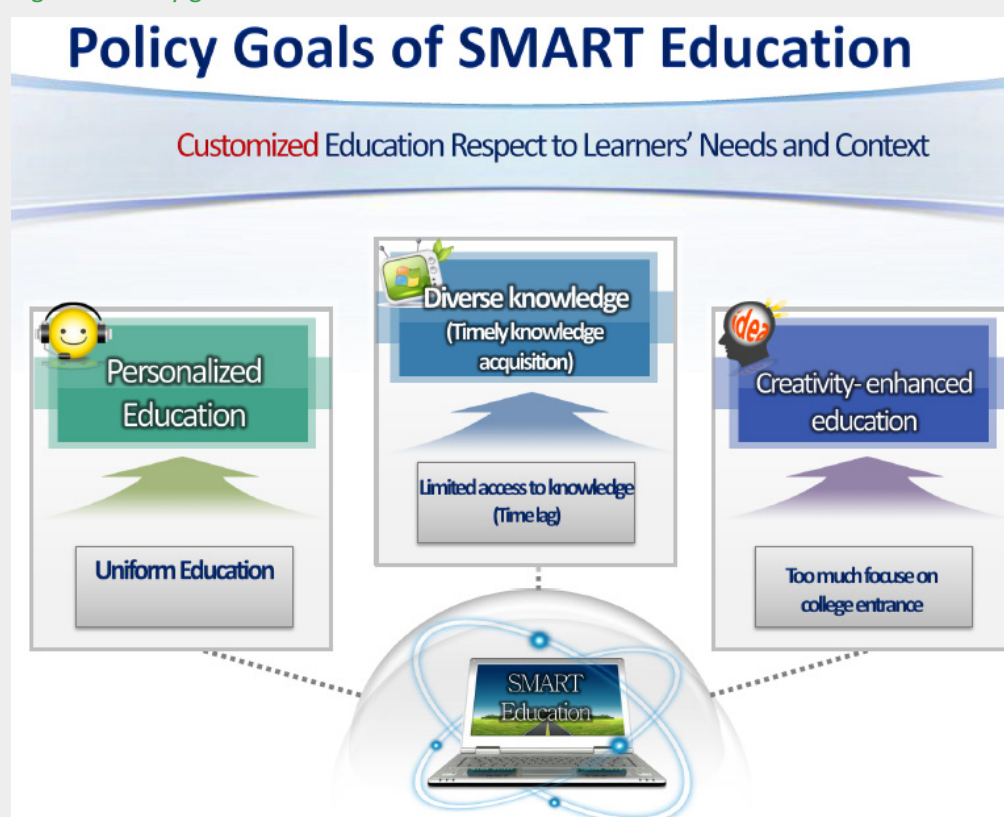
²⁶ <http://www.itu.int/en/ITU-D/Regional-Presence/ArabStates/Pages/Events/2015/SL>.

Box 5: Case study – SMART education in the Republic of Korea

The Korean Ministry of Education, Science and Technology established in 2007 the “Digital Textbooks Generalization Plan” which launched a pilot project aimed at developing digital textbook prototypes for six subjects in thirteen elementary pilot schools.¹

In 2011 the Korean government set the goal of building a powerful country with talented people and decided to pursue SMART education policies for the 21st century. SMART (Self-directed, Motivated, Adaptive, Resource free and Technology embedded) education is an, “Intelligent and customized teaching and learning system” (MEST 2011 Presidential Report). As the initials of SMART indicate, students are expected to learn with fun, motivated, and self-directed ways based on their level and aptitude in a resource-enriched environment.

Figure 2: Policy goals of SMART education

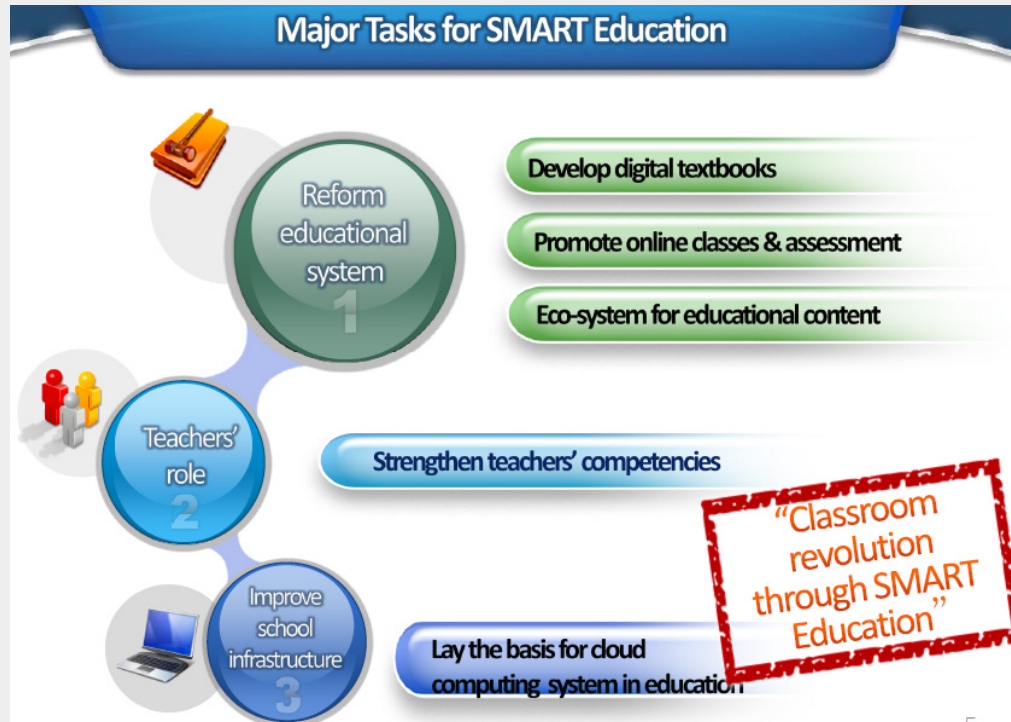


The major five pillars of SMART education policy consists of incorporating digital textbooks into the school system by 2015; promoting online classes and assessment; improving the legal framework and copyright laws; developing the capacity of teachers; and constructing a cloud computing-based infrastructure. Thanks to a cloud-based computing environment, digital textbook content can be readily downloaded so that students can access up-to-date information anytime and anywhere.

¹ <http://www.unescobkk.org/education/ict/online-resources/databases/ict-in-education-database/item/article/digital-textbook-initiatives-in-korea>.

The adoption of Digital Textbooks (computers) has been justified based on a number of reasons: (1) The limitation of paper-based textbooks; (2) Difficult to revise the curriculum in line with the fast-changing educational environment; (3) Takes lots of time and cost to modify contents in time; and, (4) Fails to satisfy various learning needs of students.

Figure 3: Major tasks for SMART education



Box 6: Case study – Smart learning program in United Arabs Emirates

The United Arab Emirates launched the Smart Learning Program in 2012. This is an important component of UAE's Vision 2021 – "to become a knowledge-based economy through the integration of technology in education". The initiative was awarded by ITU in 2014.

Through the Program, the UAE is investing heavily to bring the latest technology to the schools, encouraging the development of creativity, analytic thinking and innovation. Program aims to shape a new learning environment and culture in federal schools through the launch of "smart classes" that will provide every student with an electronic tablet and access to high-speed 4G networks by 2019. The initiative, funded through the Telecommunications Regulatory Authority's Information & Communication Technology (ICT) Fund, is under the guidance of the Ministry of Education as well as the Prime Minister's office. This is a testament to both the promise of the Program and the dedication of the UAE Government to education and ICT.

Figure 4: Smart class and education in UAE



3.4 Energy

3.4.1 Background

Energy is a key input in all facets of human life – access to sustainable energy is an ingredient to transformation of lives, economies and the world at large. As technological innovations continual to improve business process and operations by enhancing performance, improvement in the technical and operational efficiency of energy production and use is one of the pillars of a Smart Society. Economies world over are embracing innovations in ICT to improve the use and delivery of energy related services. Some of the applications include: Pay-as-you-go solar energy systems, Smart street lighting and electricity metering technology solutions.

3.4.2 Concept of sustainable energy

Sustainable Energy also has been recognized as one of the newly adopted Sustainable Development Goals (SDG7) that calls to ensure access to affordable, reliable, sustainable and modern energy for all. Including the target to by 2030. It also calls for a substantial increase in the share of renewable energy in the global energy mix and to double the global rate of improvement in energy efficiency to achieve the following targets by 2030:

1) Achieve universal access to energy

Access to modern energy services is fundamental to human development and an investment in our collective future. While the use of ICT is becoming widespread in developing countries, people cannot receive benefits of ICT without energy. It is critical to achieve the 2030 goal of universal energy access, in order to promote further spread of ICT. Despite the serious efforts already made, according to World Outlook Energy 2015, today an estimated 1.2 billion people – 17 per cent of the global population – remain without electricity.²⁷ It is important to further strengthen the existing activities. There are many ICT related projects bridging the divide such as pay-as-you-go solar power systems in rural areas.

²⁷ <http://www.worldenergyoutlook.org/weo2015/>.

2) Substantial increase in the share of renewable energy in the global energy

A shift to sustainable and renewable energy use is also imperative to protect the Earth's climate and people's health. According to International Energy Agency (IEA) reports, 2.7 billion people – 38 per cent of the global population – put their health at risk through reliance on the traditional use of solid biomass for cooking.

3) Improving energy efficiency

New smart ICT applications such as Smart Grids, Smart Buildings, Smart Transportation Systems, etc. can significantly contribute to improving energy efficiency. Smart Grid technologies for instance can reduce costs of grid congestion, power outages and power quality disturbances. By putting intelligence and allowing for data communication in networks, such as the electric grid, ICTs allows for a dynamic use of energy, greater consumer empowerment, new business models and efficiency gains.

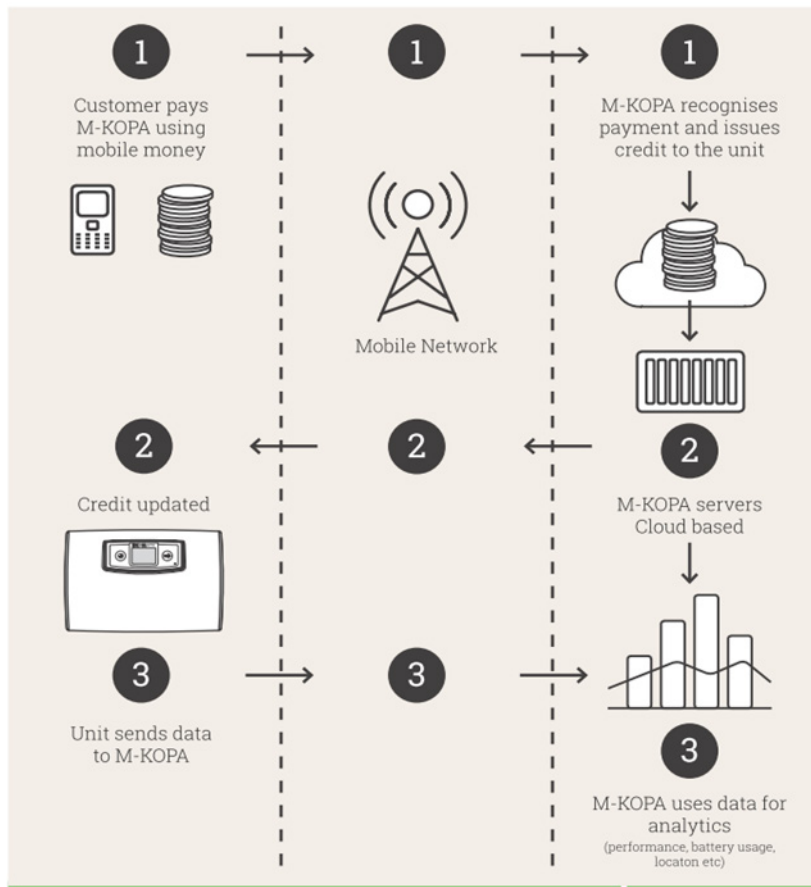
3.4.3 Example of sustainable energy

Pay-As-You-Go solar energy systems in Kenya

In Kenya, an estimated 6 million households are outside the power grid. One example of business model to tackle this affordability problem is M-KOPA.²⁸ M-KOPA's solution enables customers to purchase a self-install, mobile-connected solar home energy system. Figure 4 shows how M-KOPA works. With M-KOPA Solar, customers can deposit USD 30 to take the system home. Then, customers make small payments over a period of time, topping up 'units of credit' via their mobile phone and when they need to use the system. Embedded GSM technology activates the system remotely when credits are bought. After 12 months, they own the system outright, have a positive credit score. Since its commercial launch, M-KOPA has acquired over 250,000 customers across Kenya, Uganda, and Tanzania.

²⁸ Website: [Lessons from M-KOPA's first three years of innovative energy service.](#)

Figure 5: M-KOPA system



Electricity distribution

Smart society applications can increase the stability and efficiency of electricity distribution. For instance, a regional electric distribution network across Queensland, Australia²⁹ has been developed to provide energy for more than 720,000 homes and businesses in some of Australia’s most isolated and economically vulnerable communities. The network is installed with hundreds of circuit breaking reclosers to manage power distribution throughout the network, with a significant number operating in the most isolated parts of the state where cellular and terrestrial connectivity is limited or not available. Using satellite M2M to remotely monitor, control, and manage the recloser network meets their requirements for a single, ubiquitous, reliable network that is impervious to natural disasters and weather events, and provides a high level of security.

Smart street lighting

Smart street lighting refers to systems that control the use of streetlights to use energy more efficiently. At its simplest, this includes a system for measuring accurately the power consumed by streetlights. A more advanced concept would calibrate the amount of power needed to run street lights, and send messages to a central data point if one of the street lights is broken or malfunctioning. Sophisticated systems can also include lighting that is able to adjust itself according to various external factors, e.g. traffic flow.

Intelligent lighting systems of this kind are currently being deployed around the world – patents have already been granted in United Kingdom, United States of America, Australia, Canada, Ireland, France,

²⁹ <https://www.ergon.com.au/about-us/news-hub/talking-energy/electricity-industry/machines-talking-to-machines-are-powering-regional-queensland>.

Germany, People's Republic of China, Japan, and Russian Federation. The efficiencies to be gained from smart street lighting are clear: one industry study has found that implementing this technology will mean an annual cost saving per lamp of nearly USD 45. Multiplied by the amount of street lights in just one city, the economic savings are clearly significant. Smart street lights are also found to deliver an energy saving dividend of 43 per cent, an annual CO₂ reduction per lamp of 128 kg.³⁰

3.5 Agriculture

Agriculture is essential for maintaining human life and social life, and for preserving the environment. It is an important resource that serves as the basis of industries. In many developing countries, agriculture, including forestry and fisheries, is the key industry and has been considered as core regional industries that exert spillover effects on the food industry and on manufacturers and installers of relevant equipment. For example, in Rwanda, agriculture continues to be the largest source of employment by providing 82 per cent of the workforce.³¹

Regarding "e-Agriculture", agriculture and ICT collaborations, priority support will be provided to increase the usage of ICT for the active implementation of marketing and production management. ITU and other UN related organizations are working for e-agriculture to address the Sustainable Development Goals' challenges. Since the 2005 World Summit on the Information Society (WSIS) in Tunis, solid progress has been made in making ICT available to farmers, rural communities, fisher folk and fishing communities, providing them with up-to-date and reliable information to improve their livelihoods. They have changed the rural landscape of agricultural advisory services, market information, value chains and financial services. ICT and their applications in agriculture and rural development can offer enormous support to combating hunger and malnutrition, building resilience and reducing food waste and losses.

Meanwhile, the need to produce more food remains urgent. According to the Food and Agriculture Organisation (FAO), the world population is expected to reach nearly 11 billion by 2050, representing an increase in agricultural demand of approximately 70 per cent – a figure that can only be met with a new revolution in agriculture.

There are a wide range of effective, replicable and sustainable examples of ICTs for agriculture being implemented in by sector members. Some of the solutions are technology based- Satellite M2M technology can contribute to the creation of smart societies³² – Satellite M2M is used to monitor agricultural activities. A case study from Brazil shows how the operators were largely providing service in areas not covered by cellular networks. A system was developed using satellite M2M technologies to track and monitor the harvesting machines in real time. The monitoring system was able to collect, manage, and analyze this information quickly. As a result, the operators were able to respond to the data in order to schedule maintenance and adjust machine use to optimize fuel efficiency. Operational time (not in repair) of machines improved by 10 per cent, while fuel efficiency increased by 5 per cent.

Especially, future deployment of IoT technologies is important as a viable way to increase agricultural yield and the sustainability and resiliency of supply chain, along with delivering financial and social benefits to smallholder farmers. Solutions themselves are becoming more affordable and better. A case study from People's Republic of China shared the experience of using ICT to set up the Information System for Food Quality and Safety Traceability.³³ Through ICT, the system combines every segment of food production chain together, records and tracks the information, guarantees food's quality and safety effectively and therefore protects consumer rights. In recent years, the Chinese

³⁰ Document 2/80, "The role of Machine to Machine (M2M) technology in the development of smart, connected societies", ARM Holding (United Kingdom).

³¹ Document SG2RGQ/212, "Use of ICTs for agricultural development in Rwanda", Republic of Rwanda.

³² Document SG2RGQ/69, "The role of satellite-based Machine to Machine (M2M) technology in the realization of smart societies in developing countries", Iridium Communications Inc. (United States of America).

³³ Document 2/58, "The experience of information system for food quality and safety traceability in China", People's Republic of China.

government has made a great progress by taking a series of measures to construct the information system. The safety of food and increase the productivity and income are serious issues in other countries as well. ICT can play a major role to solve these issues.

By monitoring agricultural products from fields to table, from production to market sale and with the seamless flow of information of product security across the whole supply chain, the quality of agricultural products has been greatly improved. Consumers are able to get access to the information concerning raw material, production, processing, logistics and consumption by EPC (electronic code of product) provided by the merchant before making a decision on product purchase, so that they have more knowledge and choice of the products and supervise the security of the products.

For example, in Rwanda,³⁴ an initiative was established to create smart society through ICT applications. The Government of Rwanda is engaged in the deployment of various information technologies in a bid to improve the citizens' livelihood. In agriculture, the Government of Rwanda understands that the largest part of the population economic activities are in agriculture sector, and then introduced following systems:

- Market Information System (MIS/e-SOKO) an electronic product that enables farmers and traders to access information on agricultural products in markets. This is a platform that helped to fix farm gate prices, raised the awareness of retail prices in the main markets, and allowed farmers to take home a good portion of their hard earned income.
- Fertilizer Voucher Management System, which helped the consolidation of data related to farmers and subsidized fertilizer volume collection, together with monitoring and evaluation of fertilizer use and dissemination. Currently, the system has issued more than 800,000 fertilization vouchers, allowing 2.4 million farmers to benefit from the fertilizers distribution countrywide.
- MINAGRI project aims to accelerate the dissemination of Agricultural Knowledge and technical information from national level to the rural farmers in the entire country by using digital green projectors. It is supported by Rwanda Utilities Regulatory Authority (RURA) through Universal Access and Service Fund.
- Agriculture Extension website “Noza Ubuhinzi n’ Ubworozi”: This website is in local language “Kinyarwanda” aiming at facilitating both farmers and extension agent to acquire practical and technical knowledge. This website has many contents packaged commodity by commodity in PDF, Audio and video format.
- ‘Inkatrack’: An application used to track livestock health and productivity with a mobile phone or computer. The software is being used in national planning and management as it shows the number of cows in the country, how many are sick, how many have died, what kind of diseases are most prevalent, and a lot of other information.

³⁴ Document SGRGQ/212, “Use of ICTs for agricultural development in Rwanda”, Republic of Rwanda.

Figure 6: e-Soko



Source: <http://www.esoko.com>.

Other examples of Smart Agriculture solutions include the case of “SmartVineyard-Making grapes healthier” which demonstrated how to grow grape in Hungary³⁵ utilizing ICT. The systems include precision sensors capable of capturing the most accurate weather parameters. A special integrated LHT sensor was designed to measure all parameters (from leaf moisture to humidity) that play a key role in the ignition of grape diseases. Specially designed for grapes, the sensor is portable and can be placed among leaves to deliver viticulturists the most reliable results.

AgroN2 system is yet another example for Smart Agriculture that introduced a compound sensor network with solar-panel power-supply, connected to the web by communicating on radio frequency.³⁶ After collecting the data such as soil humidity, radiation, air temperature, soil temperature, the direction and velocity of wind, the software processes the values according to certain tasks, the farmer’s preferences, and offers background information such as stock lists or agricultural trends and biological forecasting mechanisms. The system aims to increase the efficiency of agricultural production by offering the latest specific information about the soil’s physical parameters, the meteorological expectancy as well as macro-economic processes for farmers of the certain crop-land. AgroN2 helps the decision making, the calculable production organizing – when to harvest, sell or plant – determining efficient, optimized utilization of the parcels as a long-term result.

“mFish”, which is an initiative designed to instantly cross the digital divide for rural Indonesia³⁷ fisherman aiming to create an application that’s linked to an affordable sustainable mobile data plan that connects among fishermen to vital information and to the local NGO’s. It has proven to make mobile internet access affordable to people at the base of the economic pyramid and to empower broader sustainable fishery efforts and to improve livelihood in coastal communities.

ICT can also help promote more effective and efficient food production in difficult growing environments. For example, in some desert regions, countries are having success with the use of hydroponics to increase food production. These large facilities may be located in remote areas, away from urban infrastructure. Remote real-time monitoring of such sites through satellite-enabled M2M sensor technology provides low-cost updates so any required action can be taken quickly. Site security can also be maintained remotely with satellite connectivity.

³⁵ ITU Telecom World 2016 event, http://telecomworld.itu.int/wp-content/uploads/2015/09/full_exhibition_programme.pdf.

³⁶ ITU Telecom World 2016 event, http://telecomworld.itu.int/wp-content/uploads/2015/09/full_exhibition_programme.pdf.

³⁷ <http://mfish.id>.

These examples aim to highlight areas of application and models of ICT in agriculture, where effective, sustainable and scalable initiatives have been implemented at national, regional or global levels. Potential good practices offer insight into the right mix of conditions, inputs and methodologies that are important for replicable and sustainable initiatives.

It is clear the impact of ICT in the agriculture value chains is diverse, and influences the market competitiveness in different ways. Given the importance of context and the rapid development technology, it can be difficult to determine whether the appropriate tool now will persist in being the appropriate tool in the future.

As E-agriculture increases, it has the potential to more closely tie together a variety of stakeholders in the agricultural ecosystem including farmers, ICT company (for example, a wireless service provider), a global semiconductor manufacturing company focused on increasing demand for its processors, retailers, food manufacturers, distributors, retailers, technology companies, the public sector, NGOs, etc., must work together to alleviate the bottlenecks to information flow as they arise.

It is necessary to continue to promote the use of ICT to reinforce the resilience capacity of states, communities and individuals and to foster collaboration and knowledge sharing, including through the e-Agriculture stakeholders.

3.6 Resource management – water and waste

3.6.1 Background of smart environmental resource management

Since the time of the second industrial revolution, three major global crises have occurred owing to the fact that people did not adequately foresee the negative impacts of that revolution, namely over-usage of resources, environmental pollution and ecological damage, and failed to take sufficient preventive measures. Every country realized the importance of environmental governance, and do great effort to it. Information and communication technology is a key tool in the analysis of environmental data. Smart environmental resource management involves combining ICT with the Internet of Things (IoT) to gain a comprehensive perception of, and then manage, water resources, the atmosphere, wastes and the environment. This will result in an integrated smart environmental protection system which, through smart perception, smart processing and smart management, will help to foster worldwide emission and pollution reduction and facilitate environmental protection, thereby contributing to harmonious development of the environment, human life, the economy and society at large.

3.6.2 Concept of smart environmental resource management

Smart environmental resource management refers to the concept of combining IoT with computerized environmental data to achieve the following goals:

- 1) More in-depth and comprehensive perception of the environment by leveraging all manner of advanced cognitive devices, including a wide variety of sensors, meters and other instruments (including advanced video-monitoring equipment, smart video-analytical technologies and radio-frequency identification technologies) to monitor and measure physical and chemical indicators, the nature and condition of water resources, and hazardous gases in the atmosphere. The integrated use of such equipment and technologies allows for unprecedented smart perception.
- 2) The ever more extended interconnection of all manner of Internet devices, the Internet itself and advanced cognitive equipment, with the information acquired in real time being transmitted by the cognitive device to the service platform, which forwards the data to handheld devices, computers or other smart terminals.
- 3) A higher-level of system intelligence, with the data captured through cognitive devices being used for the corresponding service system, and even serving as the basic data for modelling.

The data management platform gathers data in real time and performs an analysis. When the data show the permissible limit to have been exceeded, an automatic alarm is triggered, alerting the department responsible for environmental resource protection or pollution management to the need to address the situation as a matter of urgency.

3.6.3 Examples of smart environmental resource management

Smart water management opportunities for the Arab region³⁸

Arab countries cover ten per cent of the world's area but receive only 2.1 percent of its average annual precipitation. Recently, Arab countries are conducting the pilot of Integrated Water Resource Management (ISWM), the ISWM depends on the employment of an Advanced Metering Infrastructure (AMI), combined with innovative smart water-extraction mechanisms and/or linking all that with ICT facilities to monitor and measure water consumption.

This can be leveraged to address the above challenges by increasing water-use efficiency, mitigating climate change, controlling water quality and ensuring water-use security. The following areas represent the potential key directions for conducting the pilot in the Arab region:

- Water-systems models;
- Water-systems simulation and optimization;
- Advanced metering infrastructure linked with water extraction and consumption;
- Water distribution network efficiency and leakage control;
- Water quality monitoring and control;
- Water information systems for an integrated Decision Support System (DSS) for irrigation;
- Precision agriculture.

Smart water management opportunities in Kenya³⁹

In Kenya, the Government, through the Urban Water agency NCWSC, has installed Water Automated Teller Machine (ATM) dispensers in the *Mathare* slum that allows access to clean and affordable water. *Mathare* slum like many, informal settlements in the urban areas, lack the requisite infrastructure to connect piped water to individuals, proper sewerage and disposal management systems.

The ATM Water dispenser is a unique integrated platform for revenue collection and online remote management of water points. The platform has three main components: (a) the smart cards where water credits are stored, (b) the water dispenser where water is tapped and credits managed, and (c) the online water management system which processes and publishes transactional and operational data. The ATM water dispensers is cash-less revenue collection platform that not only improves service delivery to underserved areas in the informal settlements but also provides valuable data on customer water consumption behaviour and system operations and ensures quality, clean and affordable water to residents. The key benefits from the 'water ATMs' include the following:

- A closed system for credit distribution using Smartcards and mobile banking ensuring automatic and efficient collection of water revenues through pre-payment;
- Reduction in non-revenue-water;
- Transparent, efficient and effective revenue collection;
- Convenient, affordable and reliable access to clean portable water to the end-users;
- Reduction of waterborne diseases; and,

³⁸ Document 2/76, "Smart water management opportunities for the Arab Region", Arab Republic of Egypt.

³⁹ Document 2/189, "Adoption of ATM Water Dispenser Machines", Republic of Kenya.

- Improvement in living conditions due to reliable water supply.

Figure 7: ATM water dispenser



Public water and sewage monitoring

A Smart public water and sewage monitoring system⁴⁰ that relies on satellite technology to transmit monitoring data on water and wastewater industry has been deployed in countries including United States, Australia, the United Kingdom and Canada. The system can monitor an impending sewage spill in advance so that measures can be taken to address the issue. The system provides complete reliable two-way wireless communications, real-time continuous remote sensing, alarming to devices of the customer's choice – such as a smartphone, a web based interface, and long and short-term data collection and analysis. Built to operate at sites that are environmentally difficult, have no power or communications, the system provides “instant infrastructure” – it can operate virtually anywhere in the world and installs in minutes. Such monitoring systems enable authorities to monitor water and wastewater sites, provide remote security, or monitor environmental or critical locations.

Glacial lake outburst flood monitoring and warning system in Bhutan

When glacial lake water previously dammed by glacial debris or a glacier suddenly breaks through, this results in a Glacial Lake Outburst Flood (GLOF).⁴¹ GLOFs⁴² in Bhutan can cause massive property and livestock damage as well as loss of life. After the 1994 GLOF claimed 22 lives, the government of Bhutan sought to establish an early warning system to give downstream inhabitants time to evacuate.

In 2004, a basic warning system was implemented but it involved manual readings of gauges installed at remote glacial lakes and was susceptible to radio communication failure. The majority of the sensors were only accessible after travelling by pack animal for nine days, and maintenance visits were likewise time consuming.

⁴⁰ Document SG2RGQ/69, “The role of satellite-based Machine to Machine (M2M) technology in the realization of smart societies in developing countries”, Iridium Communications Inc. (United States of America).

⁴¹ Document 2/243, “Applications of satellite based machine-to-machine technologies in early warning systems”, Iridium Communications Inc. (United States of America).

⁴² <http://www.hydromet.gov.bt/?q=22>.

Figure 8: GLOF early warning station



Bhutan embarked on the construction of a project to supply a reliable early warning system in 2010. In order to surmount the difficult terrain challenges, the project built two-way communications, remote diagnostics, back-up sensors, and data-loggers into the system, allowing for remote updates to software. Likewise for the sirens, two-way communication with the control center enables remote diagnostic and battery monitoring. As Low Earth Orbit (LEO) satellites are used the data delays between the remote hydro-met station and the control station in Wangdu are virtually unnoticeable. Other communications systems were ruled out due to a lack of the necessary two-way communications, high-cost, or a requirement to use repeater stations across the difficult terrain.

The GLOF early warning system consists of six sensors and 17 siren stations, connected to one central control station. The sensors collect water level and outflow data and transmit to control center through satellite telemetry (circumnavigating unreliable local terrestrial infrastructure). The siren stations, positioned near the population centers, are powered by 80W solar panels with 75Ah 12V batteries to ensure continuous operation. The GLOF early warning system was fully operational starting 2011. This system is expected to be the first of many early warning systems in Bhutan.

3.7 Commerce

M-commerce (mobile commerce) is the buying and selling of goods and services through wireless handheld devices such as cellular telephones and Personal Digital Assistants (PDAs). The recent advancement in technologies enables users to access the Internet without needing to find a place to plug in. The industries affected by smart commerce include:

- Financial services, which includes mobile banking (when customers use their handheld devices to access their accounts and pay their bills) as well as brokerage services, in which stock quotes can be displayed and trading conducted from the same handheld device;
- Telecommunications, in which service changes, bill payment and account reviews can all be conducted from the same handheld device;
- Service/retail, as consumers are given the ability to place and pay for orders on-the-fly;
- Information services, which include the delivery of financial news, sports figures and traffic updates to a single mobile device.

3.7.1 Role of ICT platforms on financial inclusion and smart commerce

The deployment of mobile communications worldwide and rapid pace of technological development has transformed the financial services and especially the payment platforms. The mobile devices, initially designed solely for voice communication, into a multifunctional ICT device. In recent years, the mobile phone has been ever more vigorously used for the provision of payments of goods and services, e-government, medical services and utilities.

In developing countries, a large part of the population lives outside urban centers without easy access to basic infrastructure and services. In these communities, mobile money applications, which rely on mobile devices engineered with smart chip technology, have improved the financial capability of previously underserved segments of the population. Innovative technological solutions, accompanied by adequate regulatory frameworks, are presenting solutions to the lack of infrastructure, low literacy levels, absence of formal identification documents, and the other unique needs and habits in the banking sector in developing countries.

According to the report of the m-Powering Development Initiative Advisory Board published in December 2014, mobile payments are an integral part of mobile commerce.

One of the fundamental cornerstones to the success of Smart Commerce is the creation of platforms that facilitate the creation of money, the ability to move it from point A to point B—the so-called “velocity of money”. Innovative ways of mobile money transfer such as M-PESA has reduced the supply-side limitations by reducing the transaction costs of sending and receiving money to either complete a business transaction or for personal use in other socio-economic activities.

M-PESA has been instrumental in driving growth and development in Kenya. The World Bank estimates that reducing remittance commission charges by 2 to 5 percent could increase the flow of formal remittances by 50 to 70 percent, boosting local economies.⁴³

Box 7: Case study – Mobile money in Kenya as a catalyst for commerce and development

The introduction of mobile phone technology and its proliferation has provided an unmatched platform for Kenya to leapfrog access to financial services in a remarkably successful way. In 2006, only 26.4 percent of adults in the country had access to financial services, but by end of September 2015, this had more than doubled to 66.7 percent with 135,724 mobile money agents.

Kenya has one of the highest mobile money penetration rates anywhere in the world. There are more than 28 million mobile money account holders in Kenya who can make Peer-to-Peer (P2P) transfers, bill payments, as well as receive social disbursements and international remittances. Other innovative mobile money products, services, and applications, that are underpinned by smart chip technology, have been developed and contribute to the realization of the smart society in Kenya with tangible benefits to people that otherwise would struggle to access basic services, such as water and electricity. Today, using mobile phone-based banking applications, Kenyan households in remote communities can, for instance, have access to clean drinking water.

Evolution of ICT-based services brings innumerable social opportunities and help to stimulate economic growth of all nations thereby benefiting the daily lives of all citizens. This phenomenon provides a unique opportunity to widespread introduction of such services in everyday life of society, thereby affecting the development of the society itself and is known as ‘Smart Society’. One of the

⁴³ <http://pubdocs.worldbank.org/en/346121443469727614/Global-Economic-Prospect-2006-Economic-implications-of-remittances-and-migration.pdf>.

most important components of smart society is electronic commerce – the trading or facilitation of trading in products or services using telecommunication networks, such as the Internet or mobile networks. The e-commerce is not a kind of new industry, but it is creating a new economic model and is an important and significant part of the smart society. Generally speaking, as a type of business active procedure, the e-commerce is going to leading an unprecedented revolution in the world.

One of the areas of e-commerce, received a powerful development, is the use of mobile devices. With such powerful technology available in most rural and remote areas, and such unprecedented computing power in the palm of our hands it is imperative that we harness this technology for use not only in commerce, but also in health, education, agriculture, sport and in everything that will serve humanity and help us to achieve sustainable development.

The widespread deployment of mobile communications worldwide and rapid pace of technological development, which made the mobile telephone the most popular ICT device, have since transformed the mobile device, initially designed solely for voice communication, into a multifunctional ICT device. In recent years, the mobile phone has been ever more vigorously used for the provision of m-government, m-health, m-learning and m-commerce services.

Aware as it is of the importance of mobile devices in ICT services, ITU has been steadfastly engaged in the standardization and implementation of mobile-based services.⁴⁴ For its part, ITU's Telecommunication Standardization Sector, which in 2011 had begun developing Recommendations for ensuring the protection of mobile payments, organized in 2014 a Focus Group on Digital Financial Services (FG DFS) with the task of consolidating and working to standardize the different approaches being taken to the sphere of mobile financial operations.⁴⁵ After two years of extensive consultation, the FG DFS has concluded its work with the publication of 28 technical reports:⁴⁶

- DFS Ecosystem (12 technical reports);
- Interoperability (5 technical reports);
- Consumer protection (3 technical reports);
- Technology, Innovation and Competition (7 technical reports);
- Recommendations (includes some 85 policy recommendations for policymakers and DFS operators).

One more way to achieve high security level of m-commerce systems may be the creation of certification laboratory, which aims certification of mobile services on conformity to the requirements of security standards. Certification of this laboratory could become a reliable guarantee of the mobile payment system security and serve as a key to its success. Since mobile devices were not designed from the very beginning to provide secure operations, previous models of mobile devices did not have any special structures for secure storage and handling of sensitive data, except SIM cards. But SIM cards are the property of mobile operators, which hinders access of other substances to the provision of services. As the result – most of existing mobile-based services are not secure enough. However implementation of the latest technology innovations and standardization activity in the field of security will make for the elimination of this “Achilles heel” in mobile devices, thereby facilitating the even wider deployment of mobile payment and mobile banking services.

Protection of the earliest mobile payment systems was achieved by means of security features that lay with the mobile operator. The best results were obtained by using the SIM card as the secure element within which the confidential data were stored and processed, effectively ensuring a monopoly for mobile operators. Since then, we have seen the appearance of mobile devices with an embedded

⁴⁴ At the ITU Telecom World 2012 event, the Director of ITU's Telecommunication Development Bureau, Mr Brahim Sanou, launched the “m-Powering Development” initiative, aimed at the rapid and ubiquitous introduction and development of such services.

⁴⁵ Two documents [DFS-LS-001](#) and [DFS-LS-006](#) invite experts to take part in the activity of the FG DFS.

⁴⁶ Document [2/TD/9](#), “Liaison Statement from ITU-T FG DFS to ITU-D SG2 Question 1/2 on collaboration”.

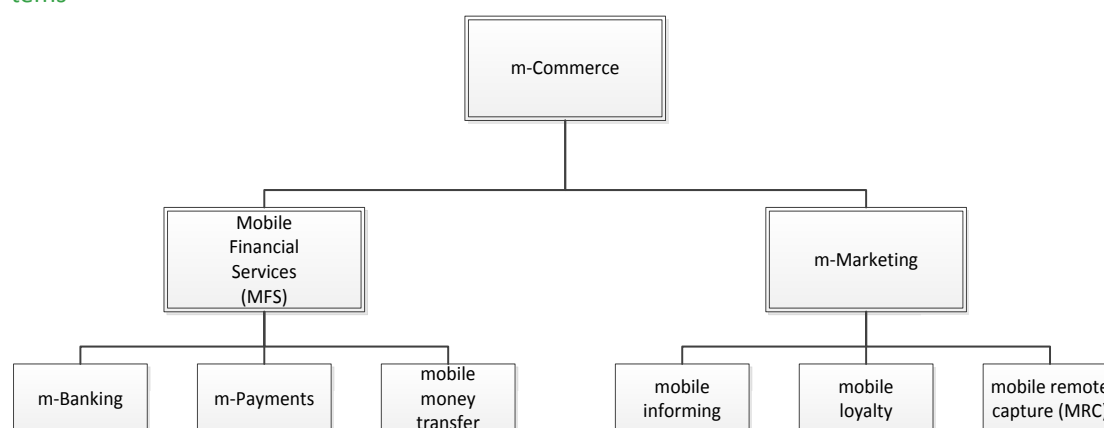
secure element, as well as devices which allow for the installation of a secure microSD card, enabling banks and other entities to provide mobile payment services. However, even the presence of a secure element cannot fully ensure transaction security, since it does not protect against data interception between the secure element and the display or keypad. To protect against such interception in a way that gives effect to the “sign what you see” principle, processors are now being developed with a so-called Trusted Execution Environment (TEE), i.e. an isolated hardware-protected environment within the device’s processor.

TEE protects the integrity and confidentiality of key resources, ensuring the secure storage and processing of sensitive data and trusted applications. Applications running in a protected area have access to the resources of the main processor and memory, while hardware isolation protects these from user installed applications, or from applications introduced by an attacker, running in the main operating system. Software and cryptographic isolation inside the TEE protect the trusted applications contained within the TEE from each other. TEE currently provides the highest level of physical and software protection for data.

At the same time, a widely-adopted principle is that of keeping the data stored in the user’s device to a minimum through the use of temporary tokens. This principle forms the underpinning for another approach, known as Host Card Emulation (HCE) that has recently gained considerable popularity. The two main variants of HCE are the “cloud-based solution”, whereby each transaction requires an online request to be made to a remote server in order to obtain the attributes needed to execute the payment, and the “token-based solution”, which involves storing, within the telephone, a one-time or limited-use proxy for a card’s Primary Account Number (PAN), or some other attribute of the payment source. The highest level of security is provided by the hybrid solution, in which the secure element contains a minimum of cryptographic key or peer entity authentication data, with all of the remaining critical data being stored in the cloud.

Another promising line of development now being actively pursued is biometric authentication, used in place of passwords. Biometric parameters include fingerprints, vein recognition, electrical impulses from the heart, physiognomic features, retina scanning and even behavioural biometrics.

Figure 9: The structure of m-commerce and distinguishing features of different m-commerce systems⁴⁷



Most notably, a system will be of either the “remote” or “proximity” kind. The communication technologies used by remote systems are SMS, USSD, various types of packet data transmission, DTMF tone bursts and even voice. Proximity systems use NFC, Bluetooth, optical readers and even audio signals. Apart from the communication technologies, systems differ in terms of their level of security and the means by which it is achieved, as well of the way in which the service is implemented: on

⁴⁷ Document 2/176, “Strategic, regulatory and technical aspects of developing the mobile payment business”, Intervale (Russian Federation), Odessa National Academy of Telecommunications n.a. A.S. Popov (Ukraine).

the basis of standard mobile-operator services or of special applications in a protected area (the SIM card, a microSD card or an embedded secure element), or in the unprotected phone memory.

Apart from such technological differences, systems also differ in terms of the payment source, which may be a bank account, payment card, account with the mobile operator, various types of e money, as well as other options including anonymized.

Box 8: Case study – Digital Financial Services using post offices in Kazakhstan and the Russian Federation

Successful introduction of online money transfer, using Post service is a good example of combination of modern ICT innovations with traditional Post services.¹ The money, sent online from the web-site or using mobile phone can be received in the post office or delivered by postman. The outcomes of this project for Russian Post and Kazpochta (Kazakhstan) was presented at the meeting of the ITU-T Focus Group on Digital Financial Services (FG DFS), held in Geneva.

“Posts’ experience in financial transactions (particularly domestic and international remittances), trusted brand image and proven capabilities in operating large-volume, small-margin commercial services make them particularly well-suited to the offer of digital financial services (DFS)” – said David Avsec, the Postal Technology Centre of the Universal Postal Union Deputy Director.

¹ Document SG2RGQ/200, “Use of mobile applications for the advancement of digital financial services in postal networks”, Intervale (Russian Federation).

3.8 Smart transport networks and road safety (domestic and cross-border)

3.8.1 Definition of smart transport networks

Smart transport networks can be broadly interpreted as referring to all of the technologies which support Intelligent Transport Systems (ITSs). Such networks encompass all modes of transport and cover all components of the transport system, such as the vehicle, infrastructure and driver or user, working together in a dynamic relationship.

ITS is a generic expression used to describe the integrated application of communication, control and information processing technologies to the transport system. The main purpose of ITSs is to enhance the decision-making process, in real-time, for transport network operators and other users, thereby improving transport system operation as a whole. Given that information forms the basis of any ITS, a significant proportion of ITS tools have to do with the gathering, processing, integration and dissemination of information.

3.8.1.1 Purpose of ITS smart transport networks

The main reason for investing in ITSs is to improve transport system operations in order to increase productivity, save lives, make better use of time, reduce costs and make energy savings. It is in this context that, over the past three decades, we have seen the transport industry and global economies relying increasingly on ITSs.

3.8.2 ITS development in developing countries

3.8.2.1 Current ITS status in developing countries

In developing countries, the ITS sphere is still in its early days, and the degree to which it has been accepted, adopted and locally applied varies from country to country. However, the majority of developing countries are facing the same transport issues, which include the following:

1. Rapid urbanization, resulting from population growth in towns and cities, generates social problems such as worsening congestion, atmospheric pollution and road accidents;
2. Significant growth in the number of private cars and the unprecedented challenges to which this is giving rise;
3. The fact that the vehicle population in developing countries is generally older than in industrialized countries, with all of the safety issues to which this gives rise, particularly in towns and cities;
4. With the number of private cars increasing in almost all developing countries, public transport systems are suffering, partly on account of a chronic lack of investment in the public-transport infrastructure;
5. Having one's own car is considered a mark of social success, while use of public transport is constantly declining;
6. The low level of road infrastructure investment is likewise considered a major problem by numerous developing countries, where the inadequacy and irregularity of roadway maintenance is also an issue;
7. The expansion of trading areas and higher volumes of road haulage are increasing the pressure on road networks.

3.8.2.2 Role and advantages of ITS

In all countries, transportation is a driver of economic development. ITSs essentially provide two types of benefit. First, they help to improve road network usage and reduce congestion, pollution and road accident levels; and second, they enhance the services provided to users and the efficiency of the transport system and its operation.

3.8.3 Which ITS applications and experiences in developing countries?

3.8.3.1 Existing applications

The following four types of application have been identified by the World Bank,⁴⁸ in a study focusing on certain developing countries.

Traffic management

In major cities, urban traffic regulation constitutes an essential response to the rapid growth in the number of vehicles in developing countries. Most major cities, such as those in Thailand (Bangkok and certain rural areas), have introduced traffic-light management systems, where the great challenge is to network such systems to achieve more efficient operation.

Electronic toll collection

Electronic Toll Collection (ETC) systems have been deployed in numerous developing countries, where the motivation for doing so is strong since they constitute a source of revenue for infrastructure

⁴⁸ <http://siteresources.worldbank.org/EXTROADSHIGHWAYS/Resources/Appendix.pdf>

financing. In many cases, their deployment involves the participation of several national entities and private-sector operators, responsible for the construction and operation of toll roads.

According to the World Bank study, already in 1996 Brazil had initiated a toll-road programme in response to major transport issues such as heavy congestion, a high accident rate and a draconian cutback in public spending on the road infrastructure.

Effective management of public transport

Public transport networks are a key factor in urban planning initiatives aimed at reducing congestion. Electronic “smart tickets”, preferably the kind that allow access to various modes of transport, are widely used in many developing countries.

Then there are other ITS solutions, such as traffic lights which prioritize buses, the networking of main and feeder roads, enhanced integration of transport modes, better user-information systems and improved security features.

Public transport management is being modernized in many developing countries, with GPS traffic monitoring systems being used to rationalize the operation of different public transport and fleet-management networks. Real-time passenger information systems have been installed in buses in several cities.

In Cape Town, South Africa, one real-time information system includes an onboard video surveillance network for passenger safety and security.

In Bangkok, Thailand, traffic information is generated using GPS sensors installed in taxis and lorries. This system has been replicated in other regions such as the Philippines and Indonesia, where traffic jams constitute a major challenge for the authorities.

Commercial vehicle tracking systems

GPS solutions can be used for tracking commercial vehicles such as lorries, thereby enhancing operational efficiency and security. Digital mapping is necessary for GPS operation, but the availability of such maps varies widely from country to country.

Numerous developing countries are currently seeing significant growth in freight transportation, with a particular increase since the 1990s in trade between the countries of western and Eastern Europe. This has resulted in physical infrastructure problems and long waiting times at border crossings, for example:

In Latin America, border-crossing systems have been introduced following decisions aimed at fostering trade within this geographic area (NAFTA is an example of such an area), the objective being to strengthen the regional economy.

In Eastern Europe, initiatives have been implemented to rationalize the use of lorries by using the carrying capacity available on the return journey. In 2001, Romania launched TransInfo, a web-based service for trade in carrying capacities whereby haulage contractors post their offers for setting up transactions.

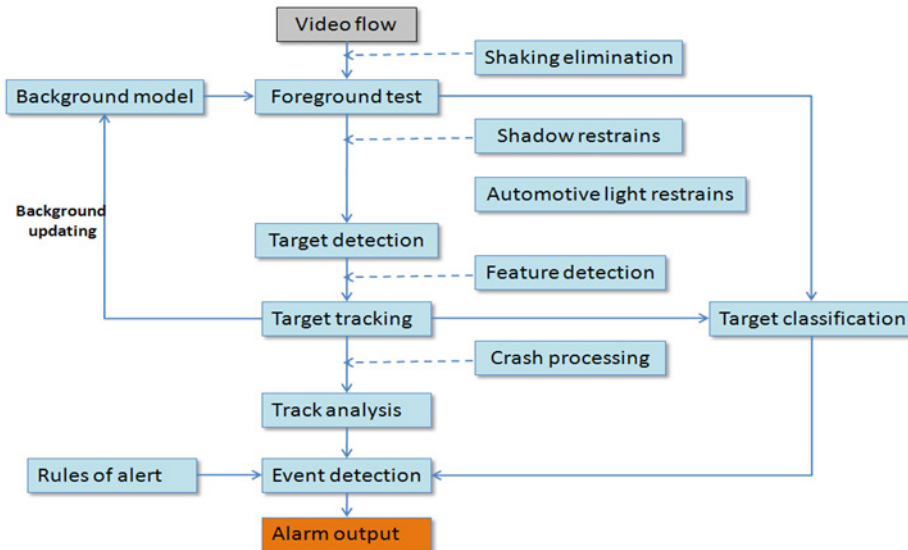
A satellite-based lorry-tracking system has also been introduced for security reasons in Mexico, Brazil and Argentina, and covers the whole of South America.

3.8.3.2 Experience of People’s Republic of China

Although ITS promotion is still in its early stages, the construction of smart cities is proceeding ever more rapidly, and each city has invested in the development and implementation of ITS solutions.

Cities such as Beijing have invested in smart urban transport applications, with results that can essentially be grouped into the following areas:

Figure 10: The algorithm process of intelligent front-end intelligent transportation system



Road traffic management

China has constructed a highly efficient smart road-traffic management system, which includes signaling control on urban roads, traffic detection, video surveillance, traffic violation detection and an accident warning system.

Public transport management

China has constructed a public transport management system which includes passenger information management and the organization of bus repair services.

Electronic toll collection

China has installed a municipal card system for public electric bus and urban rail services.

Passengers and freight

China has established an online ticketing system for journeys beyond ten long-distance inter-provincial stations and five security monitoring centers (including two planning services), as well as a GPS tracking system for vehicles transporting hazardous goods.

3.8.3.3 Experience of Thailand

Among the top ten places for the world's worst traffic, Bangkok (Thailand) comes eighth after Jakarta (Indonesia), Istanbul (Turkey), Mexico City (Mexico), Surabaya (Indonesia), Moscow (Russia) and Rome (Italy).

Since 2015, according to statistical data, the traffic on Thailand's roads has comprised: 109 671 taxis, at the rate of 365 taxis every 24 hours on all Bangkok streets; 16 321 buses; 58 276 motorcycle-taxis; and 8 996 tuk-tuk tri-cycles. By way of data sources, the following have been installed in taxis and lorries:

1. 9,000 GPS devices in Bangkok taxis, providing data every 3 to 5 seconds, for a total of 60 million data items per day.
2. 250 (currently being increased to 5000) GPS devices in lorries travelling all over the country.

3. 108,533 links distributed throughout the country, as follows: Central: 28 519 links; Northern: 21,532 links; Southern: 16 482 links; Eastern: 10 978 links; Western: 4 308 links; Northeastern: 26,714 links.

The links have been installed according to type of road.

Table 2: Links installed according to type of road

Type of road	Number of links per type of road
Highway	74
Expressway	626
Main road	87 787
Other	20 046
Total	108 533

3.8.4 Economic and financial aspects of ITS investment

Barring a few exceptions, developing countries are characterized by a lack of financial resources in general and by a lack of investment in ITSs in particular. In some countries, the funds needed both for road networks and for ITSs are obtained through the construction of toll roads and use of ETC systems.

The necessary funding is often, moreover, provided by the World Bank and European Commission, the latter being particularly important for EU candidate countries.

4 CHAPTER 4 – Challenges and way forward for achieving a Smart Society in developing countries

4.1 ICT policy and regulation

New generation networks are the foundation of innovation in the ICT sector and the engine for the development of m-services and applications. Therefore, governments are encouraged to support policy frameworks (e.g., reinvigorating national broadband policies, minimizing regulatory burdens, and establishing a consistent and stable policy environment for broadband networks and services) that promote the investment in robust network deployment and technology development necessary for the continued growth of IoT and other smart society services well into the future.. Cooperation among all public authorities involved at the international, regional, national, and local levels is key to realizing an interoperable policy framework that supports the global nature of m-services and applications. This includes recognition of the vital importance of cross-border data flows. Policy makers and regulators must be mindful of the importance of designing flexible, incentive-based and market-oriented policy and regulatory frameworks with regard to spectrum allocation and assignment for mobile broadband services, bearing in mind the important role of satellite communications to facilitate the smart society, so as to create trust and provide the necessary conditions for m-services and apps markets to thrive.

Because these services can be delivered using a wide range of technologies, it is important that policies be applied in a technology-neutral manner. Accordingly, market players should be allowed to choose the technology that is most appropriate to support the full range of capabilities for the smart society. For example, in the case of numbering, ideal numbering policies and provisioning and activation models can vary significantly across applications. What works best in one application may not fit another. Thus, international regulators must permit providers to choose between various available options for numbering and device management, rather than imposing a single, one-size alternative for all cases, and certainly not one that is determined or established on a country-by-country basis.⁴⁹

With regards to smart devices, the development of new markets and the industry for mobile devices need to be sustained through adequate regulatory measures, in particular in developing countries.

Revisiting and reviewing, where necessary, current Government policies to make sure that they are still valid and appropriate for the new environment, and ensuring privacy and security of user data may be necessary while open and collaborative regulatory frameworks are needed to promote the development of cross-cutting services such as m-commerce, m-banking and mobile money, as well as m-health. We recognize that creating a converged reference framework for competition, interconnection and interoperability can effectively facilitate the relationships among the various providers of infrastructure and services, as well as among them and apps and content providers.

Recognizing the potential of m-services and apps for improving the transparency, accountability and efficiency of public services, governments can benefit from the knowledge and experience of

⁴⁹ Regulators in several countries have taken an enlightened approach to the numbering issues presented by the IoT, such as by allowing the extra-territorial use of IMSI codes in the context of the provision of M2M services and adjusting their numbering policies to make them more flexible to enable such extra-territorial use. See Summary and further analysis answers to the consultation at the request of the Belgian Institute for Postal Services and Telecommunications (BIPT) Council of 25 November 2014 on reviewing the policy regarding the numbering plan management of 28 July 2015 (“BIPT Summary”), available at <http://www.bipt.be/en/operators/telecommunication/Numbering/regulation/summary-and-further-analysis-answers-to-the-consultation-at-the-request-of-the-bipt-council-of-25-november-2014-on-reviewing-the-policy-regarding-the-numbering-plan-management-of-28-july-2015>; CITEL document no. CCP-I-TIC/doc. 3905/16 rev.1, recommendation no. 4. See also Body of European Regulators for Electronic Communications (BEREC) Report on Enabling the Internet of Things, Dec. 2, 2015, available at http://berec.europa.eu/eng/document_register/subject_matter/berec/reports/5755-berec-report-on-enabling-the-internet-of-things; European Conference of Postal and Telecommunications Administrations (“CEPT”), Extra-Territorial Use of E.164 Numbers- High level principles of assignment and use, ECC Recommendation (16)02, Approved April 28, 2016, available at <http://www.erodocdb.dk/Docs/doc98/official/pdf/REC1602.PDF>.

stakeholders to draw up holistic strategies to allow users to use m-services and apps. Governments should also innovate and become lead users in this field. Initiatives for connecting public administrations and institutions such as schools, libraries and hospitals can create significant market opportunities and stimulate both the supply of and the demand for m-services and apps.

We recognize the role regulators can play in supporting and encouraging partnerships to facilitate the development of m-services and applications and raise awareness on how they can help increase economic productivity. In particular, social apps for the disadvantaged or unconnected populations can enhance quality of life across all sectors of the economy. Joint efforts with government agencies from other sectors could also generate win-win opportunities, inter alia for promoting education, digital skills, financial inclusion and integration in health-related programmes.

We further emphasize the importance of promoting the development and distribution of appropriate digital content, including multi-language content and content in local languages.

Data protection and data security are fundamental to any policy and regulatory position intended to enable the development of the smart society. Technology is advancing where regulatory tools to address data security are still being developed to help boost data security. To illustrate, a device and end-to-end application encryption are being rolled out by a number of service providers in response to allegations of government surveillance and a number of high profile data breaches in recent years.

Advances in this so called “encryption at the edge” present some new challenges however. For example, upgrades to the software running embedded IoT devices in infrastructure or connected cars need to be transmitted over the airwaves. Questions relative to who is responsible for ensuring the data transmitted is not jammed or interfered with and checking that regular upgrades have taken place must be addressed to build consumer trust.

In the context of the smart society, data protection is mainly about ensuring that citizens are comfortable with how their data is being processed to offer improved services. It is incumbent on industry to take the lead here and not to wait on regulators to step in with new rules. Consumers expect clear and simple explanations of how their data is being used and will quickly turn their backs on new innovations if they feel that their trust has been betrayed and privacy breached. Industry is best placed to respond to user demand by creating new tools and procedures to empower their users to take greater control over how when and where their data is shared and for what purpose. It is important to recognize that many m-services and applications do not involve personally identifiable data and consequently present no meaningful privacy risk. As a result, any approach to privacy should begin by examining the privacy implications of the application in question, rather than treating all applications the same.

We also call for industry to make such services as accessible as possible, including at reasonable cost. Carriers, device manufacturers, software developers and original equipment manufacturers should work cooperatively to help achieve this objective.

4.2 Budgets

In many countries there is no specific budget for many smart society projects. Instead planners have to identify government funding that was identified for purposes where ICT solutions could add value, such as monitoring pollution. This enables ICT to be an integral part of responding to challenges the society has already faced rather than as just an additional project.

The lesson from the city of Portland (United States of America) showed that IoT project does not require unique funding streams. Instead, including in developing countries, it should be seen as an important part of a broader project, whether in the transport sector, agriculture sector, manufacturing, or elsewhere. Including IoT roll-out as an integral part of delivering necessary solutions to problems citizens currently face will allow grant money and other sources of funding put aside for development to be accessed for ICT solutions for smart society.

Innovative, out-of-the-box measures should be put in place to stimulate the take-up of m-services and the creation of locally-relevant apps in remote and rural areas. Among other measures, universal service strategies can be defined and the appropriate mechanisms used to create ICT incubators or for funding local developers and locally-relevant apps.

4.3 Standardization

Standardization is the one of the most important factors to achieve the smart society. ITU-T Study Group 20 is working to address the standardization requirements of Internet of Things (IoT) technologies, with an initial focus on IoT applications in Smart Cities and Communities (SC&C).

4.4 Human capital

Human capital is a crucial factor to achieve the smart society. Although the city of Portland⁵⁰ had a high human capital labour market, there were specific skills needed in the running of IoT that are too specialized to be widely available. Portland planners' solution to this problem involved establishing a partnership with a University to run the analytical aspects of their IoT applications. Another benefit of this partnership was the opportunity it created for planners to exploit the significant R&D capacity of universities.

A lack of human capital to enable the deployment of IoT is also a problem in developing countries. Insufficient skills mean that the benefit from certain IoT services, such as data mining and analysis cannot be maximized, therefore limiting the benefits to society, as well as preventing the generation of positive externalities that can be realized in a world of big data. One solution is to follow the example of Portland and look for experts outside of government, such as partnering with higher education institutions to overcome the ICT skills shortage. The experience in Portland example shows that external partnership can have a multiplier effect for the IoT project and subsequently the local community.

We further recognize that acquiring digital skills is essential for the wide take-up and efficient use of m-services and apps, and inclusive training programmes for different target groups need to be established.

4.5 Sustainability

Ensuring sustainability is another challenge faced by many developing nations in achieving a smart society through ICT projects. Lack of proper consideration of sustainability in the planning and designing stage may lead to failure of the ICT project or at best, a one-time event. Therefore policy maker must consider sustainability matters in implementing ICT project. To ensure the sustainability of ICT projects, considerations include the development of local human capacity, appropriateness of the adopted ICT technology, the impact of the financial burden on citizens, the diverse needs of social groups and indicators for measuring these four components of sustainability. These indicators can be used as a bench marking reference for ensuring sustainability of ICT projects.

Most dialogues on smart society mainly focus on the use of smart technology (mobile, sensors, artificial intelligence, big data, etc.) for production and industrial activities such as transportation, agriculture, logistics, commerce, etc. However, the key actor in society is a citizen, and therefore, the use of smart technology or achieving a smart society should be accomplished from the perspective of people. For this purpose, an assessment is needed on the impact of the smart technology on how it has improved the quality of life. In other word, to what degree has the smart technology empowered citizens and has helped solve their problems (e.g., economic poverty, employment, health, learning, safety, good neighbouring, etc.).

⁵⁰ Document 2/246, "The Smart City: City of Portland", ARM Holdings (United Kingdom).

Finally, potential negative impacts of the adoption of smart technology also should be considered. For example, such consequences may include a growing digital divide between users and non-users of smart technology, loss of traditional jobs which may be accelerate by the adoption of smart technology, over-dependence on smart technology, unethical use of artificial intelligence (robot), and leaking of personal information in big data. These considerations should be taken into account as stakeholders develop policy frameworks and industry best practices for achieving the smart society. With the possible risks acknowledged and mitigated, the vast opportunities the smart society offers will proliferate.

Abbreviations and acronyms

Various abbreviations and acronyms are used through the document, they are provided here for simplicity.

Abbreviation/acronym	Description
ALECSO	Arab League Education Culture and Sciences Organisation
AMI	Advanced Metering Infrastructure
ATM	Automated Teller Machine
BDT	Telecommunication Development Bureau
CAMERWA	Central Drug Purchasing Agency in Rwanda
CFS	Canadian Forces Station
CO	Carbon monoxide
COP	Conference of the Parties
DSS	Decision Support System
DTMF	Dual Tone – Multi Frequency
e-SOKO	Information and communication service for agricultural markets in Africa
ETC	Electronic Toll Collection
EU	European Union
FAO	Food and Agriculture Organisation
FG DFS	ITU-T Focus Group on Digital Financial Services
FG SSC	ITU-T Focus Group on Smart Sustainable Cities
GEA	Government wide Enterprise Architecture
GIDC	Government Information Data Center
GIS	Geographic Information System
GLOF	Glacial Lake Outburst Flood
GPS	Global Positioning System
GSM	Global System for Mobile Communications
HCE	Host Card Emulation
HIV/AIDS	Human Immunodeficiency Virus infection and Acquired Immune Deficiency Syndrome
HMIS	Health Management Information Systems
HTS	High-Throughput Satellite
HVAC	Heating, ventilation and air conditioning
IBMS	Intelligent Building Management System

Abbreviation/acronym	Description
ICTs	Information and Communication Technologies
IEA	International Energy Agency
IoT	Internet of Things
ISWM	Integrated Water Resource Management
IT	Information Technology
ITS	Intelligent Transport Systems
ITU	International Telecommunication Union
ITU-T	ITU Telecommunication Standardization Sector
LED	Light-Emitting Diode
LEO	Low Earth Orbit
M2M	Machine-to- Machine
MFS	Mobile Financial Services
MINAGRI	Ministry of Agriculture and Animal Resources (Rwanda)
MIS	Market Information System
MRC	Mobile Remote Capture
MSS	Mobile Satellite Service
NAFTA	The North American Free Trade Agreement
NCWSC	Nairobi City Water and Sewerage Company (Kenya)
NFC	Near-Field Communication
NGO	Non-Governmental Organisation
OECD	Organisation for Economic Co-operation and Development
OGD	Open Government Data
OpenMRS	Open-source Medical Records System
P2P	Peer-to-Peer
PAN	Primary Account Number
PDA	Personal Digital Assistant
PGD	Patient Generated Data
R&D	Research and Development
RECI	Spanish Network of Smart Cities (Asociación Red Española de Ciudades Inteligentes)
RFID	Radio-frequency Identification

Abbreviation/acronym	Description
RURA	Rwanda Utilities Regulatory Authority
SC&C	Smart Cities and Communities
SDGs	Sustainable Development Goals
SFPUC	San Francisco Public Utilities Commission
SIM	Subscriber Identity Module
SSC	Smart Sustainable City
TB	Tuberculosis
TDAG	Telecommunication Development Advisory Group
TEE	Trusted Execution Environment
TRAC	Treatment and Research AIDS Centre
UAE	United Arab Emirates
VSAT	Very Small Aperture Terminal
WSIS	World Summit on the Information Society
WSN	Wireless Sensor Network
WTDC	World Telecommunication Development Conference

Annexes

Annex 1: List of the Rapporteurs and BDT focal points

Rapporteur	Dr James Ngari Njeru (Kenya)
Vice-Rapporteurs	Mr Richard Anago (Burkina Faso)
	Mr Evgeny Bondarenko (Intervale, Russian Federation)
	Dr Cheung-Moon Cho (Republic of Korea)
	Mr Romain Ciza Mweze (Democratic Republic of the Congo)
	Mr Seydou Diarra (Mali)
	Mr Turhan Muluk (Intel Corporation, United States of America)
	Mr Jean-David Rodney (Haiti)
	Mr Dominic Vergine (ARM Holdings plc, United Kingdom)
	Ms Xing Xin (People's Republic of China)
	Ms Joëlle G. Zopani Yassengou (Central African Republic)
BDT Focal Points	Mr Karim Abdelghani (BDT Focal Point (ARB))
	Mr Hani Eskandar (BDT Focal Point (Headquarters))
	Ms Ida Jallow (BDT Focal Point (AFR))
	Mr Takashi Masumitsu (BDT Focal Point (Headquarters))
	Mr Farid Nakhli (BDT Focal Point (CIS))
	Mr Ashish Narayan (BDT Focal Point (ASP))

Annex 2: Mandate and objectives of the Question

1) Statement of the situation or problem

All areas of society – culture, education, health, transport and trade – will depend for their development on the advances made through ICT systems and services in their activities. ICTs can play a key role in the protection of property and persons; smart management of motor vehicle traffic; saving electrical energy; measuring the effects of environmental pollution; improving agricultural yield; management of healthcare and education; management and control of drinking water supplies; and solving the problems facing cities and rural areas. This is the smart society.

Delivering the promise of the smart society relies on three technological pillars – connectivity, smart devices and software – and on sustainable development principles.

Connectivity encompasses and includes existing and traditional networks (mobile, broadband, and cable) as well as new technologies most often reliant on radio spectrum. Connectivity is a key enabler and component of machine-to-machine (M2M) and resulting applications and services such as e-government, traffic management and road safety.

Smart devices are the things that are connected that create smart societies. Cars, traffic lights and cameras, water pumps, electricity grids, home appliances, street lights and health monitors are all examples of things that need to become smart, connected devices so that they can deliver significant advancements in sustainability and economic and social developments. This is especially important in developing countries.

Software development connects and enables the first two pillars that, all working together, support new services that would never have been possible before. These new services are transforming everything from energy efficiency to environmental improvements, road safety, food and water safety, manufacturing and basic government services.

2) Question or issue for study

- Discussion of and assistance in raising awareness of methods of improving connectivity to support the smart society, including connectivity to support smart grids, smart cities and e-environment and e-health applications.
- Examination of best practices for fostering and enabling deployment and use of smart devices, including mobile devices, the importance of the application of such devices having been highlighted by BDT's m-Powering Development initiative, launched at ITU TELECOM World 2012 in Dubai, with an emphasis on successful examples from rural areas in developing countries.
- Survey of methods and examples of how software, both open-source and/or proprietary, enables connectivity of smart devices, thereby supporting smart services and smart societies.
- Definition of a measurement and performance benchmark for quality-of-life indicators in smart cities, and possible regulation and communication mechanisms that can be followed for good urban governance.
- The experiences of developed countries that have built smart cities.
- Creation of a national ecosystem that will include all stakeholders involved in defining national road-safety policy.
- Definition of a regional cooperation and coordination framework in the area of intelligent transport on cross-border networks.

3) Expected output

The output expected from this Question will include:

- Case studies on how to enable use of telecommunications and other means of connectivity, including M2M communications, and access to ICT applications to support sustainable development and foster smart societies in developing countries;
- Increasing awareness among relevant participants regarding the adoption of open-source strategies for enabling access to telecommunications, and studying the drivers for increasing the degree of preparedness to use and develop open-source software to support telecommunications in developing countries, as well as creating opportunities for cooperation between ITU members by reviewing successful partnerships;
- Analysis of factors affecting the efficient roll-out of connectivity to support ICT applications that enable e-government applications in smart cities and rural areas;
- Sharing of best practices in the use of ICT networks to enable road safety;
- Annual progress reports and detailed final report containing analysis, information and best practices, as well as any practical experience acquired in the areas of use of telecommunications and other means of enabling ICT applications and connecting devices for development of the smart society.

4) Timing

A preliminary report should be submitted to the study group in 2016. The studies should be concluded in 2017, by which time a final report will be submitted.

5) Proposers/sponsors

The Question was approved by WTDC-14, on the basis of Question 17-3/2 and proposals from the Asia-Pacific Telecommunity, Arab States, Member States of the African Telecommunications Union, the United States, Algérie Télécom Spa, Intervale (Russian Federation) and the A.S. Popov Odessa National Academy of Telecommunications (Ukraine).

6) Sources of input

- Progress on study of the Questions relevant to this issue in ITU-T and ITU-R study groups;
- Contributions from Member States, Sector Members, Associates other United Nations agencies, regional groups, and BDT coordinators;
- Progress of BDT initiatives with other United Nations organizations and the private sector on using ICT applications for development of the smart society;
- Progress on any other relevant activity carried out by the ITU General Secretariat or BDT.

7) Target audience – Who specifically will use the output

Relevant policy-makers, regulators and participants in the telecommunication/ICT and multimedia sectors.

Table 1A: Target audience

Target audience	Developed countries	Developing countries*
Telecom policy-makers	Yes	Yes
Telecom regulators	Yes	Yes
Service providers/operators	Yes	Yes

Target audience	Developed countries	Developing countries*
Manufacturers (telecommunication/ICT equipment manufacturers, automobile industry, etc.)	Yes	Yes
BDT programmes	Yes	Yes

* These include the least developed countries, small island developing states, landlocked developing countries and countries with economies in transition.

8) Proposed methods for the implementation of the results

In guidelines for implementing BDT regional initiatives.

9) Proposed methods of handling the Question or issue

Within Study Group 2.

10) Coordination and collaboration

- The relevant BDT unit dealing with these issues;
- Relevant work in progress in the other two ITU Sectors.

11) BDT programme link

All BDT programmes are concerned by the Question as regards, in particular, aspects relating to information and communication infrastructure and technology development, ICT applications, enabling environment, digital inclusion and emergency telecommunications.

12) Other relevant information

To be identified later during the life of this new Question.

Annex 3: Sample of case studies

Recommendations on the development of smart agriculture submitted by People's Republic of China (Document 303/2)

This case study begins with the achievements of the development of smart agriculture and describes China's experience in this regard. It also analyses the issues that China has encountered during the process and provides recommendations to address the issues.

1) Achievements of smart agriculture

Smart agriculture is a modern mode of development of agriculture by using technologies such as profound sensing, reliable transmission and big data analysis and by means of automatic production, optimized control, smart management, systematic logistics and E-trading, aiming at maximizing the efficiency of the use of agricultural resources, reduction of cost and energy consumption while minimizing impairments to the ecological environment and optimizing the overall system of agriculture.

With the progress of technologies, traditional agriculture in China is under migration to smart agriculture in an accelerated way. At the current stage, relying on the sophisticated technologies such as IoT. Innovations on multiple functions and intelligence have been promoted to facilitate the transformation of the achievements into products for agricultural production. The achievements of smart agriculture are reflected mainly in the following three areas:

- **Intelligence in various areas of agricultural production**

Remote control of agricultural production environment has been made possible with the video monitoring devices acquiring information of crops by making use of real time parameters of humidity, lighting and CO₂ density collected by wireless sensors. As a result of digitization and integration, information would be uploaded real time to the smart management system through transmission networks. The system will control precisely the automatic on-off function of the different devices according to the objectives of various crops.

For instance, the pilot projects of water conservation for agricultural corridors in the municipalities of Beijing and Tianjin initiated in 2008. Thousands of water metering management system with the capability of remote billing for agricultural water use have been put into place. Consequently, 50 per cent of water has been saved for each unit of land, lowering the cost of farmers on water use and reducing the waste of water tremendously. Pilot areas for water use have also been established in Xinjiang Autonomous Region and Henan province, which has greatly improved the efficiency of irrigation and water conservation. Provinces of Heilongjiang and Henan have monitored the growth of crops and soil and implemented precise application of pesticides and fertilizer as well as remote diagnosis by means of IoT.

- **Circulation of agricultural products**

With RFID, a tracking system for agricultural products has been set up in order to increase sharing and transparent management of the information concerning the whole process from production and processing to transportation and sale, contributing to branding and adding value to agricultural products.

For example, in Beijing and Lanzhou of Gansu province, an operational mode of integration of production, distribution center, transportation and direct marketing has been established, which ensures the quality and security of the products by a tracking system with surveillance and control over sites of production and transportation.

- **Guidance on crop production**

By analyzing data on air, soil, growth of crops and climate, the system is conducive to the zoning of the industrial park, rational distribution of products, on-line diagnosis and treatment of crop diseases, scientific prediction and crop rotation.

North-west Agricultural and Forestry University of China has developed a big data platform of agriculture, monitoring comprehensively soil, quality of water, climate and disasters and analyzing on the relationship among all the elements, thus assessing the impact of ecological environment on crops.

2) Experience of smart agriculture development

Based on the development of smart agriculture in China, experience could be drawn from the following 3 points:

- **Enhanced support from the government to promote smart agriculture**

The development of smart agriculture is indispensable from the government support. In the Thirteenth Five-Year Plan of National Economy and Social Development launched by the state, promotion of information technology for agriculture and standardization have been mentioned many times. Smart agriculture has become a major orientation for the future. Driven by the national policy, efforts in this regard have been witnessed all over the country with relevant policies and financial support to the application of technologies of sensing, communication and computing to agriculture.

- **Guided by the government, enterprises are given full play**

Smart agriculture development in China has always involved the interaction between the government and businesses. At present, there are a huge number of IoT enterprises. Under the proper guidance of the government, these enterprises have been motivated, encouraging more businesses to get involved in the development of smart agriculture, for instance, both Zhengbang Group and Dabei Agricultural Group are typical high-tech companies of agriculture which have played a significant role in the expansion of smart agriculture.

- **Strengthening R&D and building pilot zones for promotion**

IoT of agriculture is the key to smart agriculture. China has been on the forefront in this field. With the concerted efforts from China Academy of Science, China Academy of Agricultural Science, University of Agriculture, Northwest University of Agriculture and Forestry, the important project of information technology application in agriculture has yielded remarkable results. As the number of pilot zones keeps increasing, the development of smart agriculture has been progressing steadily.

3) Current issues in relation to smart agriculture

China has accumulated some experience in the R&D and application of technologies of smart agriculture, playing a positive role to its further development. However, there are still problems to be addressed along the process.

First, poor information technology facilities. Regional gap, industry differences and shortage of fund constitute obstacles to the progress of agricultural information technology, resulting in poor level of digitization and intelligence, which can hardly satisfy the needs of smart agricultural production in terms of timeliness, precision and comprehensiveness of information.

Second, there's a lack of unified technology standard for agricultural applications. The diverse sources and random structures of information have impeded agricultural production and its R&D. The normalization and standardization level could not meet the expectations of the standardized agricultural production for resources, nor the need of information for R&D.

Thirdly, farmers have inadequate knowledge of technology. The education level of farmers in China is generally low, therefore, they are not fully capable of applying and adopting information technology.

Fourthly, the production scale is limited. In most parts of China, agriculture production is characterized by family operation, which is hard to achieve central management, rational production and on-demand plantation.

4) Recommendations for the development of smart agriculture

Based on the above-mentioned issues, the application of IoT and big data analysis to agriculture should be promoted in order to advance smart agriculture. Development mode of agriculture should be transformed rapidly and more pilot projects should be given priority in the areas of production and operation management, quality and security of products and supervision of agricultural resources and ecological environment.

- **Tackling key technologies for smart agriculture**

Dedicated sensors used for various agricultural applications should be developed to deal with the common problem of sensing nodes deployment in the IoT of agriculture. The application service system to satisfy the need of Chinese agriculture should be created, providing technical support to the system integration, mass production and application of IoT products.

Led by the relevant department, users, research organizations and higher institutions will be working together to develop the application standards of agricultural IoT, including the function, performance, interfaces of agricultural sensors and identification devices, data transmission protocol for agriculture information, analyzing and processing standard for the converged data from multiple sources and the standard of application and service.

- **Laying a solid foundation for the application of smart agriculture**

The government should play a leading role with regard to human resources, financial and material support. This will help to address not only the issue of agricultural production and income of farmers, but also the prosperity of future generations and national security, because government input is required in the infrastructure building, progress of information technology and education in the rural areas. All players will be encouraged to take part in the development of smart agriculture.

- **Formulating policies and developing human resources**

Policies for educating and training technical experts for agriculture should be developed by working together with relevant universities, research institutions and entities so as to improve the capability of innovation in rural areas. Incentive mechanism should be established to maintain and enlarge the team of expertise in order to meet the needs of agriculture. More efforts are expected to explore new technologies, modes of operation and platforms.

- **Rationalizing structure and balancing development**

Modern agriculture should be featured by the rational distribution of incubators, seeding parks, standardized production, processing facilities and logistic centers as well as balanced development. Smart agriculture involves many aspects, leading to problems of resources integration and sharing. To minimize repeated investment, the top layer structure should be designed in an optimal manner so as to facilitate the transformation, promotion and application of R&D results and achieve consistency and harmony in the development.

Recommendations on energy submitted by Republic of Haiti (Document [2/341](#))

1) Background

As energy is the backbone of any modern society, it must be at the heart of the “Smart City”. This means that control over its consumption, diversification in the ways use is made of “energy resources” available for the production of goods and services, minimization of the impacts caused by their use, and, in general, smart control over the global interrelations between the individual, energy and the environment (in the broadest sense) constitute the best indicators of quality of life within a geographical space inhabited by a community of individuals sharing common interests – i.e. a “Smart City”.

Thus, the concept of “Smart City” cannot be dissociated from that of “Smart relations with Energy”. A city with a high “energy footprint” cannot be a smart city. And since it is the individual that drives consumption in a city, the “optimized functioning” of the “Individual-City-Energy” trinomial is essential if there is to be a smart city.

Pursuit of this Optimized Functioning is fundamental, as reflection generally focuses on “binomial relations”:

- The Individual and the City, or the Individual as the creator of cities;
- The individual and energy;
- The City and energy flows.

The key to the issue nevertheless resides in optimizing the trinomial interrelations between Individual-City-Energy, for the following reasons:

a) The individual

Begins to realize that:

- Human (aggressive) activities are extremely liable to cause climate change;
- The pursuit of “comfort” impacts the physical space lived in;
- Concentration within cities (with the trend towards growth) offers opportunities but creates new difficulties in terms of the management and offer of services.

b) The city

As a nerve center comprising a functional and dynamic set of artificial and natural systems, the city is increasingly transforming into a place of intensive activities that is called upon to integrate everyone’s differing interests while at the same time facilitating the creation of wealth and avoiding poverty and exclusion.

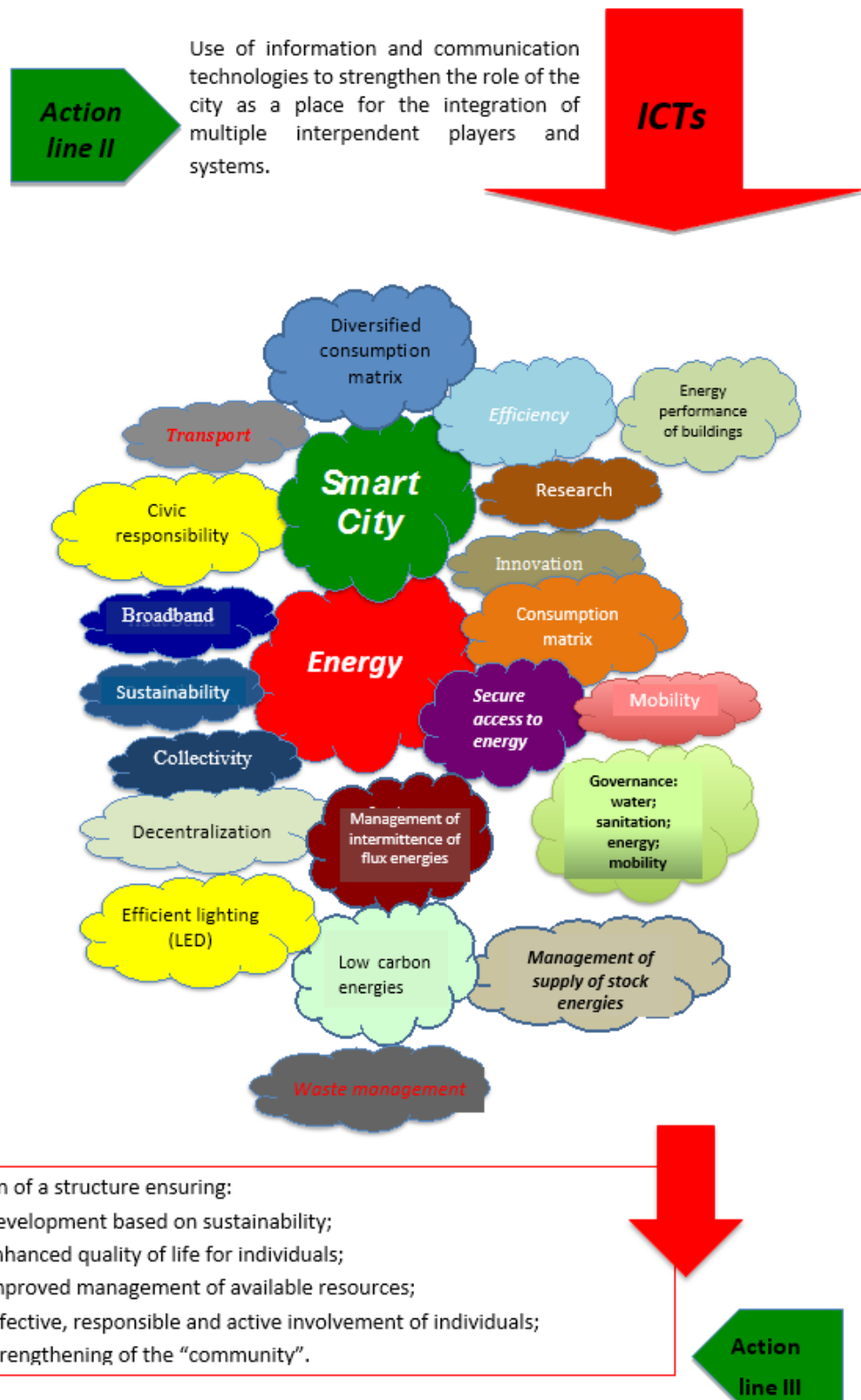
The capacity to harmonise the available space, sophistication of the services on offer and quality of life are of no small importance, as the “competitiveness of the city” will be its “appeal”.

c) Energy relations

Energy Relations must take account of the fact that fossil fuels will inevitably run out, and of the “recent agreements” reached in Paris (COP 21).

Ensuring that the (virtuous) circle of interrelations in this trinomial is efficient is thus what will make the city a Smart City, as it is a question not only of mitigating the negative impacts on the environment (physical and social), but also of RETHINKING the ways resources are accessed, transport utilization (Logistics and Mobility in addition to infrastructure), waste management, the energy performance of buildings, and energy management in general (resources, supply logistics, utilization, etc.). One way of presenting the problem visually is to identify all issues constituting the challenges, stakes, weaknesses and opportunities to be tackled by society in order to build a smart city. This is illustrated in **Figure 1A**.

Figure 1A: Energy relations in the Smart Society



2) Redefinition of the Smart City based on the energy approach

In view of what precedes, we must consider that the energy system of a smart city must be capable of:

- 1) Promoting the economic growth and development of the community;

- 2) Ensuring the sustainable protection of the environment by minimizing the impacts caused to the Environment;
- 3) Facilitating access to Energy and to Energy Security.

In the most general terms, it may be said that a smart city is one whose energy behaviour is in line with Goal 7 of the Sustainable Development Goals (SDGs): Ensure access to affordable, reliable, sustainable and modern energy for all.

The four dimensions of SDG 7 (affordability, reliability, sustainability and modernity) are different but not mutually exclusive, and they are adaptable to the imperatives of the Energy Trilemma: Energy Security – Energy Equity – Sustainable Environment:

- *Energy Security*: Efficient management of supply of primary energy from internal and external sources, reliability of energy infrastructure and capacity of energy providers to meet current and future demand;
- *Energy Equity*: Accessibility, including economic accessibility, of energy supply for the population;
- *Sustainable Environment*: Encompasses the enhancement of energy efficiency on both the offer and the demand side and the development of energy supply based on renewables and other low-carbon sources.

In consequence, appliances, structures, mechanisms and systems in a smart city must be designed to ensure that everyone has access to affordable, reliable, sustainable and modern services.

Associated energy parameters

The present analysis lays no claim to representing an exhaustive study of the various different aspects involved in configuring a smart urban space. The various aspects addressed nevertheless provide a sufficiently complete picture of the work to be carried out and action to be taken to ensure that:

- 1) The smart city's energy configuration is based on sustainability;
- 2) The integration of Information and Communication Technologies (ICTs) in the energy architecture is smart and contributes to building sustainable infrastructures focused on the "overall wellbeing" of the individual.

Appliances, structures, mechanisms and systems

It may be said that the logic of a smart urban space (in the region of concern to us or elsewhere) is based principally on the following:

- Decentralized energy production: smart energy production spread over the entire territory. A "targeted" offer adapted to "local" needs and designed to reduce the associated costs.
- Promotion and development of Smart Grids, and within this framework:
 - Achievement of widespread use of Renewable Energies (on large and small scale);
 - Development of isolated or interconnected mini- and/or micro-networks;
 - Promotion of systematic measurement for both educational and civic responsibility purposes.
 - Promotion of Smart Metering: Improve the management of personalized energy consumption data for each user using smart meters.
 - Telemetric meters to improve understanding of and optimize consumption. Such systems make it easier to foresee and adapt consumption, thereby lowering costs for citizens and consequently reducing emissions.
- Promotion of Energy Efficiency: In the housing sector, the services sector, goods manufacturing;
 - Enhanced energy performance of buildings;

- The Smart Citizen: Enhance citizens' knowledge regarding energy; Smart Citizens for a Smart City;
- Energy management. The choice was made to integrate renewable sources into the network, in order to enhance efficiency and reduce CO2 emissions.
- Promotion of Sustainable Logistics and Mobility;
 - Strengthening of smart mobility to facilitate user mobility (on foot, bicycle, public or private transport);
 - Improvement of collective transport systems (private or public);
 - Promotion of electromobility;
 - Creation of transport facilitation structures.
- Management of Greenhouse Gas Emissions.

3) Conclusion

This study of the energy-related parameters associated with development of the “smart city” may give rise to questions regarding the costs linked to such an approach, the possibilities of obtaining the funding required for it, and the availability of the requisite human capital. These are indeed fundamental questions, but even if unanswered they should neither prevent nor delay the development of such approaches. For there is no doubt that the way in which cities have evolved shows clearly that their viability depends on “global” society's ability to make them functionally smart spaces – be the city Paris, Sidney, Barcelona, Bridgetown, Kingston or Port-au-Prince.

And since the same “needs typology” will prevail everywhere, regardless of where the individual comes from or resides, sooner or later the evolution of urban spaces will impose the smart city as the norm, and the smart use of energy resources as a strategy for (human) durability.

The first actions to be recommended to this end are those indicated in the four action lines described, and the appliances, structures and systems to be put in place are those also described.

Annex 4: List of contributions and information documents

Reports

Web	Received	Source	Title
2/REP/33 (Rev.1)	2017-03-28	Rapporteur for Question 1/2	Report of the Rapporteur Group meeting on Question 1/2 (Geneva, Friday 7 April 2017, 09:00 - 12:00 hours)
RGQ/REP/20	2017-01-19	Rapporteur for Question 1/2	Report for the Rapporteur Group meeting on Question 1/2 (Geneva, Tuesday, 24 January 2017, 09:30-12:30 and 14:30- 17:30 hours)
2/REP/22	2016-09-26	Rapporteur for Question 1/2	Report of the Rapporteur Group Meeting on Question 1/2 (Geneva, 30 September 2016, 09:00 - 12:00 hours)
RGQ/REP/10	2016-04-21	Rapporteur for Question 1/2	Report of the Rapporteur Group meeting on Question 1/2 (Geneva, Thursday, 21 April 2016, 09:30-12:30 and 14:30- 17:30 hours)
2/REP/11	2015-09-11	Rapporteur for Question 1/2	Report of the Rapporteur Group Meeting on Question 1/2 (Geneva, Friday 11 September 2015, 09:00- 12:00 hours)
RGQ/REP/1	2015-05-04	Rapporteur for Question 1/2	Report of the Rapporteur Group Meeting on Question 1/2 (Geneva, Monday, 4 May 2015, 09:30-12:30 and 14:30- 17:30 hours)
2/REP/1 Appendix	2014-09-22	Rapporteur for Question 1/2	Report of the Rapporteur Group Meeting on Question 1/2 (Geneva, Monday 22 September 2014, 14:30- 17:30 hours)

Question 1/2 contributions for Rapporteur Group and Study Group meetings

Web	Received	Source	Title
2/466 +Ann.1	2017-03-23	Argentine Republic	Pursuing UN Sustainable Development Goals through IoT for irrigation systems
2/465	2017-03-23	Argentine Republic	Tiflocelulares – Access to the library Tiflolibros for people with visual impairment through cellular devices
2/457 (Rev.1)	2017-03-21	Korea (Republic of)	Topics for the study of Question 1/2 for the next study period
2/450	2017-03-09	Iran University of Science & Technology	Smart e-Government in Iran (v0.8)
2/438	2017-01-24	Rapporteur for Question 1/2	Report of the Rapporteur Group meeting on Question 1/2, Geneva, 24 January 2017
2/430	2017-02-17	China (People's Republic of)	Big data-based research on the development of intelligent credit investigation industry
2/429	2017-02-17	China (People's Republic of)	Case study on municipal-level Internet public legal service platform
2/427	2017-02-17	Intervale (Russian Federation)	Definition of terms that use the word “smart”

Web	Received	Source	Title
2/413 [OR]	2017-02-16	Rapporteur for Question 1/2	Final Report for Question 1/2
2/412	2017-02-15	Rwanda (Republic of)	ICTs for the Nation's transformation into a Smart Society
2/408	2017-02-06	Spain	The smart cities ecosystem in Spain: A successful model to be continued
RGQ/241	2017-01-06	AT&T, Inc.	Proposed additional information for inclusion in Chapter 4 of the Draft Final Report for Question 1/2
RGQ/224	2016-12-02	Palestine(*)	One-stop shop for government and private services
RGQ/221	2016-11-28	Senegal (Republic of)	Overview of the Digital Senegal 2025 (Sénégal Numérique 2025) Strategy validated and adopted in 2016
RGQ/220	2016-12-02	Senegal (Republic of)	The C, Ku and Ka bands as alternative solutions for an effective universal service and other vital uses in developing countries
RGQ/212	2016-11-24	Rwanda (Republic of)	Use of ICTs for agricultural development in Rwanda
RGQ/208 [OR]	2016-11-17	Rapporteur for Question 1/2	Draft Final Report for Question 1/2
RGQ/204	2016-11-14	Norway	Creating a metric for cyber security culture
RGQ/200	2016-11-02	Intervale (Russian Federation)	Use of mobile applications for the advancement of digital financial services in postal networks
RGQ/194	2016-10-27	China (People's Republic of)	Telecommunication equipment building and pipeline planning for industrial parks
RGQ/193	2016-10-27	Inmarsat plc	The role of satellite connectivity in facilitating smart societies and the Internet of Things
RGQ/192	2016-10-27	Iran University of Science and Technology, Iran (Islamic Republic of)	Smart Traffic Management in Iran
2/378	2016-09-14	AT&T	Supportive Policy for the Development of the Internet of Things and the Smart Society
2/374	2016-09-14	Intel Corporation	Women's health wearable for the developing world
2/373	2016-09-13	Inter-American Telecommunication Commission	CITEL PCC.I "Recommendation to Incentivize Greater Adoption of IoT/M2M Services in the CITEL Member States"
2/359	2016-09-13	Korea (Republic of)	Draft Text for Chapter 2 (section 2.1.1, 2.1.2) and Chapter 4 of the Final Report

Web	Received	Source	Title
2/352	2016-09-07	Intel Corporation (United States of America)	Importance of 5G for Developing Countries
2/345	2016-08-31	China (People's Republic of)	The experience of agricultural product traceability system with QR code and IT technology in Hainan Province
2/341	2016-08-17	Haiti (Republic of)	Prise en compte de l'offre satellitaire comme alternative de développement du Service Universel et d'autres services orientés développement
2/338 (Rev.1) [OR]	2016-08-12	Rapporteur for Question 1/2	Draft Final Report for Question 1 /2
2/337	2016-08-11	Kenya (Republic of)	Transforming Public Service Delivery through creation of Huduma Centres in Kenya
2/303	2016-08-04	China (People's Republic of)	Recommendations on the development of smart agriculture
2/302	2016-08-04	China (People's Republic of)	Proposal on establishing the smart energy mechanism
2/301	2016-08-04	China (People's Republic of)	The research on the application of IoT in agriculture
2/300	2016-08-04	China (People's Republic of)	Telecommunication equipment building and pipeline planning for industrial parks
2/299 Rev.1	2016-08-04	China (People's Republic of)	Building smart cities in Central and Western China with experiences gained in Jiuquan municipality as an example
2/298	2016-08-04	China (People's Republic of)	Comprehensive mobile coverage solutions for high-rise residential buildings
2/297	2016-08-04	China (People's Republic of)	The application of ICTs in the industrial and manufacturing sector and the development trends
2/290	2016-08-02	Intervale (Russian Federation)	Use of mobile applications for the advancement of digital financial services in postal networks
2/286	2016-08-04	Senegal (Republic of)	Prise en compte de l'offre satellitaire comme alternative de développement du Service Universel et d'autres services orientés développement
2/257	2016-04-21	Rapporteur for Question 1/2	Report of the Rapporteur Group Meeting on Question 1/2, Geneva, 21 April 2016
RGQ/157	2016-04-05	Rapporteur for Question 1/2	Initial draft of the Final Report on Question 1/2
RGQ/135	2016-04-01	Telecommunication Development Sector	ITU-D Study Groups Cocreation Challenge and Methodology
RGQ/128	2016-03-22	Intel Corporation	Draft Text for Subchapter 3.2

Web	Received	Source	Title
RGQ/127	2016-03-23	China International Telecommunication Construction Corporation	Proposed mechanisms for information management and sharing in smart society
RGQ/114	2016-03-04	Telecom Regulatory Authority of India (TRAI)	The role of Information and Communication Technology (ICT) in the realization of smart societies in developing countries
2/246	2015-08-27	ARM Holdings	The Smart City: City of Portland
2/243	2015-08-27	Iridium Communications Inc.	Applications of satellite based machine-to-machine technologies in early warning systems
2/232	2015-08-25	Korea (Republic of)	Smart and sustainable society for developing countries
2/223	2015-08-27	ARM Holdings	The benefits of smart chip technology for the advancement of smart societies in developing countries
2/221	2015-08-12	Telefon AB- LM Ericsson	Evolution in mobile broadband networks, for its consideration in the reports
2/211 +Ann.1-2	2015-08-04	Institute of Electrical and Electronics Engineers, Inc.	IEEE Smart Cities Activities- Overview
2/207 (Rev.1)	2015-08-01	Democratic Republic of the Congo	Regulatory aspects of mobile applications and services
2/206	2015-07-31	Intel Corporation	ICT in Education- Smart Learning
2/205	2015-08-31	Rwanda (Republic of)	ICT for development vision in Rwanda
2/204	2015-07-29	Democratic Republic of the Congo	Section 3.6: Les réseaux de transport intelligents et la sécurité routière (domestique et transfrontalière)
2/193	2015-07-24	Kenya (Republic of)	The scope of a smart society
2/192	2015-07-24	G3ict	Evolution of accessibility features available on mobile devices as presented at the M-Enabling Summit 2015 in Washington, DC
2/189	2015-07-24	Kenya (Republic of)	Adoption of ATM Water Dispenser Machines
2/188	2015-07-24	China (People's Republic of)	Introduction to the Internet+ Agriculture development in China
2/187 (Rev.1)	2015-07-24	China (People's Republic of)	Smart environment
2/186 (Rev.1)	2015-07-24	China (People's Republic of)	Proposed mechanisms for information management and sharing in smart society

Web	Received	Source	Title
2/185	2015-07-24	China (People's Republic of)	Exploring the inclusion of smart city associated sectors in decision-making models and policies
2/184	2015-07-24	China (People's Republic of)	Intelligent visual sensor networks
2/183	2015-07-24	China (People's Republic of)	Active RFID and GIS-based integrated management systems
2/182	2015-07-24	China (People's Republic of)	Smart environmental resource management - Water, wastes and environment
2/180	2015-07-24	China (People's Republic of)	Smart transport- Providing reliable road infrastructure for the development of a smart society
2/176 +Ann.1	2015-07-22	Intervale (Russian Federation) , Odessa National Academy of Telecommunications n.a. A.S. Popov	Strategic, regulatory and technical aspects of developing the mobile payment business
2/173	2015-07-23	China (People's Republic of)	Full lifecycle methods of dumb resource management, planning and design
2/172	2015-07-23	China (People's Republic of)	Discussion on the design of the IPv6 network-based high definition video monitoring application
2/171	2015-07-23	China (People's Republic of)	Best Practice for the Smart City- The City and social sustainable development
2/149	2015-06-29	BDT Focal Point for Question 1/1	ITU GSR15 discussion papers and best practice guidelines
2/142	2015-05-12	Rapporteur for Question 1/2	Table of Contents for the final Report on Question 1/2
2/133	2015-05-08	Rapporteur for Question 1/2	Report of the Rapporteur Group Meeting on Question 1/2, Geneva, 4 May 2015
RGQ/97	2015-11-09	ITU-T Study Group 20	Liaison Statement from ITU-T SG20 to ITU-D SG1 and 2 on new ITU-T SG20
RGQ/69	2015-04-14	Iridium Communications Inc.	The role of satellite-based Machine to Machine (M2M) technology in the realization of smart societies in developing countries
RGQ/62	2015-04-13	Korea (Republic of)	Change of draft table of contents of the final report in order to include sustainability and openness in exploring Question 1/2
RGQ/57	2015-04-01	Intel Corporation	Reflection of "ICT in education" Chapter in Question 1/2
RGQ/41 +Ann.1	2015-03-11	ITU-T Focus Group on SSC	Liaison Statement from ITU-T FG on SSC on the new ITU-D Study Question on smart society and activities of the Focus Group on Smart Sustainable Cities
RGQ/27	2015-02-21	Intervale (Russian Federation)	Mobile payments: Problems and prospects

Web	Received	Source	Title
RGQ/5	2014-12-15	Rapporteur for Question 1/2	Draft work plan for Question 1/2
2/98	2014-09-12	BDT Focal Point for Question 1/2	Smart Society: Need for policy and regulatory facilitation by ICT sector
2/89	2014-09-09	General Secretariat	WSIS Stocktaking: Success stories
2/87	2014-09-08	General Secretariat	Report on WSIS Stocktaking 2014
2/84	2014-09-08	Kenya (Republic of)	Proposal for initial work plan for Question 1/2
2/80	2014-09-04	ARM Holdings	The role of Machine to Machine (M2M) technology in the development of smart, connected societies
2/77	2014-09-02	Symantec Corporation	Cyber-security's role and best practices to ensure Smart Cities' service continuity and resilience
2/76	2014-09-01	Egypt (Arab Republic of)	Smart water management opportunities for the Arab Region
2/74	2014-08-29	China (People's Republic of)	China smart city development and smart practice in Nanjing
2/73	2014-08-29	China (People's Republic of)	Discussion on the combination of wireless network site planning of smart cities with city planning
2/72	2014-08-29	China (People's Republic of)	Research progress on smart city planning methods
2/71	2014-08-29	China (People's Republic of)	Safe city networking model and new technology deliberation
2/70	2014-08-29	China (People's Republic of)	The city intelligent transportation system which is based on the technology of video analysis
2/68	2014-08-29	China (People's Republic of)	The current construction and development status of smart industrial park in China
2/66	2014-08-29	China (People's Republic of)	Research of city information integration platform based on integrated GIS
2/62	2014-08-28	China (People's Republic of)	Proposal mechanisms for information sharing of smart city
2/61	2014-08-28	China (People's Republic of)	Proposed mechanisms for open operation of smart city
2/60	2014-08-28	China (People's Republic of)	Progress of ITU-T Focus Group on Smart Sustainable Cities (FG-SSC)
2/59	2014-08-28	China (People's Republic of)	Analysis of ICT application in China's manufacturing industry
2/58	2014-08-28	China (People's Republic of)	The experience of information system for food quality and safety traceability in China

Web	Received	Source	Title
2/57	2014-08-28	China (People's Republic of)	China telecom's smart cities development experience introduction
2/56	2014-08-28	China (People's Republic of)	Chinese smart cities development introduction and some suggestions for Question 1/2
2/29	2014-08-04	Telecommunication Standardization Bureau	Working Groups deliverables of the FG SSC and planned approval date
2/28	2014-08-04	Telecommunication Standardization Bureau	Summary of the fifth meeting of the Focus Group on Smart Sustainable Cities (FG-SSC)
2/27 +Ann.1	2014-08-04	Telecommunication Standardization Bureau	Overview and next steps of Focus Group on Smart Sustainable Cities (FG SSC)
2/26	2014-08-04	Telecommunication Standardization Bureau	Agreed definition of a Smart Sustainable City

Contributions for QAll for Rapporteur Group and Study Group meetings

Web	Received	Source	Title
2/453 +Ann.1	2017-03-17	Telecommunication Development Bureau	Feedback received through the survey on ITU-D Study Group Questions, Procedures, and Proposals on Future Activities
2/452	2017-03-17	Telecommunication Development Bureau	Innovation activities in ITU-D
2/451	2017-03-15	Russian Federation	Proposals for the revision and rearrangement of ITU-D Study Groups 1 and 2' Study Questions
2/448 +Ann.1-2	2017-03-09	Rapporteur for Question 9/2	Analysis of feedback received through the global survey on the work of ITU-D study groups
2/436	2017-02-22	Vice-Chairman, ITU-D Study Group 2, and Co-Rapporteur for Question 8/2	Study Groups, study Questions, and working method for WTDC-17
2/424	2017-02-17	Côte d'Ivoire (Republic of)	Draft texts for the revision of the study Questions and new Questions for the period 2018-2021
2/423	2017-02-17	Côte d'Ivoire (Republic of)	Proposal for new Question on Internet of Things for the study period 2018-2021
2/355	2016-09-07	Telecommunication Development Bureau	Update on innovation activities to ITU-D Study Groups
2/320	2016-08-05	General Secretariat	WSIS Stocktaking 2014-2016 Regional Reports of ICT Projects and Activities
2/319	2016-08-05	General Secretariat	WSIS Prizes 2016-2017
2/318	2016-08-05	General Secretariat	WSIS Stocktaking 2016-2017
2/312	2016-08-04	General Secretariat	WSIS Action Line Roadmaps C2, C5 and C6

Web	Received	Source	Title
2/311	2016-08-04	General Secretariat	ITU's Contribution to the Implementation of the WSIS Outcomes 2016
2/309	2016-08-04	General Secretariat	WSIS Forum 2016 and SDG Matrix
2/308	2016-08-04	General Secretariat	WSIS Action Lines Supporting Implementation of the SDGs
2/307	2016-08-04	General Secretariat	WSIS Forum 2016: High Level Track Outcomes and Executive Brief
2/306	2016-08-04	General Secretariat	WSIS Forum 2016 Outcome Document - Forum Track
2/305	2016-08-04	General Secretariat	WSIS Forum 2017- Open Consultation Process
2/274	2016-06-24	Chairman, ITU-D Study Group 2	Compendium of Draft Outlines for expected outputs to be produced by ITU-D Study Group 2 Questions (September 2016)
RGQ/124	2016-03-18	BDT Focal Point for Question 8/1 and Resolution 9	Outcomes of RA-15,WRC-15 and CPM19-1 related to ITU-D
RGQ/107	2016-02-18	Kazakhstan (Republic of)	Contribution from Kazakhstan to Questions 1/1, 2/1, 3/1, 4/1, 5/1, 6/1, 7/1, 8/1 and 5/2
2/249	2015-09-24	Telecommunication Development Bureau	Final list of participants to the second meeting of ITU-D Study Group 2, Geneva, 7 - 11 September 2015
2/247	2015-08-28	Telecommunication Development Bureau	List of information documents
2/229	2015-08-25	Telecommunication Development Bureau	ITU-D Study Groups Innovation Update
2/213	2015-08-07	Telecommunication Development Bureau	1st ITU-D Academia Network Meeting
2/190	2015-07-24	General Secretariat	WSIS Forum 2015: High level policy statements, Outcome document, Reports on WSIS Stocktaking
2/150	2015-07-06	Uganda (Republic of)	Increasing women's participation in ITU Study Groups' work
2/149	2015-06-29	BDT Focal Point for Question 1/1	ITU GSR15 discussion papers and best practice guidelines
2/101 Rev.1	2014-09-29	Chairman, ITU-D Study Group 2	Final list of participants for the First Meeting of ITU-D Study Group 2, Geneva, 22-26 September 2014
2/100 Rev.1	2014-09-24	Chairman, ITU-D Study Group 2	Appointed Rapporteurs and Vice-Rapporteurs of ITU-D Study Group 2 Questions for the 2014-2018 period

Web	Received	Source	Title
2/99	2014-09-19	Intel Corporation	New Question for ITU-D Study Group 1 (2014-2018): Assistance to developing countries for the implementation of ICT programs in education
2/97	2014-09-11	Telecommunication Development Bureau	List of information documents
2/96	2014-09-15	Chairman, ITU-D Study Group 2	Establishment of working parties for ITU-D Study Group 2
2/95	2014-09-11	Telecommunication Development Bureau	ITU Workshop on Digital financial services and financial inclusion, and First Meeting of Focus Group Digital Financial Services: 4-5 December 2014, ITU, Geneva
2/92	2014-09-09	General Secretariat	WSIS Action Lines Executive Summaries (Achievements, Challenges and Recommendations)
2/88	2014-09-09	General Secretariat	WSIS+10 High level event: High level policy statements, Forum track outcome document, reports
2/86	2014-09-08	General Secretariat	WSIS+10 High level event: Outcome documents
2/51	2014-08-23	Nepal (Republic of)	Need for developing detailed table of contents for each Question under both the ITU-D Study Groups at the beginning
2/5 (Rev.1-2)	2014-09-08	Telecommunication Development Bureau	Candidates for Rapporteurs and Vice-Rapporteurs of ITU-D Study Group 1 and 2 study Questions for the 2014-2018 period
2/4	2014-09-01	Telecommunication Development Bureau	List of WTDC Resolutions and ITU-D Recommendations relevant to the work of the ITU-D Study Groups
2/2 +Ann.1	2014-08-20	Telecommunication Development Bureau	Resolution 2 (Rev. Dubai, 2014): Establishment of study groups + Full text of all ITU-D Study Group 1 and 2 Questions in Annex 1
2/1	2014-08-20	Telecommunication Development Bureau	Resolution 1 (Rev. Dubai, 2014): Rules of procedure of the ITU Telecommunication Development Sector

Annex 5: List of liaison statements

Liaison statements for Question 1/2

Web	Received	Source	Title
2/TD/9	2017-03-29	ITU-T Focus Group on Digital Financial Services (FG DFS)	Liaison Statement from ITU-T FG DFS to ITU-D SG2 Question 1/2 on collaboration
2/339	2016-08-19	ITU-T Study Group 20	Liaison Statement from ITU-T SG20 to ITU-D SG2 Q1/2 on collaboration with ITU-D SG2 Q1/2
2/272	2016-05-18	ITU-T Study Group 5	Liaison statement from ITU-T Study Group 5 to ITU-D Study 1 and 2 on updates on ITU-T SG 5 activities relevant to ITU-D study groups
RGQ/97	2015-11-09	ITU-T Study Group 20	Liaison Statement from ITU-T SG20 to ITU-D SG1 and 2 on new ITU-T SG20
2/157	2015-07-04	ITU-T Study Group 15	Liaison Statement from ITU-T SG15 to ITU-D SGs on ITU-T SG15 OTNT standardization work plan
2/144	2015-05-19	ITU-T Focus Group on SSC	Liaison Statement from ITU-T FG-SSC to ITU-D SGs on Final deliverables of the Focus Group on Smart Sustainable Cities (FG-SSC) and proposal of a new Study Group
RGQ/41 +Ann.1	2015-03-11	ITU-T Focus Group on SSC	Liaison Statement from ITU-T FG on SSC on the new ITU-D Study Question on smart society and activities of the Focus Group on Smart Sustainable Cities
RGQ/33	2015-03-03	ITU-T Study Group 5	Liaison Statement from ITU-T Study Group 5 to ITU-D Study Group 2 on the Executive Summary of the ITU-T Study Group 5 Meeting
RGQ/3 (Rev.1)	2014-11-18	ITU-T Focus Group on SSC	Liaison Statement from ITU-T Focus Group on Smart Sustainable Cities (FG-SSC) on Activities of the Focus Group on Smart Sustainable Cities
2/24	2014-06-26	ITU-T Focus Group on SSC	Liaison Statement from the ITU-T FG on Smart Sustainable Cities (FG-SSC) to ITU-D SG1 and SG2 on Activities of the Focus Group on Smart Sustainable Cities

Liaison statements for all ITU-D Study Group 2 Questions

Web	Received	Source	Title
2/403	2017-01-31	ITU-T Study Group 12	Liaison Statement from ITU-T SG12 to ITU-D SG1 and SG2 on operational plan for implementation of WTSA-16 Resolution 95 (Hammamet, 2016)
RGQ/199	2016-10-31	ITU-T Study Group 15	Liaison Statement from ITU-T SG15 to ITU-D Study Groups 1 and 2 on the latest version of the Access Network Transport (ANT), Smart Grid and Home Network Transport (HNT) Standards Overviews and Work Plans

Web	Received	Source	Title
2/371	2016-09-13	Inter Sector Rapporteur Group	Liaison Statement from Inter Sector Rapporteur Group to ITU-D SG2 on requirements for the application of the UNCRPD for media services for all
2/288	2016-07-29	TSAG	Liaison Statement from TSAG to ITU-D Study Groups on ITU inter-sector coordination
2/281	2016-06-28	ITU-T Study Group 12	Liaison Statement from ITU-T SG12 to ITU-D SG1 and SG2 on revised definition of Quality of Experience (QoE) and new terms in Rec. P.10/G.100
2/280	2016-06-28	ITU-T Study Group 12	Liaison Statement from ITU-T SG12 to ITU-D SG1 and SG2 on ITU inter-Sector coordination (reply to TSAG LS17)
RGQ/117	2016-03-07	ITU-T Study Group 15	Liaison statement from ITU-T SG15 to ITU-D SG1 and 2 on the latest version of the Access Network Transport (ANT), Smart Grid and Home Network Transport (HNT) Standards Overviews and Work Plans
RGQ/111	2016-03-03	ITU-T Study Group 15	Liaison statement from ITU-T Study Group 15 to ITU-D SG 1 and 2 on ITU-T SG15 OTNT standardization work plan
RGQ/110	2016-03-03	ITU-T Study Group 15	Liaison statement from ITU-T Study Group 15 to ITU-D SG 1 and 2 on new technical classification and numbering of ITU-T L-Series Recommendations
RGQ/103	2016-02-08	TSAG	Liaison statement from TSAG to ITU-D study groups 1 and 2 on ITU inter-Sector coordination
RGQ/94	2015-11-18	ITU-R Study Group Department	Liaison statement from ITU-R Study Group Department to ITU-D SG 1 and 2 on Resolutions approved at the Radiocommunication Assembly (RA-15)
RGQ/82	2015-09-29	Asia-Pacific Telecommunity (APT)	Liaison statement from the APT Standardization Program Forum (ASTAP) to ITU-D Study Group 1 and 2 on NGN activities
2/230	2015-08-24	ITU-T JCA-AHF	Liaison Statement from ITU-T JCA-AHF, Chairman to ITU-D SGs on Draft meeting report of Joint Coordination Activity on Accessibility and Human Factors (JCA-AHF) in Geneva on 17 June 2015
2/158	2015-07-10	ITU-T Study Group 15	Liaison Statement from ITU-T SG15 to ITU-D SGs on the latest versions of the Access Network Transport (ANT), Smart Grid and Home Network Transport (HNT) Standards Overviews and Work Plans
2/157	2015-07-04	ITU-T Study Group 15	Liaison Statement from ITU-T SG15 to ITU-D SGs on ITU-T SG15 OTNT standardization work plan
2/148	2015-07-12	TSAG	Liaison Statement from TSAG to ITU-D Study Groups on ITU inter-sector coordination

Web	Received	Source	Title
2/144	2015-05-19	ITU-T Focus Group on SSC	Liaison Statement from ITU-T FG-SSC to ITU-D SGs on Final deliverables of the Focus Group on Smart Sustainable Cities (FG-SSC) and proposal of a new Study Group
2/143	2015-05-12	ITU-T Study Group 13	Liaison Statement from ITU-T SG13 to ITU-D SGs on Development of the Roadmap on IMT
2/129	2015-04-30	ITU-T Study Group 11	Liaison Statement from ITU-T SG11 to ITU-D Study Groups on the progress on standardization work to combat Counterfeit ICT devices
2/128	2015-04-29	ITU-T Study Group 16	Liaison Statement from ITU-T SG16 to ITU-D SGs on ITU-D SG1 and SG2 Questions of interest to ITU-T Study Groups
2/127	2015-04-29	ITU-T Focus Group on Digital Financial Services	Liaison Statement from ITU-T Focus Group on Digital Financial Services (DFS) to ITU-D Study Groups on BDT's work on ITU m-Powering Development
2/126	2015-04-29	ITU-T Focus Group on Digital Financial Services	Liaison Statement from ITU-T Focus Group on Digital Financial Services (DFS) to ITU-D Study Groups concerning its work
RGQ/34	2015-03-03	ITU-T Study Group 16	Liaison Statement from ITU-T SG16 to ITU-D SGs on ITU-D SG1 and SG2 Questions of interest to ITU-T Study Groups
RGQ/20	2015-02-10	ITU-R Study Groups-Working Party 5D	Liaison Statement from ITU Radiocommunication Study Groups WP5D to ITU-D Study Groups concerning the Handbook on "Global Trends in IMT"
RGQ/19	2015-02-10	ITU-R Study Groups-Working Party 5D	Liaison Statement from ITU Radiocommunication Study Groups WP5D to ITU-D Study Groups concerning the Handbook on "Global Trends in IMT"
RGQ/16	2015-01-23	ITU-T FG DFS	Liaison Statement from ITU-T Focus Group on Digital Financial Services (DFS) to ITU-D Study Groups on BDT's work on ITU m-Powering Development
RGQ/15	2015-01-22	ITU-T FG DFS	Liaison Statement from ITU-T Focus Group on Digital Financial Services (DFS) to ITU-D Study Groups concerning its work
2/22	2014-05-23	ITU-T JCA-AHF	Liaison Statement from ITU-T Joint Coordination Activity on Accessibility and Human Factors (JCA-AHF) on Assistive Listening Devices (ALD) and the allocation of Mobile Phone Services in the 2.3-2.4 GHz band
2/19	2014-03-10	ITU-T Study Group 11	Liaison Statement from ITU-T Study Group 11 to ITU-D SG1 and SG2 on Request for status update from GSMA and ITU on proposed studies on the issue of mobile theft, grey market and counterfeit devices
2/18 (Rev.1)	2014-03-10	ITU-T Study Group 11	Liaison Statement from ITU-T Study Group 11 to ITU-D SG1 and SG2 on Technical report on counterfeit equipment

Web	Received	Source	Title
2/16	2014-02-10	ITU-T Focus Group on Innovation	Liaison Statement from the ITU-T FG on Innovation to ITU-D SG1 and SG2 on New Standardization Activities for ITU-T study groups and ICT Innovation Panel
2/9	2013-10-22	ITU-T Focus Group on Innovation	Liaison Statement from the ITU-T FG on Innovation to ITU-D SG1 and SG2 on inputs on ICT innovation panel

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