Economic & Social Affairs

UNITED NATIONS E-GOVERNMENT SURVEY 2018

GEARING E-GOVERNMENT TO SUPPORT TRANSFORMATION TOWARDS SUSTAINABLE AND RESILIENT SOCIETIES

UNITED NATIONS

Department of Economic and Social Affairs

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United Nations Department of Economic and Social Affairs

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Foreword

To fulfil the far-reaching potential of the transformative 2030 Agenda for Sustainable Development, technologies must be used innovatively to ensure that the Sustainable Development Goals are met on time.

We are at a critical juncture, in the middle of a digital revolution that is not just about technologies, but also about the centrality of people and the planet. We are witnessing the simultaneous proliferation of big data, artificial intelligence, data science, blockchain, robotics and other frontier and fast-emerging technologies. These frontier technologies are building on and amplifying one another, affecting everything from our food systems, water and sanitation, energy, to education, health care and social services.

In particular, digital government has ushered in significant and enduring changes in the way people live and interact with each other, their environment, and public services. The 2018 Survey highlights a persistent positive global trend towards higher levels of e-government development. It examines how digital technologies and innovations are impacting the public sector and changing people's everyday lives. As evidenced by the survey assessment and case studies, exploiting digital government has far-reaching potential for countries, not just in improving institutional processes and workflows for greater efficacy and effectiveness of public service delivery, but also in ensuring inclusion, participation and accountability to leave no one behind.

However, connectivity and access to new technologies remain elusive for some regions and countries, especially the most vulnerable, in particular the African countries, the least developed countries, small island developing States and the landlocked developing countries. In addition, there is a need to consider the inherent new and unprecedented risks. Without careful design application and oversight, artificial intelligence tools could harm vulnerable populations, reinforce existing inequalities, widen digital divides and adversely affect jobs and economies, as well as privacy, denial of service and other cybersecurity issues – also examined in the 2018 Survey. It is therefore also important to develop a tailored capacity training programme to create new public policy, science ethic and data scientist professions to strengthen institutional capacities of countries in deploying digital government and digital services.

LIU Zhenmin
Under-Secretary-General for Economic and Social Affairs
United Nations

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Engaging United Nations Volunteers in the Survey

The 2018 edition continued to engage United Nations Online Volunteers (UNVs) in order to cover most primary languages of the 193 UN Member States. Since the Survey won the UN Volunteer Award in 2013, the 2018 edition was able to attract 197 volunteers with knowledge of 66 languages from 92 countries. Over the course of four months, volunteers completed 393 research surveys. Deniz Susar provided overall coordination throughout the data collection process and with the assistance of Enkel Daljani, Rosanne Greco, Lydia Gatan, Madeleine Losch and Stella Simpas, coordinated the UNVs, which were engaged in four teams. Special thanks also go to the following UN staff members who, under the supervision of DPIDG, reviewed a number of countries: Aarao Benchimol, Aisha Jeelaan, Alexandra Bettencourt, Aranzazu Guillan Montero, Benedicte Niviere, Flor Velazco-Juarez, Iwona Gardon, Laura Marrocchi, Madoka Koide, Said Maalouf, Said Maalouf, Saw Htoo, Sovanna Sun and Victoria Kim. UN staff members, with the support of interns completed a comprehensive second stage data assessment and review. Vincenzo Aquaro, Deniz Susar and Elena Garuccio worked together to update the statistical methodology. Elena Garuccio conducted the statistical regressions and data correlation analysis.

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Acronyms

AAL	Average Annual Loss
AGESIC	Agency for e-Government and Information and Knowledge Society of Uruguay
AI	Artificial Intelligence
ARC	African Risk Capacity
CCRP SCP	Caribbean Catastrophe Risk Insurance Segregated Portfolio Company
CEPA	Committee of Experts on Public Administration
CRED	Centre for Research on the Epidemiology of Disasters
DRM	Disaster Risk Management
EGDI	E-Government Development Index
EM-DAT	The International Disaster Database
EPI	E-Participation Index
ECLAC	Economic Commission for Latin America and the Caribbean
ESCAP	Economic and Social Commission for Asia and the Pacific
ESCWA	United Nations Economic and Social Commission for Western Asia
FAQ	Frequently Asked Questions
G2B	Government-to-Business
G2C	Government-to-Citizen
GNI	Gross National Income
HCI	Human Capital Index
ICT	Information Communication Technologies
ITU	International Telecommunication Union
LAC	Latin America and the Caribbean
MSQ	Member State Questionnaire
NGO	Non-Government Organization
NITA	National Telecommunications and Information Administration
O&E	Outbreak and Epidemic Response
OECD	Organisation for Economic Co-operation and Development
OGD	Open Government Data
OSI	Online Service Index
OSQ	Online Service Questionnaire
PPP	Public-Private Partnerships
RCT	Randomized Controlled Trial

RSS	Rich Site Summary
SDG	Sustainable Development Goals
SIDS	Small Island Developing States
SMS	Short Message Service
TII	Telecommunication Infrastructure Index
UIDAI	Unique Identification Authority of India
UN/CEFACT	United Nations Centre for Trade Facilitation and E-business
UNDESA	United Nations Department of Economic and Social Affairs
UNECE	United Nations Economic Commission for Europe
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNICEF	United Nations Children's Fund
UNOOSA	United Nations Office for Outer Space Affairs
UNOSSC	United Nations Office for South-South Cooperation
WPSR	World Public Sector Report
WSIS	World Summit on the Information Society
XCF	Extreme Climate Facility

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About the *Survey*

Background

The *2018 United Nations E-Government Survey* (hereinafter referred to as "the *Survey*") is issued at the time of key rapid technological changes, with Member States in the third year of the implementation of the Sustainable Development Goals (SDGs). The Survey provides new analysis and evidence to further utilize the potential of e-government to support the 2030 Agenda. This particular edition examines how governments can use e-government and information technologies to build sustainable and resilient societies.

Scope and purpose

Since 2001, the United Nations Department of Economic and Social Affairs (UNDESA) has published the *United Nations E-Government Survey*. Following on past editions, and now in its tenth edition, the *Survey* provides an analysis of progress in using e-government.

The *Survey* is the only global report that assesses the e-government development status of all Member States of the United Nations. The assessment rates the e-government performance of countries relative to one another, as opposed to being an absolute measurement. It recognizes that each country should decide upon the level and extent of its e-government initiatives in keeping with its own national development priorities and achieving the Sustainable Development Goals.

The *Survey* measures e-government effectiveness in the delivery of public services and identifies patterns in e-government development and performance as well as countries and areas where the potential of Information and Communications Technologies (ICT) and e-government has not yet been fully exploited and where capacity development support might be helpful.

It serves as a development tool for countries to learn from each other, identify areas of strength and challenges in e-government and shape their policies and strategies in this area. It is also aimed at facilitating and informing discussions of intergovernmental bodies, including the United Nations General Assembly, the Economic and Social Council and the High Level Political Forum, on issues related to e-government and development and to the critical role of ICTs in development.

The *Survey* is mainly intended for policy makers, government officials, academia, civil society, private sector and other practitioners and experts in the areas of public administration, e-government, and ICTs for development.

Structure and methodology

The *Survey* is composed of an analytical part and of data on e-government development contained in the annexes of the publication, providing a snapshot of relative rankings of e-government development of all Member States. Every edition of the *Survey* focuses on a specific theme and sub-themes that are of particular interest to Member States and the international community at large.

The methodology for the analytical part of the *Survey* is based on a literature review and an analysis of the *Survey*'s data. Innovative practices are also collected to illustrate how ICTs are being used to transform public administration and institutions in support of sustainable development. In addition, during the preparatory process of the publication, expert group meetings are organized to solicit views and inputs from world-renowned scholars and practitioners.

The methodological framework for the collection and assessment of the Survey's data on e-government development is based on a holistic view of e-government that incorporates three important dimensions that allow people to benefit from online services and information: the adequacy of telecommunication infrastructure, the ability of human resources to promote and use ICTs, and the availability of online services and content. The Survey tracks progress of e-government development via the E-Government Development Index (EGDI). The EGDI, which assesses e-government development at the national level, is a composite index based on the weighted average of three normalized indices. One-third is derived from a Telecommunications Infrastructure Index (TII) based on data provided by the International Telecommunications Union (ITU), one-third from a Human Capital Index (HCI) based on data provided by the United Nations Educational, Scientific and Cultural Organization (UNESCO), and one-third from the Online Service Index (OSI) based on data collected from an independent survey questionnaire, conducted by UNDESA, which assesses the national online presence of all 193 United Nations Member States. The survey questionnaire assesses a number of features related to online service delivery, including whole-of-government approaches, open government data, e-participation, multi-channel service delivery, mobile services, usage up-take, digital divide as well as innovative partnerships through the use of ICTs. This data is collected by a group of researchers under the supervision of UNDESA through a primary research and collection endeavour.

As a composite indicator, the EGDI is used to measure the readiness and capacity of national institutions to use ICTs to deliver public services. This measure is useful for government officials, policy makers, researchers and representatives of civil society and the private sector to gain a deeper understanding of the relative position of a country in utilizing e-government for the delivery of public services.

The methodological framework has remained consistent across *Survey* periods while its components have been updated to reflect new trends in e-government as well as new indicators for telecommunications and human capital. The 2004 and 2005 editions of the *Survey* captured the state of a country's readiness for e-government. However, in 2008, as 'readiness' was not deemed to adequately reflect the need for concrete implementation on the ground, the publication changed its focus from assessing readiness to assessing actual development. In 2014, 'e-government maturity' was viewed as obsolete since e-government goals and targets are constantly evolving to deliver and surpass what the public expects (UNDESA, 2014).

The 2018 *Survey*'s data is presented both at the end of the publication and online[1]. This includes data relative to the EGDI by country (in alphabetical order), by region and by countries in special situations, i.e. Small Island Developing States (SIDS), Landlocked Developing Countries (LLDCs), Least Developed Countries (LDCs). The publication then presents information about the Online Service Index and its components; the Telecommunication Infrastructure Index and its components; and the Human Capital Index and its components. Information about the E-Participation Index (EPI) is also contained in the data tables. Further comprehensive information about the methodology of the 2016 *Survey* is available in the Annexes.

Preparatory process of the 2018 *Survey*

The preparatory process of the 2018 *Survey* has included a number of activities. The first was to outsource an external evaluation of the eGovernment Survey for the period 2003-2016[2]. This evaluation took a look at the history of the e-Government Survey and answered a number of questions aimed at evaluating the overall program. It then summarized a number of observations, and made recommendations for going forward, setting the scene for a more in-depth methodological

review. Further, two Expert Group Meetings (EGMs) (in New York and in Guimarães, Portugal) were organized to allow experts in the field of digital government to exchange views on challenges, identify emerging issues and areas from a sustainable development perspective, and reflect/review/update the current methodology of the Survey. The work started at the EGMs was continued until December 2017 through consultation with an Informal Advisory Working Group comprised of 10 international experts and practitioners from academia, private sector and civil society, who served in their personal capacity.

For the Online Service Index (OSI) values for 2018, a total of 206 online United Nations Volunteer (UNV) researchers from 89 countries with coverage of 66 languages assessed each country's national website in the native language using the Survey's Online Service Questionnaire. In addition, all United Nations Member States were requested (through the Member State Questionnaire) to provide information regarding their website addresses (URL) for different government ministries and the national portal(s). One hundred (100) Member States (comprising 51.8% of UN membership) returned the completed questionnaires, and the appropriate submitted sites were then utilized during the verification process.

What was changed in the 2018 edition compared to 2016

To improve the methodology and take into account the lessons learned from the previous editions, the inputs and feedback received by Member States, the recommendations from the external evaluation, the outcomes of the EGMs and the latest technological and policy development, a limited number of changes were introduced in the 2018 Survey as summarized below:

The questionnaire to assess the government portals, Online Service Questionnaire (OSQ), was expanded to include the main principles of the Sustainable Development Goals (SDGs) and Leaving No One Behind, with a particular focus on Goal 16, namely accountability, effectiveness, inclusiveness, openness and trustworthiness.

- In regard to the OSQ, further automated tools were used to assess accessibility and presentation of websites in smart phones and on other small-screen devices.
- For the first time, the list of the OSQ areas assessed in this edition of the UN E-Government Survey was added in the Annexes.
- An updated and detailed Member States Questionnaire (MSQ) was launched in 2017 to gather further detailed information about the efforts of governments in e-government development.
- The MSQ and the list of 100 responding Member States were added in the Annexes.
- A pilot Local Online Service Index (LOSI) has been created and a pilot analysis and ranking, covering 40 cities worldwide, was added.
- The list of the LOSI indicators assessed in this edition was added in the Annexes.
- The sub-indicator of Telecommunication Infrastructure Index (TII) entitled "Wireless broadband subscriptions per 100 inhabitants" was replaced by "Active mobile-broadband subscriptions per 100 inhabitants" due to incontinuity of data collection for the latter by ITU.

References:

1 See, for reference, https://publicadministration.un.org/egovkb

2 Edward M. Roche (2017). *Evaluation of the UN E-Government Survey for the period 2003-2016*. [online] Available at: http://workspace.unpan.org/sites/Internet/Documents/UNPAN97454.pdf

Executive Summary

The *2018 UN E-Government Survey,* with the overall theme "gearing e-government to support transformation towards sustainable and resilient societies", is published as the implementation of the 2030 Agenda advances to its third year and the 2018 High-level political forum (HLPF) focuses on transformation towards sustainable and resilient societies.

Shocks of various kinds can derail progress towards realizing the vision of the 2030 Agenda. Strengthening resilience is at the heart of all sustainable development goals (SDGs) and is thus essential for sustainable progress. Strengthening resilience by ensuring that people, societies, and institutions have the resources, capacities and knowledge to limit, anticipate, absorb and adapt to shocks, underpins all the SDGs. Governments are responsible for pursuing policies to build resilience and assist those most affected. The *2018 United Nations E-Government Survey* considers the ways in which, using digital technology, governments can and are responding to shocks emanating from natural or man-made disasters and various types of other crises. The Survey acknowledges the progressive reliance on digital technologies in managing emergency responses, performing essential functions, and swiftly recovering from crises. For example, governments are ramping up their use of Geographic Information Systems (GIS), open data, e-government services, and cutting-edge technologies such as Artificial Intelligence and blockchain to hasten response and strengthen resilience.

Mobilizing e-government to build resilient societies: preconditions and enabling environment

The Survey highlights the many and complex opportunities for deploying e-government to build resilient societies and sets out the necessary preconditions, as well as outlines ways in which e-government can advance the implementation of the Sustainable Development Goals. Basic services such as health, education, water and sanitation, as well as sound infrastructure and utilities, are essential to sustaining development and improving quality of life. To ensure resilience of societies and development sustainability, the Survey suggests that public services should be made available to everyone, leaving no one behind. New and existing technologies are essential for broader access as well as the provision of significant benefits to service users at a reduced cost. The transformational and facilitating powers of ICTs are creating a paradigm shift in the public sector, but despite the sector's enormous influence, governments remain responsible for quality, standards, and ethics of public services, and for ensuring that no one is left behind. Despite the technological advances in e-government, an increasingly digitized world carries risks, including growing threats to social cohesion and economic prosperity, as well as planetary challenges related to climate change and environmental stress. The 2018 Survey assesses the readiness of governments to confront these threats and challenges.

E-government for leaving no one behind

The *Survey* notes a negative correlation between digital use and social exclusion. Online use, offers an opportunity for e-inclusion but also risks a new digital divide, owing to insufficient access in low-income countries, either because of a lack of devices or of bandwidth and speed. The research also indicates that the greater ease with which information is gathered, stored, analyzed and disseminated and the decreasing cost and coverage of mobile-cellular and mobile broadband subscriptions have improved e-service delivery to vulnerable populations.

According to the *Survey*, since 2012, there has been a steady increase in the number of country websites with information about specific programmes benefiting women and children, persons with disabilities, older persons, indigenous people, and people living in poverty. Increasingly, United Nations Member States are addressing the needs of marginalized groups through more targeted interventions and services provision. Still, the majority of the world's population remains offline, which increases the risk that vulnerable groups without Internet access will fall further behind in the rapidly progressing digital society. Thus, technology can both aid and impede the overarching goal of leaving no one behind.

The digital divides are reviewed, both in terms of access to ICTs and the potentially negative consequences of a "digital first" approach wherein services are primarily offered online, isolating those who do not have online services or do not know how to access or use them. The *Survey* discusses the implications both of having digital skills and the lack thereof. It concludes that there are many opportunities to enhance social and digital inclusion through e-government and that emerging technologies and innovative multi-stakeholder partnerships can help to expand e-government access for all and provide dedicated services to address traditional problems related to poverty and social exclusion.

E-government: A tool to better anticipate and respond to disasters

The *Survey* presents an overview of natural disasters, the consequent loss of life and economic devastation, and the ways in which countries and regions are affected differently. Natural disasters continue to constrain the efforts of Member States in achieving the sustainable development goals. Particularly worrisome is the exposure and vulnerability of landlocked least developed countries, least developed countries and small island developing States. Often, these countries do not have adequate coping mechanisms, especially when faced with multiple hazards. The losses incurred from damaged infrastructure, such as schools and homes, and health facilities, can be immense and can undermine development for generations.

Global accords such as the Sendai Framework for Disaster Risk Reduction 2015-2030, which encourage the mainstreaming of disaster risk concerns into all sectors, are detailed. ICTs play an important role in ensuring that disaster response and recovery are fast and efficient. Indeed, ICTs are recognized as an enabler in supporting all phases of disaster risk management from prevention, reduction, and preparedness to respond and recover, and the *Survey* emphasizes the need to protect critical ICT infrastructure from disaster impacts. Several e-resilience initiatives across the globe are designed to support the various phases of disaster risk management and response. Examples from Uganda, Madagascar, Chile, Sri Lanka and Bhutan underline the importance of relaying the right information at the right time. Given that some disasters such as floods, cyclones and typhoons, and droughts are transboundary in nature, inter-regional and global data sharing and coordination among concerned countries and regions are crucial. Partnerships also aid smaller economies, which may not have sufficient budgets or personnel to take charge of all phases of disaster risk reduction.

Building the resilience of e-government

Cybersecurity is a key factor in the transformation to resilient e-government. Security measures need to be strategically incorporated from the outset, during the design phase. The global community is increasingly embracing ICTs as a key enabler of social and economic development but cautions that misuse is raising questions about State security and protection of individuals and businesses in the explosion of global connectivity. It is important for governments to

improve the management of ICT-driven approaches to guarantee continuity of online services as well as to safeguard people's data and privacy.

The Survey posits that a change in existing procedures as well as heightened cybersecurity consciousness among civil servants are required, noting for example, that ransomware attacks are increasingly affecting businesses and consumers, and indiscriminate campaigns are distributing massive volumes of malicious emails. In May 2017, the WannaCry ransomware cyberattack caused major disruptions to critical information infrastructures of companies and hospitals in more than 150 countries, prompting a call for greater global cooperation.

The most common barriers to e-government resilience are insufficient training and accessibility, as well as e-illiteracy. There is a need for trust, security, and privacy, which can be established through the following cybersecurity measures: (i) adopting a harmonized set of laws at regional and international levels against the misuse of ICTs for criminal or other nefarious purposes; (ii) integrating adequate technical capabilities in detecting and responding to cyber-attacs, and to ensure a climate of trust and security; (iii) and establishing minimum security criteria and accreditation schemes for software applications and systems. A secure e-government system requires collaboration among vendors, industries and manufacturers to ensure that devices are secure by design and that users can interact with them to perform updates and make configurations changes, among others. The digital transformation must be thoughtfully strategized and continuously updated to ensure security and relevance along the path to sustainable development.

Global and regional trends in e-government

E-government has been growing rapidly over the past 17 years since the first attempt of the United Nations to benchmark the state of e-government in 2001. The *2018 Survey* highlights a persistent positive global trend towards higher levels of e-government development. In this edition, 40 countries scored "*Very-High*", with EGDI values in the range of 0.75 to 1.00, as compared to only 10 countries in 2003, and 29 countries in 2016. Since 2014, all 193 Member States have been delivering some form of online presence. The average world EGDI has been increasing from 0.47 in 2014 to 0.55 in 2018 due to the continuous improvement of its subcomponents indices. This suggests that globally, there has been steady progress in improving e-government and public services provision online. But despite some development gains and major investments made in several countries, the e-government and digital divides persist. Fourteen countries in the Low-EGDI group are African and belong to the least developed countries.

Denmark, followed by Australia and the Republic of Korea, lead the world in providing government services and information through the Internet according to the 2018 E-Government Development Index (EGDI). The remaining countries in the top 10 are the United Kingdom, Sweden, Finland, Singapore, New Zealand, France and Japan.

E-government development increases overall across regions, driven largely by improvements in the Online Service Index. The European countries lead e-government development, while the Americas and Asia share almost equal standing in the High- and Middle-EGDI levels. The number of African countries in the High-EGDI-level group remains relatively modest at 6, with only one country, Ghana, joining the group since 2016. Many people in these countries are unable to benefit from ICTs because of poor connectivity, high cost of access and lack of necessary skills. These disadvantages are likely to affect further development of e-government

in Africa as the pace of technological innovation intensifies. Finally, in order to build a well-functioning e-government, countries need to strengthen investments in developing human capital and telecommunication infrastructure.

According to the *2018 Survey*, the complexity of e-government in promoting accountable, effective, inclusive, transparent and trustworthy public services that deliver people-centric outcomes is growing. Currently, there are trends in deploying e-services, especially in health, education, the environment, and decent employment, while the reach to the most vulnerable is expanding. The major drivers of the EGDI, as well as trends in open government data, public participation and engagement for delivery of innovative public services are scrutinized in detail.

According to the *Survey*, the three most commonly used online services in 2018 are utilities payment, submission of income taxes, and registration of new businesses. Service availability through emails, feed updates, mobile apps and SMS (short message service, or texts) has doubled globally, especially in the health and education sectors. For instance, 176 countries provide online services in education via email alerts to citizens compared to 88 countries in 2016, and 152 countries provided such services in the health sector this year compared to 75 in 2016. A growing number of countries is also providing targeted online services to vulnerable groups: 86 per cent in the Americas, 79 percent in Asia, 57 per cent in Africa, and 15 per cent in Oceania.

One hundred forty (140) Member States provide at least one transactional service online. Improvement in such services is strong and consistent in all assessed categories: paying for utilities; submitting income tax; registering new businesses; paying fines and fee; applying for birth and marriage certificates; registering motor vehicles; and applying for driver's licenses and personal identity cards.

Transforming cities to increase resilience and sustainability

The *Survey* provides an overview of assessment models and presents the findings of a pilot study, carried out in 40 municipalities around the world. The challenges and opportunities of applying e-governance to local government units are presented through specific cases. E-government improves public services, citizen engagement, and transparency and accountability of authorities at the local level. E-government also strengthens resilience and sustainability and better aligns local government operations with national digital strategies.

Among the top 10 of the 40 pilot cities, Moscow ranks the highest, followed by Cape Town and Tallinn (second, tie) and by London and Paris (forth, tie). According to the Local Online Services Index (LOSI) used in determining this ranking, the remaining cities in the top 10 are Sydney, Amsterdam and Seoul (seventh, tie), and Rome and Warsaw (ninth, tie). The LOSI covers the technical and content aspects of the city/municipality websites, as well as electronic services provision and e-participation initiatives available through the portals.

Politicians, policy-makers and public officials are creating new policies to promote resilience and sustainability especially in the areas of poverty eradication, equal opportunity for all, support for vulnerable groups, land development and planning, economic development, smart growth, pollution prevention, energy, resources and water conservation, inner-city public transit, eco-projects and alternative energy. Public administration processes are being reengineered to integrate these policies into local planning and development efforts, even as these administrations are striving to keep pace with the speed of technological innovation.

Improving local e-government is inseparable from the pursuit of sustainable development goals. The 2030 Agenda recognizes the importance of technological innovation in the implementation of the Goals and contains specific references to the need for high quality, timely, reliable and disaggregated data including earth observation and geospatial information. Many of the specific targets of the 2030 Agenda are directly or indirectly related to local e-government assessment indicators. Local governments are indeed the policy-makers and catalysts of change. They are also the level of government best-placed to bind the SDGs with local communities. The development of electronic services and the increasing number of citizens participating in decision-making will motivate efforts to achieve the SDGs and will assist in making cities sustainable, inclusive, safe and resilient.

Fast-evolving technologies affecting e-government and possible applications for the SDGs

Today, fast-evolving technologies have a potential to transform the traditional way of doing things across all functions and domains of government as well as the ways in which ICTs offer governments an unprecedented opportunity to achieve sustainable development and improve the well-being of their citizens. The challenge lay in the fact that the speed with which technology is evolving surpasses the speed with which governments can respond to and use ICTs to their advantage.

The Survey discusses some of these transformative technologies, such as data analytics, Artificial Intelligence including cognitive analytics, robotics, bots, high-performance and quantum computing. It explains how forces driving such technologies are the result of long-term and painstaking research and development, their use by businesses and citizens as well as the increased processing power of hardware, increasing data availability and society's driving needs and expectations. Oftentimes, it is not the technologies that are new but the convergence of developments in hardware, software and data availability.

Data is being currently referred to as the new oil, the new raw material driving innovation and growth in both the private and public sectors. Indeed, data use will grow exponentially in the next decade and will offer the ability to systematically analyze and act in real time in solving more complex business problems, creating more competitive advantage and making better informed decisions in a tightly connected world. Yet, integrated approaches to achieving synergies and minimizing trade-offs may remain relatively untapped in many countries.

Artificial Intelligence is beneficial, particularly with its potential applications, touching on Neural Networks, Natural Language Processing, Machine Learning, and Robotic Process Automation. The recognized benefits of AI are error reduction, robust functioning, delegation of repetitive jobs, improved security, improved business operations as well as improved customer experience. However, the rise in use of AI also carries uncertainty in terms of employment. It is feared that AI, particularly robotic automation, will leave low-skilled workers without jobs.

The fourth industrial revolution and convergence of innovative technologies such as Big Data, Internet of things, cloud computing, geo-spatial data and broadband, AI and machine learning, is promoting a dramatic shift towards more data and machine-driven societies.

Digital transformation does not depend only on technologies alone, but also requires a comprehensive approach that offers accessible, fast, reliable and personalized services. The public sector in many countries is ill-prepared for this transformation. Governments can respond by developing the necessary

policies, services and regulations, but many of these instruments are slow in being "brought to the market". Principles such as effectiveness, inclusiveness, accountability, trustworthy and openness should direct the technologies and not the other way around.

The *Survey* concludes that while e-government began with bringing services online, the future will be about the power of digital government to leverage societal innovation and resilience and to transform governance to better achieve the SDGs.

Mobilizing e-government to build resilient societies: preconditions and enabling environment

1.1 Introduction

At the United Nations Summit held in New York in September 2015, world leaders adopted an ambitious road map to guide the sustainable development of all countries over the next 15 years. This new Agenda – entitled "Transforming our world: the 2030 Agenda for Sustainable Development"– defines 17 Sustainable Development Goals (SDGs) and 169 targets to stimulate actions for people, planet, prosperity, peace and partnerships. With the adoption of the 2030 Agenda, a common transformative vision based on solidarity, accountability and shared responsibility, has been guiding governments, civil society, the private sector and other stakeholders in their efforts to eradicate poverty and promote a better world for all. The SDGs have been formulated to stimulate action over the next 12 years.

Indeed, the 2030 Agenda envisages a world in which "democracy, good governance and the rule of law, as well as an enabling environment at the national and international levels, are essential for sustainable development, including sustained and inclusive economic growth, social development, environmental protection and the eradication of poverty and hunger" (A/RES/70/1, para. 9). The Agenda explicitly highlights in Goal 16 the need to build peaceful, just and inclusive societies, which provide equal access to justice and are based on respect for human rights (including the right to development), effective rule of law and good governance at all levels, and transparent, effective and accountable institutions" (A/RES/70/1, para. 35).

It is widely agreed that deploying e-government in support of good governance is essential for building effective, accountable and inclusive institutions at all levels, as called for in Goal 16, and for strengthening implementation of Goal 17, both of which underpin achievement of the SDGs as a whole. In addition, the 2030 Agenda[1] underlines the strategic benefits offered by the technology revolution: "The spread of information and communications technology and global interconnectedness have great potential to accelerate human progress to bridge the digital divide and to develop knowledge societies, as does scientific and technological innovation across areas as diverse as medicine and energy." However, for this to occur, several preconditions need to be in place, as outlined by the World Bank in its report on Digital Dividends.[2]

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This chapter sets out the conditions necessary for e-government to support sustainable and resilient societies, and it outlines ways in which e-government can support implementation of the SDGs. It also examines the challenges, risks and vulnerabilities associated with e-government and the readiness of countries and regions, and governments at all levels to confront them. Despite recent progress, there are heightened dangers of a more troubled world, owing to deepening and increasingly interconnected risks[4]. These include growing threats to social cohesion and economic prosperity, as well as planetary risks related to climate change and environmental stress. It is also ever more important to meet the special needs of the poorest and most vulnerable, by empowering them through a range of targeted policy measures. The chapter closes with a brief review of lessons learned and conclusions.

1.2 Preconditions for e-government to accelerate the building of sustainability and resilience

1.2.1. Political commitment and public trust in e-government

The 2030 Agenda encouraged all United Nations Member States to "develop as soon as practicable ambitious national responses to the overall implementation of this Agenda". The Agenda notes that it is up to each Government to "decide how [the] aspirational and global targets [of the SDGs] should be incorporated into national planning processes, policies and strategies." It specifies that national responses towards implementation can "build on existing planning instruments, such as national development and sustainable development strategies". At the same time, the SDGs and the commitments contained in the Paris Climate Change Agreement, the SAMOA Pathway, the Addis Ababa Action Agenda, the Sendai Framework for Disaster Risk Reduction and other UN-lead agreements are mutually reinforcing. Thus, they should be implemented in a complementary and synergistic way. Institutions need new capacities and knowledge to provide integrated support to implementation and to leave no one behind.

Many governments have already made good progress in adapting the SDG targets to their national circumstances and priorities and incorporating them in their policies and strategic development plans, where applicable. By the United Nations High-Level Political Forum on Sustainable Development (HLPF) in 2016 and 2017, 65 countries had carried out the first and second voluntary national reviews (VNRs). They will be followed by 47 more countries, which will present their national reviews in July 2018 during the annual HLPF.[5] That requires that national strategies, including those dealing with Information and Communication Technologies and e-government, adopt an integrated approach to comprehensive and balanced development. National plans and strategies set the overall direction and priorities and form the first opportunity to express SDG efforts in a coherent way at the national level.

Member States also will have to adapt their institutions, engage local governments, parliaments and other actors as they identify follow-up and review structures. The SDGs, as an integrated framework, call for whole-of-government and whole-of-society approaches, and many countries have been moving in this direction. Good practices, lessons and challenges are already emerging.

Based on a recent research conducted by UN-DESA[6], existing national development plans and national sustainable development strategies provide a framework for implementation of the 2030 Agenda. (See Box 1.1.). These plans and strategies guide countries' overall development and are not solely dedicated to SDGs.

Box 1.1. Compendium of national institutional arrangements for implementing the 2030 Agenda for Sustainable Development

In order to implement the 2030 Agenda for Sustainable Development and the SDGs, many countries have been adapting their policy and institutional frameworks and are actively mobilizing all parts of government, parliaments, supreme audit institutions, as well as non-state actors. The compendium of national institutional arrangements for implementing the 2030 Agenda reflects institutional approaches taken by countries facing different contexts and circumstances. The compendium aims at facilitating exchanges on institutional practices and lessons learned among governments and other stakeholders, thereby helping them to support the realization of the SDGs. The compendium, prepared by the Division for Public Institutions and Digital Government of the United Nations Department of Economic and Social Affairs, initially covered 22 UN Member States, which chose to present reviews of progress on the SDGs at the 2016 HLPF, and then was expanded to cover additional 43 countries that presented Voluntary National Reviews in 2017. The information collected for each country is classified in nine categories: (i) national strategies and plans; (ii) national institutional arrangements; (iii) local authorities; (iv) parliament; (v) engaging and equipping public servants; (vi) civil society and the private sector; (vii) monitoring and review; (viii) supreme audit institutions; and (ix) budgeting. The research was conducted between August 2016 to December 2017. All the countries covered in the report had an opportunity to review the information that concerned them, and to provide feedback, inputs and comments through their representatives to the UN in New York.

United Nations
Department of Economic and Social Affairs

Source: http://workspace.unpan.org/sites/Internet/Documents/UNPAN97468.pdf

1.2.2. National policy alignment

It is recommended that governments exploit the potential of ICTs through coherent public sector-wide policies closely aligned with the broader national policies aimed at delivering the SDGs. Being successful requires a whole-of-government approach across ministries and agencies and between levels, as well as partnerships with non-government actors. That approach must be supported by a high-level political will, an example of which is an effective cross-government institution with clearly earmarked financial resources and decision-making powers. Maximizing the potential of ICTs also demands appropriate infrastructure for interoperability and digital transactions across the public sector, dependent on common standards, data sharing, highly skilled staff, as well as sound organizational capacity.

There are many good examples from around the world where governments are applying such strategies. Azerbaijan, for instance has adopted a whole-of-government approach to modernize service delivery in a joined-up manner to change the mindset of civil servants through human resources and capacity building. Political will has proved critical for that strategic change of direction. It is also essential to achieve public service impacts through deployment of the full range of channels for service delivery, both online and offline, designed to reach the entire population, whoever they are and wherever they live[7]. That relies on improved accountability and inclusive public participation, in which all parties know their rights and duties. ICTs are essential tools to making that happen.

In some countries, such as Colombia, e-government is used to improve governance, equity and peaceful reconciliation to help heal the wounds of years of internal conflict and crime. Often, the only ties between the citizens and State are through public services, so if those are non-existent or of poor quality, trust rapidly disintegrates and progress towards sustainable development falters. To achieve such improvement, it is important that governments attempt to change the mindset, not only of civil servants, but also of its citizens. Indeed, the two are mutually reinforcing. For example, a strong focus is required on open and participative government, with institutional commitments to, among others, inclusion and gender sensitivity. Both of these commitments are themselves wellsprings of innovation and improve quality of life for the citizens.[8]

The Survey will explore ways to move in that direction. The theme will be examined against the backdrop of an analysis of the trends in e-government development worldwide.

1.2.3. About resilience and SDGs

The HLPF in 2018 will focus on the theme of "Transformation towards sustainable and resilient societies" as a precondition to achieving SDGs. Strengthening resilience entails ensuring that people, societies and institutions have the resources and capacities to anticipate, reduce, absorb and adapt to various shocks and risks[9]. It also requires measures that target the poorest and most vulnerable and strive to empower them through employment and social and other policy measures. Resilience in all dimensions of sustainable development thus includes a range of strategies that go well beyond systems and emergency plans, such as bolstering public services, improving social safety nets, effective macroeconomic and urbanization policies.

Governments have the critical responsibility to build resilience and assist those most affected by possible shocks in pursuing the SDGs implementation. They must find ways to anticipate disasters and lower their impact. They themselves must prepare for risks of various kinds and adapt to and reduce their own vulnerability and exposure. They need to manage emergency responses, seamlessly perform essential functions and deliver services, and recover rapidly from crises while incorporating lessons learned into their institutions and public administrations.

Shocks of various kinds can derail progress towards realizing the vision of the 2030 Agenda. Strengthening resilience is at the heart of all SDGs and is thus essential for sustainable progress.

Digital technologies are often used by governments to respond better to disasters and other shocks and improve community resilience. Geographic Information Systems (GIS), open data, eGovernment services, and emerging cutting-edge technologies such as artificial intelligence (AI) or blockchain, can serve as a means for improving both resilience and emergency response.

Scientific and technological advancement in GIS can be utilized for better disaster risk reduction practices. Capturing, storing, analysing and managing georeferenced information (GIS) play an important role in disaster risk assessment and management. The use of spatial and geo-referenced data during pre- and post-disaster management contributes to risk reduction, early warning, vulnerability and risk assessment, and mitigation of damage. Similarly, the modern computational power of analysing big data and georeferenced images make it possible to use artificial intelligence to predict environmental changes. The World Resource Institute, for example, used a spatial modelling software and artificial intelligence to uncover the most accurate linkages between the past loss of forests and drivers of deforestation in the Democratic Republic of Congo (DRC)[10]. That helped produce a map showing areas at high risk for forest loss, and key factors behind it.

The development of ICTs has also added a new dimension of vulnerability. This requires bolstering resilience in areas where governments are not always well equipped to venture. Online services should be sheltered from the impact of cyber-attacks. Governments should find ways to ensure high security standards in online public services such as digital health while working closely with other institutions, the private sector and civil society. They must address the potential threats associated with the information society while gearing innovations towards areas that will improve people's lives. Action is also required at the international level to help developing countries boost their resilience against shocks and threats related to e-government and ICTs, while also closing the digital divide.

1.2.4. Public Trust

Building public trust for effective e-government outcomes is another fundamental step towards achieving the SDGs. This will depend primarily on implementation of sound public policy that reflects people's priorities on institutional performance and on the equal access to quality public services. For effective service delivery, e-government applications should be designed to meet needs and should promote people's active participation in identifying those, and most importantly, to implement trustworthy plans and projects at all levels. The role of local authorities in sustainable development will be ever more important to reaching the most vulnerable. Therefore, working locally with all communities through innovative participatory mechanisms is a must.

An increase in citizens' expectations for effective, equitable and citizen-centric services, demands a shift from inward, disjointed and process-oriented organizational structures to highly collaborative frameworks for seamless delivery of services and enhanced development impact.

Clear and long-term policy and strategic frameworks are needed to create an enabling trustworthy, accountable, inclusive and effective environment for technology use in public service and good governance. These frameworks should be the blueprint for public service, in support of the implementation of the core principles of sustainable development. The capacity of reliable institutions to meet performance expectations, perceptions of competence and effective public service delivery for all, along with public accountability, should be among the leading concerns in public administration and underlying objectives of public sector reform. Gender inequality must be overcome through a multiplicity of public policies, especially through participatory gender-responsive budgets.[11] Citizens and businesses are demanding more open, transparent, accountable and effective governance, while new technologies are enabling effective knowledge management, sharing and collaboration between all sectors and at all levels of government. There should be particular emphasis on building trust between citizens and their government through principles of transparency, inclusion and collaboration.

Governments can no longer provide services unilaterally and disregard demands for a more efficient and accountable use of public funds, which can result from service integration (eGovernment Survey 2014). ICTs can improve transparency by providing access to information, which also increases accountability and can keep a check on what government is doing and how well it is doing it. ICTs also promote participation through the two-way sharing of knowledge and experiences between governments and their citizens. That makes it possible to co-create public services and collaborate on evidence-based decision and policy-making, both across the silos of national government as well as across borders. In short, ICTs are a game-changing enabler.

At the same time, lack of regulation can impede ICT use in public service design and delivery. Developing a long-term strategy for ICTs and supporting it with the necessary resources, regulatory framework and political will, has a uniquely powerful potential to ensure sustainable development. An overall open government strategy, sound human resource management, and comprehensive disclosure procedures should be put in place for managing and monitoring the conduct of public servants. New forms of institutional frameworks for effective coordination, cooperation and accountability should be put in place across government, between governments and with relevant non-public actors, which can contribute building trust and creating public value.

Policy-makers must seek a government that is open to its citizens. Innovative coordination processes and mechanisms for service delivery, and citizen engagement and empowerment are essential, as is making such services open, inclusive and accessible by all groups in society, including the disadvantaged and vulnerable. The extent of engagement and the methodology varies from country to country, but what works for all is the adoption of a holistic approach for a more inclusive

people-centric public-sector reform and ethical leadership at all levels. That will restore the public administration's credibility and trust in public institutions. This strategy also will foster a culture of multi-stakeholder collaboration based on a vision of common good for all. The results can advance realization of national development agendas and the SDGs.

All of this requires transformational capabilities through ethical leadership, transparency and combatting corruption. Public administration resources should be complemented by ethical values and the transparent management of those resources. As public service delivery is one of the most expensive aspects of a government's budget, it will be extremely important, not only to pair the right policies with specific context or jurisdiction, but also to appoint public leaders with high integrity and impeccable ethical behaviour. An example of such transformation is provided in Box 1.2. describing the approach of Tax Administration of Chungcheongnam-do province in the Republic of Korea, which secured transparency through active participation of residents and fiscal innovation. Disclosure of budget execution is not a statutory requirement in the country, yet the Tax Administration decided that all fiscal information should be made available to the public, in order to enhance transparency and monitoring by expanding participation, through full digital disclosure of tax use history to residents in real time. There is a critical need for new forms of collaborative leadership and shared organizational culture, including re-shaping values, mindsets, attitudes and behaviours in the public sector through visible guiding principles and leadership.

Finally, and often underpinning the other enabling factors for gearing e-government to support transformation towards sustainable and resilient societies, it is essential to harness the power of new

Box 1.2. Tax Administration Division, Republic of Korea (2018 UNPSA Winner)

Since the global economic crisis in 2008, the increase in social welfare spending has constrained the finances of national and local governments. The seriousness of the local fiscal crisis caused by various irregularities of public officials and the poor financial management of the heads of local governments demonstrated the need for the integrity and transparency of local finance. In this process, the local fiscal system based on control and management has shifted to the direction of securing transparency through active participation of residents and fiscal innovation. In the Republic of Korea, disclosure of budget execution is not a statutory requirement. Chungcheongnam-do has concluded that it is desirable that all fiscal information should be made available to the public, in order to increase fiscal transparency and fiscal monitoring by expanding participation of residents, through 100 per cent digital disclosure of tax use history to residents in real time. The characteristic of fiscal information released by Chungcheongnam-do is the further extension of fiscal information in cooperation with the city and county as well as expansion of residents' participation. All budget information includes real-time expenditure information and shows the amount of money [spent thus far?] [that can be executed from the total amount to the present]. This budget information includes various materials to help understand such aspects as a mid-term plan and sustainable development indicators. In addition, a questionnaire answer box was added to the person in charge of budget business, and a function of registering and responding to questions or suggestions about the budget was attached, as was a description of basic finance terms.

Apart from the central government, the provincial government has strengthened the disclosure of budget status, revenues and expenditure status, and settlement status on the website of Chungcheongnam-do Province. In particular, in the case of revenues and expenditures, in July 2013 a fiscal information disclosure system was established, linking 15 primary local governments in the province for the first time in the nation. For expenditures, all the contract methods, contract contents, and contract parties were disclosed, even meal expenses. As a result, citizens can check the budget execution status of Chungcheongnam-do online in real time. Fiscal surveillance has expanded and transparency and efficiency of fiscal spending have been maximized.

Source:
Ghttps://www.nts.go.kr

technologies through appropriate ICT management strategies, which enhance policy integration and coherence in e-government approaches. The global spread of the Internet and the application of ICTs in government, as well as greater investments in telecommunication infrastructure coupled with capacity-building in human capital, can provide opportunities to promote integration and transform public administration into an instrument of collaborative governance which directly supports sustainable development outcomes.

1.2.5. Policy integration and coherence in e-government approaches

The 2030 Agenda emphasizes the importance of the integrated nature of the SDGs. Acknowledging possible synergies and the trade-offs required to achieve the targets depends on the sound allocation of resources. This can also eliminate unwanted side effects, which compromise achievement of targets in other areas.

In the same manner, providing the preconditions for sustainable and resilient societies through e-government depends upon a holistic approach that eliminates firewalls between ministries and builds government capacity to rewire policy-making through a new framework of governance and high-impact public services.

Broadly speaking, integration implies finding ways to foster cooperation among institutions at all levels dealing with closely interrelated issues. This may entail putting in place adequate institutional arrangements or streamlining public administration practices, mechanisms, capacities, budgetary arrangements and resources. It also encompasses various modalities of engagement of non-state stakeholders in decision-making[12] through participation, partnerships and the commonly used notion of whole-of-government approach. Box 1.3. refers to a recent UN DESA publication from 2018 on analysing integration efforts from an institutional perspective. The report presents three standard dimensions of integration: horizontal integration, i.e. integration across sectors or institutions; vertical integration, i.e. how the actions of national and sub-national levels of government can be aligned to produce coherent outcomes; and engagement of all stakeholders in the realisation of shared objectives.

Box 1.3. Policy integration for the Sustainable Development Goals

The World Public Sector Report 2018, entitled Working together: Integration, Institutions and the Sustainable Development Goals, aims to inform national efforts towards policy integration for the SDGs, while highlighting the challenges and opportunities that exist for public institutions and public administration. The report illustrates the ways in which interlinkages that exist among the SDGs can be addressed from an institutional perspective, based on examples. Through this, the report aims to sketch areas where public institutions need to work closely together; the types of tools that can be used to that end; and the broader implications for public institutions and public service. To illustrate the importance of integrated approaches, the report looks in detail at three themes: international migration, health, and sustainable development in post-conflict contexts.

The report finds that many countries have created a new structure or mechanism specifically designed to lead or coordinate SDG implementation across sectors. Most of these new institutions are of an inter-ministerial nature and are placed under the authority of the head of State or Government. In many countries, local governments are actively engaged in the SDGs' implementation. The report finds that stakeholder engagement has been happening through different activities, including awareness raising on the 2030 Agenda; adaptation and prioritization of the Goals in the national context; the development of national SDG implementation plans; their implementation; and monitoring and review.

Source: UN DESA, World Public Sector Report 2018: https://publicadministration.un.org/en/Research/World-Public-Sector-Reports

Alliances across government allows for coordination of policies and strategies and their implementation. Such joint efforts can leverage the maximum potential, avoid redundant or overlapping investments, exploit synergies, and introduce a culture of sharing. Of utmost importance is avoiding fragmentation and achieving effective cooperation within a collaborative governance structure that involves all relevant players. However, coordination among relevant stakeholders, such as IT bodies and ministries, is often lacking, as all too often those actors have their own agendas and do not take into consideration those of other entities. This fragmentation severely hampers the sustainable development of resilient societies.

It is important to ensure that responsibility for ICT uses in line ministries is spread among subordinated agencies, lest competition occur, leading to a duplication of efforts and wasted assets, all of which undermine interoperability. That, in turn, reduces government efficiency and effectiveness and results in poorly designed and delivered public services as well as a weakening of good governance overall. Although many deficiencies are the result of a lack of financial resources, existing systems often contain numerous redundancies, which reduce the impact of ICTs and other budgetary expenditures, thus hampering new opportunities for long-term growth.

The public sector generally considers strong organization as important to the successful integration and use of information systems and, indeed, horizontal policy integration is crucial to thwarting competition and facilitating a whole-of-government approach that fosters sustainable development.

The necessary cooperation requires extensive coordination among different agencies and organizations, and can only occur when an entity has cross-government responsibility and power, supported by clear political mandates from the top. This demands a fundamental change in culture and values of the entire organization. The transformational change and impressive performance of e-government by the Republic of Korea is an illustration of a new paradigm designed to deliver customized public services and generate new jobs through the sharing of government-owned data with the public and improved collaboration between government departments. Government 3.0, as the programme is called, was driven in 2013 by a foundational shift in institutional arrangements and behaviours based on a new set of values. That, in turn, made the government more service-oriented, competent, and transparent. The programme was successfully implemented through purposeful behaviour that was connected to a strategy with clear objectives from top management.[13]

As illustrated previously, enhanced efficiency and effectiveness in public administration and service delivery has been a longstanding and consistent driver of e-government reform. E-government facilitates, among other things, a reduction in the administrative burden. By eliminating duplication and limiting the number times the same information is collected from individuals or firms enables more systematic information sharing across government agencies.

Policy integration and coherence can be another powerful driver to advance e-government. An imperative of that integration is the design of new e-government approaches. Enhanced collaboration and cooperation across government agencies (both across sectors and levels) have implications for data sharing and communication protocols, which are directly relevant to e-government. Examples such as Bangladesh's integrated health data portal illustrates how data from various sources can be mobilised to provide different actors with a comprehensive overview of the situation in a given area, on a permanent and open basis. With regard to public services, collaboration and adequate resources are needed across government levels in order to enhance information flows. Dimensions such as data compatibility and associated standards are part of this discussion. As with other dimensions of integration in government, securing support from the public service institutions and public servants,

including through human resources and capacity building, is necessary to promote a mindset of collaboration and engagement.

Both efficiency and collaboration arguments are influenced by a third consideration, that of strengthening the interface between governments, citizens and other components of society. That involves the clear articulation of e-government solutions among all layers of government, to the benefit of both constituents and beneficiaries. ICTs provide the communication tools that enable users' direct participation in the design and delivery of services. There are examples of the use of mobile technology to facilitate participatory decision-making in Cameroon[14]. In South Kivu, Democratic Republic of the Congo for example[15], mobile technologies allow communities to discuss their basic service needs and facilitate the government's response. People's positive perception of the government as deliverer of services resulted in improved tax collection. E-government can support strategies to improve governance and make it more inclusive, which is important in post-conflict situations.

Increasingly central is open government, which seeks to improve transparency in government processes and proceedings, and made documents and data more available, which facilitates public scrutiny and oversight. One of the tools used to increase transparency and participation is Open Government Data (OGD), which can be defined as government information proactively disclosed and made available online for all to access, without restriction. OGD introduces a new approach to publishing government data and helps bridge the gap between government, citizens and the other stakeholders. The access, reuse and re-distribution of OGD creates value not only for public sector agencies but for the entire society.[16] It gives all stakeholders full and free access to public data and opens up the opportunity for people to evaluate the performance of various administrative institutions. Combined with the use of modern ICTs, this open platform allows for greater accessibility of key records to a much wider audience. Making data easily accessible gives citizens the opportunity to make informed decisions about public policies and identify development opportunities. Consequently, opening up government data can lead to more efficient use of resources and improved service delivery, which is an important component of e-government strategies in most countries.

ICTs are also essential tools to expanding coverage of public services to all population groups, which is a key principle of the 2030 Agenda. Combined with other approaches, ICTs can facilitate the tailoring of service delivery solutions in a way that explicitly targets marginalized groups such as those identified in the 2030 Agenda. Within this context, however, tensions and trade-offs among policy objectives also impact e-government strategies. A well-known example is the sharing of individuals' health data among government agencies, health providers, insurers and other actors. Similarly, the provision of public services to migrant populations may require the sharing of information across government agencies and layers, which in some cases may put the rights of migrants at risk.[17] Therefore, the drive to enhance circulation of information across all government's layers and eliminate firewalls between them should be balanced by broader ethical and societal considerations.

Experience shows that e-government innovation often happens at local, regional or city levels. (See Box 1.4.). Cities are sufficiently large to wield considerable power and resources, while at the same time, small enough to be close to their inhabitants and the everyday concerns and demands of citizens and businesses. They are also taking an active stance in the implementation of the SDGs.

Box 1.4. Santiago: ingredients for a smart sustainable city[18]

The smart city pilot development programme "Santiago of Tomorrow", initiated in 2013, seeks to improve quality of life for its inhabitants by increasing access to energy and emphasizing its sustainable use, and creating environmentally friendly smart homes. Some 85 per cent of Santiago's population of 5.12 million, which represents 40 per cent of Chile's population overall, lives in urban areas. In 2017, Santiago was named one of the top smart cities in Latin America, a ranking that includes a focus on resources and opportunities for older people and people with disabilities, with the goal of leaving no one behind[19]. In Santiago, there are business and innovation strategies for diversifying the economy away from primary industries by attracting massive ICT infrastructure investment. Another initiative is the "Start-Up Chile" programme of 2010, which aimed to establish Chile as "the definitive innovation and entrepreneurial hub of Latin America." There is also a strong focus on energy, and Chile ranked in the global top 10 for the most sustainable buildings with investments in green infrastructure, including renewable energy. In terms of mobility, the city's Metro network is organized around an ICT-based congestion pricing in a 3-tier system. Supported by a central card payment platform, the programme provides commuters with choices throughout the day. In addition, the ubiquitous network of bus routes provides free daily bus arrival updates via text messaging. There is also a strong cycling community with separated bikeways, large public bicycle racks, and bicycle sharing programmes based on smart phone apps. A pilot electric vehicle car-sharing programme, the first of its kind in Latin America, uses smart apps for real time information, booking and location updates.

Source:
http://www.smartcitysantiago.cl/

1.2.6. Societal engagement and partnerships

Sustainable development cannot be achieved by governments' efforts alone. Partnerships are a fundamental pillar of SDG 17. Since the Agenda's adoption, arrangements have been developed to ensure information sharing and accountability, and the launch of new partnerships at the global, regional and national levels, including public-private partnerships and multi-stakeholder partnerships. Such partnerships exist across many of the SDGs. For example, the overall review of the General Assembly on the World Summit of Information Society in December 2015 (WSIS+10) underscored the importance of public-private partnerships, along with universal access strategies and other approaches, to leveraging ICTs for sustainable development.

International agreements help to mobilize the private sector to contribute to the implementation of the SDGs. UN DESA has organized several international and regional fora to promote and facilitate a discussion among stakeholders about challenges and capacity gaps faced by public administrations in creating new partnerships. Those include "The Symposium on the Promotion of an inclusive and accountable public administration for sustainable development" (Bolivia, March 2016)[20], the Bahamas Symposium "Effective Partnerships for Implementing the SDGs and SAMOA Pathway"[21] (February 2017), and the Regional Symposium "Building Effective, Accountable and Inclusive Institutions and Public Administration for Advancing the 2030 Agenda for Sustainable Development"[22] (Republic of Korea, December 2017). Special attention has been given to whether public institutions have the necessary capacities, information, safeguards and culture to mobilize partnerships for delivering quality public services to all, including the poorest and most vulnerable, and realizing the SDGs and the SAMOA Pathway[23]. These symposiums took stock of those efforts and reflected on the delivery of commitments made by partnerships thus far. Emerging models of partnerships such as those where the private sector or civil society take leading roles were also explored.

The role of the private sector remains critical for realizing the SDGs. It goes well beyond corporate social responsibility to include joining in the broader efforts to reach the Goals. It also includes the creation of financial tools, facilities and solutions that can support the huge investments needed to implement the SDGs. Effective investment can be achieved by learning – including from the

public sector - and strategizing on ways to engage the private sector and ensure that it augments implementation of the SDGs. The public sector, as the main driver of public services, must be able to deliver high-quality, user-friendly services. That, in turn, requires capacities, skills, financial support, human resources, structures, policies and strategies, as well as legal and regulatory frameworks. At the strategic level, careful policy design is needed, supported by evidence and analysis reliable enough to enable sound political judgments about which public services to offer and how to do so. In short, the services provided should align with need and produce the intended social, economic and environmental outcomes.

Successful examples of using innovative technology in solving a global humanitarian and social problems abound. The partnership between the government of Jordan, The World Food Programme (WFP), the United Nations High Commissioner for Refugees (UNHCR), Cairo Amman Bank and IrisGuard Inc., for example, has introduced an innovative iris scan payment system in Jordan's Zaatari and Azraq refugee camps[24] allowing 1.5 million Syrian refugees and migrants to use digital money deposited on e-cards to access food and basic services using a scan of their eye instead of cash or vouchers.

But much greater efforts are required to mobilize all the stakeholders behind the SDGs and give them the right "ecosystem" with which to engage. The government is responsible for identifying the key stakeholders in a given area, and to try new approaches to engage them, bearing in mind that the local and municipal levels are critical. It is urgent to strengthen global partnerships for realising the SDGs, so as to ensure that developing countries have the resources and capacities necessary to eradicate poverty and boost economic growth. North-South, South-South and triangular cooperation is therefore essential, and efforts should be made to extend this imperative throughout public administrations.

It is also crucial, albeit urgent, to involve youth and the poorest and most vulnerable people in decision-making. Countries should make full use of their existing institutions that give voice to the people and to civil society, as well as to parliaments.

ICTs provide the communication tools for service users' direct participation in the design and delivery of their services. Participatory decision-making in such areas as budgeting gives citizens the opportunity to discuss and vote on how parts of their government's budget should be used. The archetypal example at Porto Alegre in Brazil is recognized internationally as a ground-breaking local-level initiative in which the state government has engaged more than 1 million residents in its multi-channel online and offline decision-making to enhance provision of a wide range of public services and utilities[25]. That is just one example of a way to increase revenue in developing countries, where tax collection rates are notably low, and where the dearth of financial resources often threatens sustainable development programmes.

Similarly, ICT use in Turkey enabled the establishment of a Communications Centre under the Prime Minister's purview to provide a fast and efficient system through which citizens can easily communicate requests, complaints and opinions related to administration. The scheme supported citizens' right to petition and right for information, and it introduced significant financial savings for the public.

Finally, governments should increase capacity to address disasters. Preventing them, where possible, through good planning and mitigation systems is essential, but effective responses in the aftermath of a disaster are also crucial. The deployment of ICTs and e-government to improve disaster mitigation and management has grown tremendously in recent years, but often remains a neglected tool, especially in those developing countries most subjected to events that threaten widespread loss

Box 1.5. President Communication Center (CIMER), Turkey

The President Communication Center (CIMER), previously called the Prime Ministry Communication Center (BIMER), is an important project that was launched in 2006 as an electronic public service tool where the public can apply for the right to petitions and right to information from anywhere in the country. As known in today's public administration literature, the concepts of "Governance" and "Participation" have come to the forefront. For this reason, the establishment of a fast and efficient system for citizens to easily communicate all requests, complaints and opinions related to administration is an indispensable requirement for the spread of democracy, as well as for the success of management. Applications are accepted all around the country and are delivered to the related public institutions rapidly. In addition, it aims to provide answers to the applicants as soon as possible, to warn the relevant units in case of delay, to receive statistical reports and to provide supervision from the center. Applicants who want to make an electronic application, can apply via "https://www.cimer.gov.tr/" or can use the e-government system. Applicants also can apply via ALO 150 telephone line, go to the application offices of the Ministry, the Governor's Office and the District Governorships in person, or by letter or fax. Approximately 6,000 applications are submitted through BI MER every day, and about 80,000 public personnel are employed by this project throughout the country. Considering that 92 per cent of the applications were received over the Internet and 60 per cent were made using mobile phones; CIMER provides significant financial savings to the public.

Source: https://www.cimer.gov.tr/

of life and material destruction. At the same time, ICT use requires adequate infrastructure for organizations and individuals. During the past decade, many developing countries have put that in place, as they strive to make ICTs accessible and affordable. Mobile technology, the Internet, Web 2.0 tools like social media, Geographic Information Systems (GIS), remote sensing and satellite communications, as well as different types of radio communication including amateur and satellite radio[26] have proved indispensable to disaster risk reduction.

1.2.7. Effective institutions in transforming and innovating government

In its resolution on Promoting Public Sector Leadership,[27] the UN Economic and Social Council (ECOSOC) stressed that governments have the "central role" in SDG implementation, and notes that "effective institutions" are essential for achieving all the Goals and targets. The resolution indicates that many countries are in the process of identifying and updating policies, strategies, institutions and arrangements for spearheading and coordinating the implementation and progress review of the SDGs. The text also recognizes that implementing the SDGs does not necessarily require the creation of new institutions. With no one blueprint for implementation, existing institutions, such as planning and finance ministries, have a critical role to play.

Governments around the world have pioneered widespread innovation and transformation across multiple levels and various platforms. These developments are critical to support the creation of sustainable and resilient societies, which meet the needs of all people. It is important to shift from an approach where the latest technologies are the exclusive focus in e-government to digital government where technology is "fully" integrated and embedded in government processes in a sustainable way and with proper institutional and legislative support[28]. The new approach must seek to build resilience and promote sustainable development in a way that leaves no one behind.

The ECOSOC resolution underlines the critical importance of leadership at all levels of government and welcomes government engagement at the highest political level in SDG implementation. It invites governments to undertake concerted efforts to raise awareness and increase ownership of the goals within national, regional and local authorities, civil society, the private sector and society

at large, and to launch initiatives to build the awareness and commitment of civil servants at all levels to the vision of the 2030 Agenda. It also invites governments to build the capacities and skills of civil servants in areas such as integrated and coherent policymaking, planning, implementation, foresight, consultation, evidence-based reviews of progress and the collection and use of statistics and data. The resolution further encourages governments to "redouble efforts" to ensure respect for the rule of law by institutions at all levels.

Box 1.6. The United Nations Public Service Forum and Awards Ceremony

The UNPSA is a prestigious international recognition of excellence in public service. It promotes and rewards innovation and excellence in public services for realizing the SDGs and the principle to leave no one behind, which is at the core of the 2030 Agenda. Through an annual competition, the UNPSA promotes the role, professionalism and visibility of public service. It was launched in 2003 and since then it has encouraged exemplary public service and recognized that democracy and successful governance are built on a competent civil service.

The Awards are usually handed out on 23 June, day designated by the General Assembly as the United Nations Public Service Day to "celebrate the value and virtue of public service to the community" (A/RES/57/277). The General Assembly, in its resolution 57/277, encourages Member States to organize special events on that Day to highlight the contribution of public service in the development process.

The UN Public Service Award (UNPSA) ceremony is part of a United Nations Public Service Forum, which takes place in different regions of the world. The United Nations Public Service Forum is a capacity development activity of UN-DESA where ministers, public servants, and representatives of civil society from all over the world gather to discuss and share innovations, build synergies and partnerships and exchange knowledge and best practices. In 2003, the General Assembly decided "that 23 June would be designated United Nations Public Service Day".

Unique global event on public governance that provides a platform for decision-makers to share successful strategies, innovative approaches and lessons learned on how to rally public servants to realize the SDGs and leave no one behind. By hearing from their peers on how they addressed the challenges related to designing and delivering services, Government officials bolster their capacity to respond to the 2030 Agenda.[29]

United Nations
Department of Economic and Social Affairs

Source: https://publicadministration.un.org/en/UNPSA

Many innovative approaches around the world make public services more effective, efficient and often transformative. These cases were recognized during the annual United Nations Public Service Awards (UN PSA) programme (please see Box 1.6.).

Significant population changes, such as increases in both the number and proportion of elderly, birth rate reductions, and migration will require more and better services. Key areas of health and long-term care, education, and professional training are starting to use big data to increase personalized and potentially more efficient and effective services, as well as artificial intelligence, which, if properly deployed, can lead to better decisions. ICTs overall can enable personalized medicine and education, support vulnerable populations, predict and manage shocks and disasters, promote social and political inclusion, improve sanitation, provide identity for unregistered persons, and reduce environmental toxicity through better monitoring. In this regard, governments have been exploring private and public partnerships to improve service delivery.

Singapore, notably, has partnered with Microsoft to create "chatbots" to deliver certain public services. There is also the potential for significant wins through the use of artificial intelligence to allocate resources in hospitals more efficiently, and, among other things, to model and control scheduling systems for public transport navigating the complex ways in which traffic flows through a

city.[30] Therefore, it is not surprising that in many countries, ICT-enabled technologies are increasingly being used to design and deliver innovative public services. This trend is likely to increase significantly in the future with lessons already being drawn. The processes of public service design, delivery and use depend largely on the preconditions, related to the policy, strategy and capacities of the public sector, and collaboration among actors. The overarching aim is to provide good quality public services across the main sustainable development pillars of social, economic and environmental need, and, generally, to improve welfare and prosperity across the whole of societies.

The process must be built on institutional changes that ensure the ability of public institutions to adapt to the new technologies and prevailing conditions and needs through greater efficiency, effectiveness, transparency, accountability and inclusivity.

1.3 E-government strategies for sustainability and resilience

1.3.1 Ensuring access for all to inclusive public services

There are many examples where ICTs are being used with tremendous effect in delivering public services to lower-income, developing countries and emerging economies. Such examples spotlight the ways in which ICTs can make huge differences in public service delivery. In developing countries, in particular, non-digital service delivery channels, such as traditional post offices, telephone call centres, over-the-counter face-to-face services in citizen centres, as well as television and radio, remain important. However, those can be significantly improved by adding a digital channel, for example, or using satellite broadcasting and multi-channel learning services through mobile Internet centres that connect teachers, learners and communities. The "back offices" of service providers can also be digitized and joined up to provide innovative solutions for enhancing service delivery, including via traditional channels. Many service components will continue to require direct human interaction in health, care, education and the building of personal and trusting relationships through dialogue and empathy. In that, ICTs can be a valuable support tool for front-line staff. Notably, ICTs are being used innovatively to provide instant access to remote and hard-to-reach people across large areas and distances, regardless of time or location.

In terms of access to and information about public services, a new initiative in Ghana is providing Wifi and Internet access in remote rural areas (Box 1.7.).

Box 1.7. Ghana: Remote access to wifi and internet services[31]

In early 2018, a Danish ICT company, in collaboration with the Ministry of Communications in Ghana, launched an affordable and sustainable "connecting the unconnected project" in four rural communities in western Ghana, prior to it being rolled out across the country. A base station 100 per cent solar energy powered establishes a Wifi hotspot with a range of up to one kilometre in diameter.[32] The hotspot is connected to the Internet by existing infrastructure such as microwave link and fibre, satellite, balloons or drones, bringing connectivity to even the most remote areas of the world. Because the programme is based on Wifi, users can browse the web, stay in touch, or participate in educational programmes using any smartphone, tablet, or laptop. A local cloud at the base station provides fast and easy access to e-learning, e-health, and e-governance, and allows citizens to share information, such as on health care and agriculture, as well as to communicate online with government authorities. Farmers can watch training videos to help them make the most of their land and to sell their crops at a fair price. Local doctors can access lifesaving information and much more. The hotspots are also in use in public establishments such as schools, hospitals, banks, police stations and market places.

Source: http://gifec.gov.gh/

Often, specific needs can be precisely targeted by using a multi-channel approach consisting of different combinations of both ICTs and traditional communication means. Relatively inexpensive ICTs, such as mobile phones, along with more traditional media like TV, radio and newspapers, are highly effective in the context of the poor and marginalized. Such approaches can be hugely successful if the business model is right, as in the Text4Baby example in the United States, which targets new and expectant mothers, most of whom, with disadvantaged backgrounds, are otherwise hard to reach (Box 1.8.).

Box 1.8. USA: *Text4Baby* SMS support service for new and expectant mothers[33]

Text4Baby provides information to expectant and new mothers about how to take care of themselves and their baby while pregnant and during the baby's first year of its life. The women most at risk often come from a disadvantaged background and thus have limited access to the Internet, but they are likely to have access to a mobile phone, so the programme sends them relevant text messages in either English or Spanish once a week. Results show a very high satisfaction rate with the service. Additionally, users' health knowledge increases, there is improved interaction with health care providers, greater adherence to appointments and immunizations, and increased access to health resources generally. The Text4Baby initiative is a highly successful partnership between the United States government and a number of non-profit and other non-governmental organizations, consisting of more than 700 partners. It is thus a very good example of collaboration between the public and civil sectors deploying simple but highly effective technology tailored to the target group.

Source: https://www.text4baby.org/

There are additional examples of how such widespread and inexpensive ICTs can have significant impacts on health. An African-based for-profit company spun out of a non-profit organization, mPedigree, works with mobile operators and pharmaceutical manufacturers to provide a mobile phone-based drug verification system for addressing the issue of counterfeit drugs in pharmacies at the point-of-sale, in Ghana, Kenya, and Nigeria. The mPedigree service is free to users and allows instant verification of whether a drug is real or counterfeit by sending a unique code via simple SMS. Automated responses in the appropriate language follow. The service relies on various partners across the value chain, both private and public, and it is also simple to rollout to new customers and easy to access for the end-user.[34]

These examples illustrate the many ways in which ICTs can help meet the SDGs. Water and sanitation are vital for basic human health and quality of life and, although those are physical services, ICTs can play a vital role in improving access, service delivery and governance. Water in particular is becoming an increasingly scarce resource as demand rises and pollution and climate change take their toll. ICTs can significantly enhance the identification, extraction and recovery of water supplies by providers as well as its efficient and effective access and use. ICTs can also improve distribution and payment systems for users, especially the poor, through mobile payment services.

In developing countries where access to good quality water is a serious challenge, there are additional examples of ICT use, such as mWater, which is a mobile and web platform for monitoring and regulating 252 water schemes in small towns, such as in Senegal, Mali, Benin and Niger, which typically rely on hand pumps from piped systems operated by private companies. The providers often have poor operational performance with a lack of knowledge about maintenance of the pipes and asset levels, which can lead to high water tariffs and poor coverage. Through ICT use, data is now collected via mobile phones, which enables providers to improve their operations, and the regulators to monitor the programme's performance.

The use of mobile devices assists in finding and exploiting suitable water resources by showing the reality of a situation on the ground. The data collected is used to make decisions aimed at establishing the sustainability and quality of water services. The so-called Water Point Mapping (WPM) in Rwanda and Ethiopia has been very successful through the use of mobile data[35], and the MajiVoice for better water in Nairobi turns citizens into active participants when it comes to their water supply services. The programme allows customers to report complaints, and the water company to provide service updates as well as proof that the complaints have been addressed, by, for example, sending photos from engineers when they repair a leak. The number of reported leaks has doubled since the introduction of MajiVoice, resulting in enhanced service performance through greater accountability. The programme also averts visits to an office, and enables staff to resolve complaints faster, thereby strengthening management and regulation[36].

1.3.2. E-government as a sustainable development platform

Viewing e-government as a platform for resilience and sustainable development arises directly out of the open governance approach. In that context, a platform means an open environment and data ecosystem, with clear standards and guidelines, tools and resources. The aim is to invite all stakeholders to collaborate in producing public value, thereby contributing to society and the common good. In one manifestation, that might be an open source service platform in the Internet cloud providing government services, data and enablers as building blocks for increased efficiency and effectiveness, as promoted by the European E-Government Action Plan.

E-government operating as a platform for sustainable development can generate public value and a range of people-centred benefits. ICT use transforms citizens' lives, communities, civil society groups and businesses from passive consumers of data and knowledge to active producers. For example, citizens are sharing ever more with each other on social media platforms and tend to consult other citizens, rather than the government, for advice. Put another way, they increasingly use the "social signal" and "social search" to organize and improve their lives. Governments thus need to recognize the value of collaboration and crowd-sourcing, which enable citizens and others to contribute as co-creators. Although governments should better mobilize their resources and talent, there is always additional talent to be found outside as well.

The public sector as a platform for ICT use can facilitate sustainable development and can support an ecosystem of stakeholders with changing roles and relationships. There is a need to consider both virtual and physical platforms, as well as their inter-relationships, to support public value co-creation with other actors. Thus, a better understanding is needed of how government - the main designer and provider of public services - can adapt its role to become an enabler, facilitator and orchestrator of that ecosystem, which would increase its public value. Such new roles, aided by appropriate tools and support, including big open and linked data, can create resilient and sustainable societies, built on standards, ethics and inclusion.[37]

There are already numerous examples of ICT use where non-government stakeholders have assumed or supplemented certain government roles. In just a few examples, noise level measurements around Amsterdam Airport were undertaken by residents in the flight path, when the responsible public authority was underperforming;[38] Microsoft's so-called health vault, which stores health records in the cloud, can be accessed by patients when they change health providers, including across borders;[39], and "Fix-My-Street" in the United Kingdom, which was developed by the civil society organization *MySociety*, enables individuals to report broken or failing infrastructure and other local problems.[40] The programme has been adopted by many local authorities and governments around the world.[41] A website, "Patients know best", allows patients to control their own medical data when negotiating

with public health authorities about their treatment.[42] In India, a non-governmental organization has supplanted the role of government in rooting out corruption with its anti-corruption initiative, "I Paid a Bribe".[43] Set up in 2010, it harnesses the collective energy of citizens to tackle corruption in public services across India. The site collects reports on its website about the nature, number, pattern, types, location, frequency and monetary value of actual corrupt acts in specific locations. The information is then used to advocate changes in governance and accountability processes, as well as to confront particular incidences of corruption. That initiative is now in use in several other countries.

Those examples spotlight just a few cases where ordinary citizens, civil organizations, private companies and others have spearheaded the use of ICTs to fill voids left by governments or to remedy governments' underperformance. However, it is important to stress that, whether or not the public sector is directly involved, the government always needs to exercise final responsibility to ensure that such activities are fair and ethical, as well as open and inclusive, and in line with prevailing regulations and laws. Government represents all interests in society, and thus, it has the legitimacy and authority to ensure the widest possible range of public value creation for sustainable development. As the duty bearer for basic services, the government, in the end, is responsible for ensuring minimum service quality, interoperability standards, legal and regulatory frameworks, and elaborating long-term policies for sustainable development. Governments are also responsible for fixing a problem when something goes wrong, even if they were not directly involved in designing and delivering a specific initiative, for it is the main entity tasked with balancing society's often competing interests.

There are numerous instances where government and e-government are the main actors. The Australian Government, for example, created a Digital Transformation Agency, which focuses on enhancing service delivery by acting as a central repository for open government data. The platform adds value to users, intermediaries and society as a whole.[44]

1.3.3. ICT-enabled public institutions

The increasing use of ICTs by institutions has also dramatically impacts public services and their delivery, both via Internet websites and portals, mobile and especially smart phones, social media, and kiosks situated in places accessible to the public. ICT-enabled public service delivery is having a significant impact, as it is much more affordable for an increasing number of users and more cost effective for governments than traditional supply channels. ICT use also enables more targeted, personalized and up-to-date service design and delivery. That gives the service user greater benefits than the sole reliance on traditional service channels, in terms of access, convenience through 24/7 availability, savings in time, and the cost of travel to physical premises such as offices. It also opens up the possibility of new types of public services for achieving the SDGs by 2030.

ICT solutions are also being used internally within institutions to better manage and analyse large amounts of data in more routine and rule-governed processes and transactions, thereby reducing overall transaction costs and increasing efficiency. One example is a collaborative health project in Cambodia to combat malaria, where there is an effective interplay among national control programmes, research institutions, and commercial and civil society organizations, aimed at data sharing and response coordination. The Malaria Information System (MIS) has been set up to process data from village malaria workers and health facilities, and to use open source software for MIS reporting via mobile phones. That also is a tool for district staff to manage such activities as mosquito net distribution and 'drug stock out' system tracking in health centres and clinics, when levels drop below a set threshold. It can also reduce the inappropriate use of antibiotics in human beings and animals and measure its impact on antibiotic resistance.[45]

However, institutions in many developing countries still have not been able to deliver basic services like education, health, water and sanitation, as well as infrastructure and other utilities, to their entire population. ICT use can contribute substantially to closing those gaps, given its extremely low cost, its power of reach, and the rapidity with which it is able to be rolled out. Thus, the aim in all countries must be to ensure access for all, including to basic services. The more developed economies have generally achieved universal access to ICTs, so there, the focus tends to be on more advanced and personalized ICT-enabled services as the next step. However, there are many examples of clever ICT use in developing countries as well.

1.3.4. User-centricity and co-creation of public services

Although context largely defines service design and delivery, ICTs enhance the process by focusing increasingly on user-centricity, with well-defined needs at its core. In a growing number of cases, that principle is complemented by the notion of user-driven and user-personalized services, where the user determines precisely the service sought or required. In turn, that lays the basis for developments in so-called open services and the co-creation of services in cooperation, or even competition, with relevant stakeholders. The design and delivery process, if undertaken in a transparent manner, can further drive innovation. ICT use has already shown its potential and benefits in terms of access, affordability and usability, and flexibility. Service design is related directly to user needs and behaviours rather than to the requirements of government. ICT use has also simplified back-office processes to save resources and offer better services. Additionally, service personalization is enhanced in the front-office to satisfy individual needs. Finally, multi-channel and blended service delivery that uses a channel mix best suited to the individual user is becoming the norm, and flexibility has been enhanced.

Portugal's modernization of public services is a good example (Box 1.9.).

Box 1.9. Portugal: The modernization of public services[46]

The modernization of public services in Portugal since the late 1990s has been driven by a policy focused both on efficiency and cost reduction, on the one hand, and high-quality services and their multi-channel delivery on the other. These policies and strategies emphasize three principles: rolling out citizen-centric services, administrative simplification, and the rationalization of the administration's interoperability, costs and resource use. So-called "citizen shops" are one of the flagships of this policy as an innovative concept of public service delivery that brings together, in the same space, several public and private entities. This involves collaboration between the local public administration and local partners and citizens who best know the needs of a population and the area. There are now more than 150 such physical multi-service centres as part of a national network utilizing ICTs to set up citizen spaces for the provision of digitally delivered services, with in-person assistance if required. This addresses the fact that digital literacy is not at the same level everywhere in the country. Another important policy pillar is the "Simplex" programme, which aims to streamline bureaucracy, modernize public administration, and facilitate interaction between citizens and companies with public administration, at both central and municipal levels.

Source: http://www.gee.gov.pt/

An example of user-centric and co-created service innovations in education is the development of massive open on-line courses (MOOCs) enabling anyone in the world with an Internet connection to access quality educational material and adapt it to their own use (Box 1.10.).

Box 1.10. MOOCs: Massive Open Online Courses -- a global phenomenon[47]

This initiative makes available all types of educational courses and material for unlimited participation, often with free and open access for everyone connected to the Internet anywhere in the world. It also directly addresses the need for lifelong education and learning as well as the "up-skilling" of the labour force. The programme offers a flexible, wide-reaching and inexpensive way of meeting societies' need for education of all types through democratizing access and providing, in principle, no limits on the numbers participating. Although there have been correspondence and open courses before, ICTs provides the means for the massive expansion of this type of education, often through "blended" learning where online channels are combined with offline and face-to-face channels. Like any other use of ICTs for service delivery, there are potential barriers in terms of limited access to high-speed networks, and varying degrees of digital literacy. Such challenges need to be addressed to ensure the quality of the course material and uphold certification and accreditation standards so the education obtained is recognized by employers and society at large. An example of a non-profit MOOC platform is edX (www.edx.org). It hosts online university-level courses in a wide range of disciplines, including some at no charge, to a worldwide student body. It also conducts research on how to use its platform. The Massachusetts Institute of Technology and Harvard University created edX in May 2012. More than 70 schools, non-profit organizations, and corporations offer or plan to offer courses on the edX website. As of 29 December 2016, edX had some10 million students taking more than 1,270 courses online.

Source: http://www.wikipedia.org/

Other trends in the area of user-centricity include the bundling of related services around the life events and experiences of users. That is a departure from service delivery, determined by the physical infrastructures and organization of government, towards more people-friendly service geared to the needs of real people in their everyday lives. The Singapore eCitizen portal was the first in the world, in 2002 to bundle service offerings around user life events for easy navigation and user-centricity. It further developed that approach in 2018 into an integrated citizen experience and one-stop-shop[48]. Another leading trend is incorporating user behavioural approaches and design thinking into creating, delivering and using services, as exemplified by initiatives in both Singapore and the United Kingdom.

It is important to recognize that users are already dramatically changing their behaviour when it comes to accessing and using e-services of any kind. The evolutionary approach to making e-government services available has been, first, abandoning the "many stops" approach and moving to the one-stop shop. However, complexity still dominates the navigation for many one-stop shop portals, hampering a user-friendly approach. However, recent experience like that in the United Kingdom shows that, rather than using sophisticated navigation, some users are increasingly deploying advanced search tools, such as autocomplete and predictive searches to attain access to the service they want in one or two clicks. In other words, users are finding and accessing services - whether commercial, personal or public by advanced online search, rather than expensive navigation portals.

In the United Kingdom, for example, the previous navigation portal, DirectGov, was replaced by Gov.uk, because, in practice, users just typed what they wanted to do into a good search engine. A group of non-government hackers had set up a rival unofficial site with such a search engine, which was being used much more widely than the official portal. The government wisely recognized this behavioral change and co-opted the group, co-creating the world's first e-government portal publicly launched in both alpha and then beta versions, rather than relying only on IT experts and a few user tests. User tests were conducted, however, to find the search terms that people actually used when searching for helpful government offerings [49].

1.4 Challenges, risks and vulnerabilities

Despite the successes and opportunities arising from the public sector's use of ICTs in furthering the goals of resilient and sustainable societies, there are many challenges and risks that can undermine the role of e-government in supporting the SDGs. Those include environmental stresses and disasters, socio-economic and governance risks, as well as those related to technologies themselves. Disturbances to political, economic and social systems are becoming more common, and often shift attention and resources away from the processes by which a society produces public, private and social goods and services. Delivery of public services is also disturbed, exposing millions to insecurity, loss of opportunity, and poverty. In the reverberation of those disturbances and stresses, public services may break down altogether, especially for the poor and vulnerable, women, children and elderly. Weakened state capacity is often reflected in a loss of control over basic public services, especially where resilience measures are lacking. Inadequate governance institutions often contribute to inconsistent or non-existent provision of education, health, and clean water. Damage to basic services may even become permanent. Risk drivers such as badly planned and managed urbanization, environmental degradation and poverty often exacerbate vulnerability with adverse impacts on progress towards implementation of the 2030 Agenda.

Governments need to understand the critical risks arising both from shocks and disasters and the vulnerability of e-government systems and consider ways to mitigate them. The manifold risks are often deeply interlinked and become more intractable in the face of so-called "wicked" problems. Those include planetary environmental risks related to climate change, extreme weather events, water crises, bio-diversity and habitat reduction, to name a few. Such stresses threaten rural and urban development, health, and economic sectors, such as agriculture and fishing, which often provide the livelihoods for poor and marginalized populations. Those problems have social and economic consequences, which governments, in partnership with non-governmental actors, must address in order to prevent erosion of social cohesion and economic prosperity. Otherwise, a vicious cycle may result of under- and unemployment, which increases income and wealth inequality and foments demographic pressures like ageing and migration, economic downturns, terrorism and conflict, and failing States. Those threats naturally strain public services[50], and combined, can derail progress towards realizing Agenda 2030. Strengthening resilience to avoid, mitigate and cope with such threats is critical, and requires the adoption of measures, including emergency plans, for tackling both natural and person-made disasters.

1.4.1. The need for adequate strategies and response systems

Good planning, mitigation systems and policies, therefore, are vital in anticipating and coping with the burgeoning stresses and threats arising from today's increasingly fractured world.[51]

Basic data, about both the population and the physical features of areas prone to disasters is essential to implementing successful strategies and response systems. ICTs, in particular mobile phones, can provide instant data from virtually any location. It is crucial to be able to collect, analyse and visualize data during and after a disaster, such as through real time spatial applications. The ability to seamlessly integrate and distribute digital data into spatially explicit forms for rapid assessment and other analyses can be enormously helpful in saving lives and mitigating long-term impacts. Governments, citizens, and businesses are increasingly using mobile technology in natural disaster preparedness and public safety responses. Real-time mobile phone data can also provide valuable insights about the behaviour of affected populations and enable both victims and rescuers to send real-time reports. By examining mobile phone activity data before, during and after a disaster, a baseline understanding of emergency behaviour and capacity to measure the rate of disaster recovery can be established.[52]

1.4.2. Technological misuse, distortion and risks

At the same time, specific threats have arisen from the way technology, especially ICTs, is developing and being used by governments and society. As digital technology companies advance, power may be concentrated in ways that current legal and regulatory frameworks are unable to address. Governments and regulators often struggle to understand the pace of change, let alone formulate relevant policies, prompting the question of what technology companies are accountable for and to whom. Such questions raise concern in various regions of the world. In relation to security, privacy and control, the rise of digital connectivity is leading to increased cyber-security concerns, for example with the hacking of critical infrastructures, including those that control power supplies and transportation networks. It is becoming increasingly important to consider the security, ownership and usage of the massive amount of personal data which is created and shared, as well as to protect the identities of both individuals and organizations.

New technology can also be misused by governments and private companies. According to the freedom on the net report[53], Internet freedom has declined for the sixth consecutive year, with more governments than ever targeting social media and communication apps as a means of halting the rapid dissemination of information, particularly during anti-government protests. Online activism has reached new heights, and the number of countries where arrests for online posts have occurred has increased by more than 50 per cent since 2013. Since June 2015, police in 38 countries have arrested individuals for their activities on social media. Social media users face unprecedented penalties, as governments censor more diverse content and install security measures that threaten free speech and privacy. There is also the rise of the so-called post-truth society, fake and fact-free news, which can thwart political discourse. Although those are not new phenomena, their significance has reached vastly new heights. Social media have played a significant role in that trend, and currently, Facebook, Twitter, Google, and others are working together to see whether they can develop algorithms to filter out false news, hate speech, and terrorist propaganda. At the same time, repeated and often large-scale leaks and hacks of user-data collected by technology companies jeopardize the trust, social cohesion and governance processes in different parts of the world. Ensuring anonymity and privacy of voter decisions during the elections is a responsibility of government authorities, and Information technology may play a role in different phases in the voting process, thus, having an impact on voter privacy. Secret balloting in many countries is aimed at preventing vote buying and coercion.

For information technology to be used for casting votes, privacy becomes not only a right but also a duty, thus e-democracy initiatives shall change the way privacy is viewed in the political process[54]. Information technology developments shall guarantee the voter right to fulfil this duty while providing a possibility for the authorities to verify the process. Recent cases of user-data transfers to and hacks by Cambridge Analytica, a political data firm hired to provide services during the 2016 presidential campaign in the United States, raised concerns about targeted political messaging on social media to influence voter preferences.

These issues are of fundamental importance for sustainable development. International organizations have a major role to play in reinstating facts and evidence, and expertise in policy debates, while ensuring they get the balance right by also leaving those debates open to legitimate scrutiny and transparency.

1.4.3. The complex roles of technology in society

It is also true that technology can no longer be considered simply as a straightforward tool, for it plays a complex role, as today's general-purpose technology affects all aspects of societal

development. Although the advance of technology has created enormous new opportunities across a range of sectors, the speed and impact of these changes have made it very difficult for society and governments to keep up and respond appropriately.

In many ways, technology is not neutral because its impacts are determined by how it is used. Social media has indeed had huge positive impacts on the lives of many, bringing people together globally, and extending an individual's horizons beyond local and even national borders. It keeps families in different parts of the world connected, and it enables communities, campaigns and democratic movements to form. It also makes governments and big business more transparent. At the same time, misuse of social media has mushroomed, from trolling and bullying the vulnerable online or allowing paedophiles to share child pornography, to the so-called "dark web" where illegal and dangerous anti-social transactions take place. The democratic and mind-broadening potential of the web has also come under scrutiny as more and more people access only the material they choose to follow. They increasingly ignore other content, leading to so-called filter-bubbles. The more they use the search engines, the more those engines adapt, through sophisticated algorithms, to feeding users what they like.[55] When people go online, they leave digital traces or footprints, which are scooped up by the tech companies and sold to advertisers who use their intimate knowledge of a user's personal life to target their advertising. The users are thus digital products to be sold to the highest bidder, in a bizarre reversal of traditional economic relationships.

Neither is the so-called neutrality of technology straightforward. There are numerous examples where technological advances are driven by social needs, such as the Linux free open-source operating system for computers and the M-PESA mobile phone money transfer app in Kenya, which allows poor people with no bank account to make secure commercial and family transactions over long distances. However, it is also clear that most technological advances are market-driven, arising out of companies' desires, first and foremost, to increase their profits. Proportionate regulation is therefore required, but there must be caution that it does not hamper increasing prosperity and realization of the SDGs.

There are also examples where new ICTs are being designed to extract market value from individuals and communities rather than increase it. Recent e-learning initiatives in Africa, connecting globally via new ICT infrastructure, can sometimes become overwhelmed by international content and social media. That risks crowding out local content and languages, which help develop local communities, cultures, companies and entrepreneurship. In turn, that can cause local income to leave the locality and even the country, draining rather than supplementing indigenous development. Also, with scant international investment in local content and language, the local context is increasingly neither supported nor even recognized as legitimate[56].

1.5 Conclusions

This chapter has demonstrated the multifarious and complex opportunities for deploying e-government to build resilient societies and play a major role in sustainable development. It has also described many of the risks, challenges and vulnerabilities governments face in ensuring their e-government systems are able to fulfil that potential. Basic services like education, health, water and sanitation, as well as infrastructure and other utilities, are essential to sustaining e- development and improving quality of life and prosperity. To ensure resilience and sustainability, those services need to be delivered universally in order to not leave anyone behind, a crucial pillar of sustainable development. New technologies and ICTs are essential to that quest, both through widening access and providing significant benefits to service users while at the same time reducing provider costs.

The transformational and facilitating power of ICTs is creating a paradigm shift in the public sector, driven by three trends. The first is the need to address ever increasing and complex societal challenges, while promoting resilience and sustainable development. The second is acceptance that, although the public sector is normally the biggest and most powerful actor, it does not have a monopoly on resources or the ability to innovate. Governments need to retain overall responsibility for quality, standards, and ethics, and ensure that no one is left behind. The third trend concerns the increased capacities of other State actors as well as civil society and the commercial sector, to participate alongside the public sector in addressing societal challenges. ICTs have not only given rise to those overlapping trends, but have shown their increasing potential to deliver when it comes to building sustainable and resilient societies, with the right preconditions and an enabling environment.

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E-government for leaving no one behind

2.1. Introduction

Addressing the needs of the poorest and vulnerable groups is one of the building blocks of resilient and sustainable societies. Given today's complexities – from humanitarian crises and migration patterns to the challenges of the urban and rural poor – technologies offer an opportunity to leave no one behind by extending the reach and access of information and services to those who need them the most.

At the 72nd Session of the United Nations General Assembly, a new agenda item on the impact of rapid technological change on the achievement of the Sustainable Development Goals (SDGs) underscored in a resolution the persistent and growing digital divides in science and technology among and within developed and developing countries. The text also addresses the issues of ensuring an inclusive and gender-sensitive approach and promoting the empowerment of women and girls[1]. It is widely agreed by countries that inclusiveness speaks to the notion of empowerment and the principle of non-discrimination and is reflected in the pledge to leave no one behind.[2] There is similarly a broad accord in the Addis Ababa Action Agreement[3] on the need to create a transformative framework that contains concrete deliverables, and to craft a cohesive strategy ensuring parity in data access and use across regions. World leaders agree that strengthening cooperation in technology, infrastructure and social protections to drive prosperity is key to realizing inclusive and sustainable development.

Social and digital exclusion are interlinked as research has shown that differing access to technology contributes to socio-economic stratification or inclusion.[4] It is therefore imperative that e-government is recognized as an incentive to bring more people online. E-government enables people with access to take advantage of digital government information and services and stimulates greater social inclusion through the use, for example, of online and mobile financial services. The *2014 United Nations E-Government* noted that digital divides are "inextricably linked to a lack of social equity in today's information world." In an increasingly digital world, electronic inclusion, or e-inclusion, is fundamental to leaving no one behind.[5] The rapid development of E-Government has created new imperatives for policy-makers to bridge social gaps through greater e-inclusion in terms of access and usage.

Digital divides[6] are no longer considered to be only a lack of access to ICT infrastructure. Neither are they necessarily a division between high- and low-income countries. Given the progress of e-government, digital divides exist in all countries, and they must be bridged to enable

Photo credit: pixabay.com

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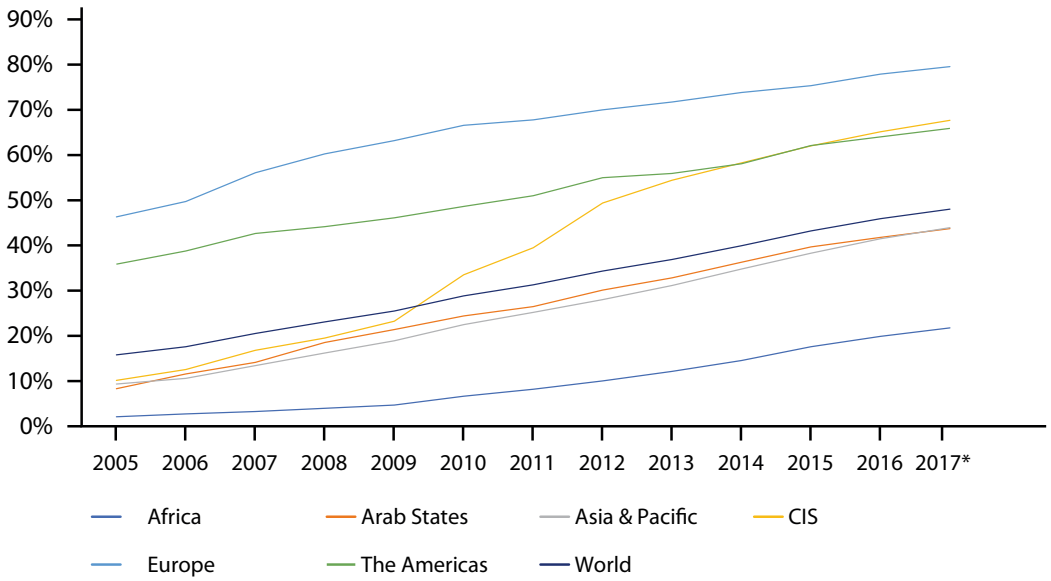
everyone to take full advantage of what the digital society is offering. A lack of e-inclusion could put vulnerable populations at risk of falling further behind. Many of the 67 principles adopted at the 2003 United Nations World Summit on the Information Society directly acknowledge that point, including principle 10, which states:[7]

> "We are also fully aware that the benefits of the information technology revolution are today unevenly distributed between the developed and developing countries and within societies. We are fully committed to turning this digital divide into a digital opportunity for all, particularly for those who risk being left behind and being further marginalized."

Global efforts to bridge access to the Internet are improving. Almost one-half, or 48 per cent of the world's population, is estimated to have used the Internet in 2017.[8] At the same time, there are large regional differences. In Europe, almost 80 per cent of the population used the Internet. The Commonwealth of Independent States (68 per cent) and the Americas (66 per cent) followed as the only regions where more people use the Internet than do not. In Africa, only 22 per cent were estimated to use the Internet in 2017, leaving the continent lagging all other regions.

Figure 2.1. Individuals using the Internet

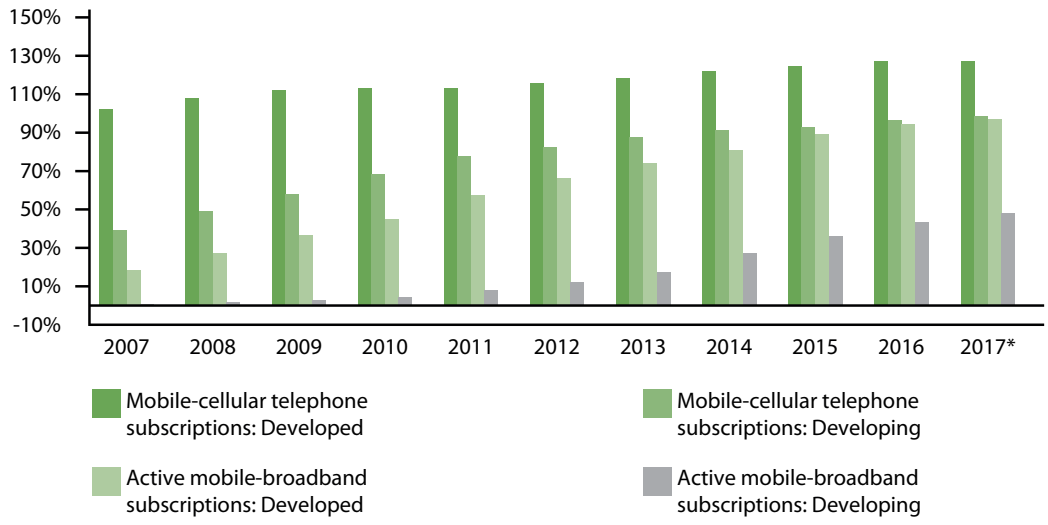


Source: ITU

Mobile devices are proving to be helpful in bridging the access divide. Fixed- and mobile-broadband prices are falling, making ICTs more accessible and affordable. In 2017, mobile-cellular telephone subscriptions were estimated at 103.5 per 100 inhabitants, of which 56.4 had an active mobile-broadband subscription providing Internet connectivity (*see figure 2.2*). There remain, however, large discrepancies between developed and developing countries. In the former, mobile-cellular subscriptions are approaching 127.3 per 100 inhabitants (as one person can have more than one subscription) while the number for developing countries is 98.7.

The rapidly increasing use of mobile devices around the world elevates the potential for mobile government (mgovernment) services as a subset of e-government. Mobile services and smart phones allow governments to better reach the poorest and most vulnerable. As a result, 74 countries have

Figure 2.2. Mobile subscriptions in developed and developing countries



Source: ITU

dedicated mobile apps to deliver online services.[9] Moreover, 83 countries indicated that they are providing some form of mobile service through short message service (SMS), mobile apps or the equivalent.

Despite this progress, most of the world's population remains offline. This increases the risk that vulnerable groups without Internet access will fall further behind in an increasingly digital society. While those online are benefiting from ever improving e-government services such as e-health and eeducation, those without access are being excluded from such opportunities. Bridging digital divides, therefore, is important for ensuring that no one is left behind in taking advantage of socio-economic opportunities. An additional benefit of greater e-inclusion is cost savings for governments themselves as people move from offline to online channels. The UK Government Digital Efficiency Report found that digital transactions were 50 times cheaper than face-to-face ones[10] (*see figure 3*). Such cost-savings could enable additional investment in bringing people online in the first instance or provide technology solutions in other areas of e-government.

Figure 2.3. Channel vs relative cost unit

Channel	Relative cost unit
Digital	1
Telephone	20
Post	30
Face to Face	50

Source: UK Government Digital Efficiency Report

However, the adoption by governments of emerging technologies such as artificial intelligence (AI), blockchain, cloud computing, big data and analytics, may inadvertently create new divides. This heightens the need for governments to create appropriate policies and regulations to stimulate adoption of emerging technologies among civil society and the private sector which would improve inclusion without widening existing divides. In addressing the pledge to leave no one behind,

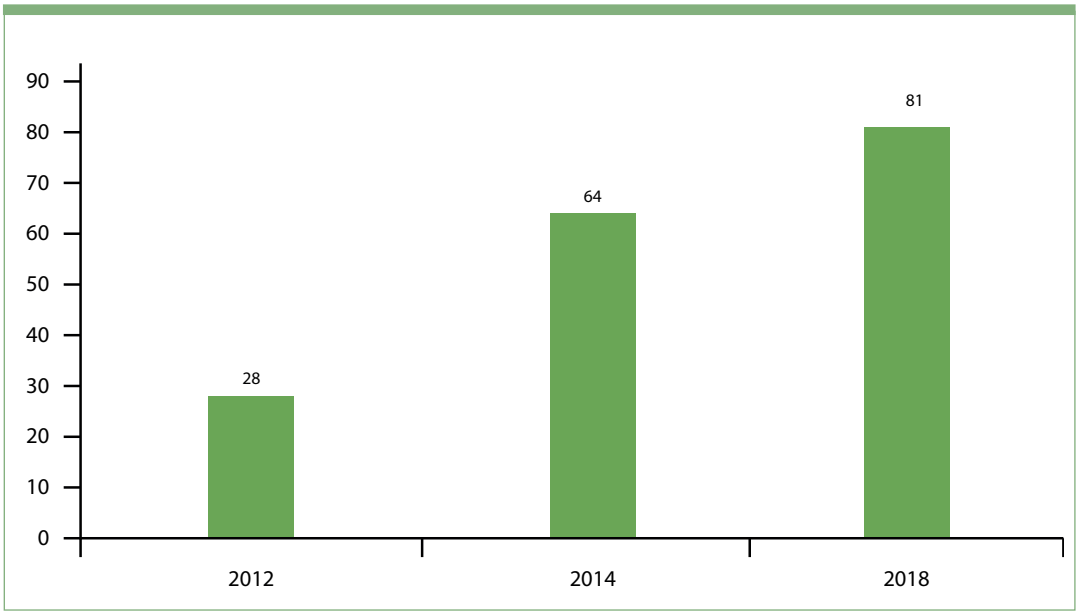
e-government is clearly at the centre of the 17 Goals and 169 targets of the 2030 Agenda for Sustainable Development.[11]

This chapter focuses on digital divide barriers to e-service delivery at the national level, including among persons with disabilities, older persons, women, youth and other vulnerable groups, and seeks to enhance understanding of the opportunities available to bridge the gaps. The 2018 Survey questionnaire includes a set of questions assessing the digital divide in e-government development (*see Survey Methodology*). All data used in this chapter come from that questionnaire, unless otherwise stated. This chapter also provides an overview of various digital divides with the aim of identifying the obstacles to greater digital adoption. Finally, it illustrates how e-government can be used to improve digital inclusion to benefit all citizens.

2.2 E-service delivery

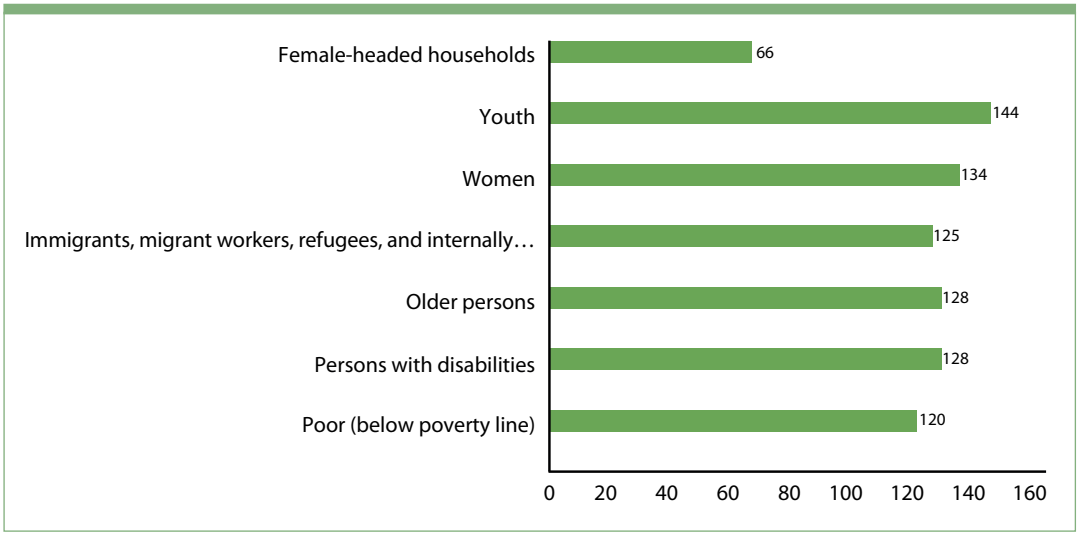
There has been notable progress recently in e-services aimed at disadvantaged and vulnerable groups. According to the Survey, the number of country websites with information about specific programmes and initiatives to benefit women, children, youth, persons with disabilities, older persons, indigenous peoples, people living in poverty, or other vulnerable groups and communities, has been increasing steadily since 2012. According to the United Nations Member State Questionnaire, 80 countries out of 100 indicated that they provide specific measures to ensure egovernment use by the most vulnerable segments of their population in 2018, up from less than 30 per cent in 2012. To track progress, 64 of those respondents said they collect usage statistics in this area.

Figure 2.4. Number of country websites with information about specific programs/ initiative to benefit vulnerable groups and communities



Great emphasis is being placed on m-government services in delivering remote education, health and other social services, which impact positively on people's everyday lives. This is particularly true for those in rural areas who have been previously at a disadvantage compared to their urban counterparts. Notably, m-government provides the same opportunity in interacting with public authorities and possibly limiting corruption in the process.

Figure 2.5. Number of countries with specific online government services available to vulnerable groups



Box 2.1. Mexico: Automated SMS communication nudges users towards healthy habits

Despite the Government's commitment to maternal and child health, Mexico has continued to lag in maternal mortality, under-five mortality and childhood stunting. To improve its reach to its citizens to influence their health decisions, the Government created the Prospera Programme, the second largest conditional cash transfer programme in the world, which provides cash to approximately 7 million families with a per capita monthly income below the minimum welfare line (USD $55 for rural areas and USD$ 85 for urban areas).[12]

The Government partnered with the United Nations Children's Fund (UNICEF) Mexico to launch Prospera Digital, a pilot randomized controlled trial (RCT), based on behavioural science principles that tested targeted messages using an open source communications platform. The service simulates conversation by sending automated Short Message Service messages; it analyses responses and replies accordingly. Each message addresses the specific needs of the end user and improves the Government's ability to respond effectively. The programme is designed to help women through pregnancy and during the first two years of their babies' lives.[13]

The pilot was launched in December 2015, and it has since been used by more than 5,000 women. Evidence suggests that Prospera Digital is having the desired impacts on promoting overall maternal and childhood health. The programme is increasingly perceived as a "trusted partner", with response rates during pregnancy at above 60 per cent.[14] By the end of 2018, the Government is planning to launch a national version of the programme that will include modules to educate and promote healthier behaviour around other health issues such as diabetes, hypertension and obesity.

Source: https://www.gob.mx/prospera

Emerging technologies are also enabling governments to improve e-service delivery and to adapt to shifting needs. Drones, for example, are being used to deliver services to remote areas at a lower cost and faster pace. In Africa, that potential is being applied across a wide range of areas, from agriculture to health care.[15] (*see Box 2.2. on the use of drones to improve health care in Rwanda*).

Artificial intelligence (AI) is also improving the efficiency of service delivery to marginalized groups. In the Middle East, the United Arab Emirates is on a path to make the country a leader in AI. In October 2017, the country created a strategy for AI and appointed the world's first Minister of State for AI. Civil society is also increasingly looking to emerging technologies to provide greater assistance to the public.[16]

Box 2.2. Rwanda: Drones to improve health care

In 2016, the Rwandan government signed a partnership with Zipline, an American drone company, to cut delivery time of medical products to remote areas.[17] Whenever a hospital needs blood, they simply send a WhatsApp message or place an order online, after which they receive a confirmation that delivery is coming. When the drone is within a minute of its destination, an SMS message is sent informing the doctor that the drone will soon dispatch the package through a parachute.

Previously, it took about four hours to deliver life-saving services such as blood to rural hospitals. But with a drone, deliveries are now being completed in less than 45 minutes, and in some cases, in as little as 15 minutes. The partnership between Rwanda's Ministry of Health and Zipline has delivered more than 5,500 units of blood, and once the programme is established nationwide, it is expected that the costs will be comparable to current deliveries made through land vehicles but with a much quicker response time.[18]

This is not the first time an East African country is spearheading emerging technology solutions aimed at greater inclusion. In 2007, Safaricom, a Kenya-based telecommunications company, launched the often-cited mobile phone-based money transfer service, M-Pesa, which has since spread around the region and the world. That success is now being replicated with drones. In early 2018, the Tanzanian government looked to replicate the efforts in Rwanda.[19] It is now setting to open four drone distribution centres with Zipline, which will provide more than 100 drones and 2,000 flights a day.

Source: https://www.moh.gov.rw

2.2.1. Digital identities

Today an estimated 1.1 billion people worldwide—mostly people living in poverty, migrants, refugees, those in rural communities and other disadvantaged groups—have no legal identity.[20] Sustainable Development Goal 16, specifically Target 16.9, seeks to remedy that by 2030. Providing legal identities to these vulnerable group can help by expanding financial inclusion and preventing fraud and corruption in the delivery of social services (*see Box 2.3. on digital financial inclusion initiatives in Bangladesh*). Digital identities have been offered as a means to expedite the process effectively.[21]

In 2014, the Peruvian National Registry of Identification and Civil Status (Registro Nacional de Identificación y Estado Civil (Reniec)) established the national electronic identity document (DNIe). The DNIe integrates two digital certificates, one of which enables the cardholder to sign electronic documents with the same validity as hand-written signatures. The electronic ID provides access to all public digital services, for example, electronic voting or processing certified copies of official acts with full legal value.[22] The identification system has been recognized as one of the best in Latin America.[23]

In India, the Aadhaar program is providing digital identity to the entire population and is serving as the basis for interacting with the Government at various levels. Aadhaar captures a biometric profile consisting of an iris scan, finger prints and a photograph. Most Indian States have now enrolled more than 80 per cent of their residents.[24]

The opportunities to create digital identities are further enabled by high mobile penetration rates. Most mobile operators are now mandated to verify the identification of users when they register a mobile SIM (subscriber identification module) card and now have "know-your-customer" (KYC) obligations for mobile financial services. This provides a unique opportunity for governments to increase digital identity registrations and improve socio-economic outcomes. For instance, mobile operators are now involved in birth registration systems in the United Republic of Tanzania, Uganda, Ghana Senegal and other countries.[25]

Box 2.3. Bangladesh: Digital financial inclusion initiatives

The rural poor in Bangladesh are still facing many barriers when trying to access the formal financial system. Financial inclusion programmes focused on branch-based banking have failed because rural villagers deal mostly in cash, and the transaction expenses are prohibitively expensive. In response to the difficulty of building bank branch networks, the Central Bank began promoting inclusive digital financial programs in 2015.[26]

Digital Financial Services (DFS) Lab+ is a joint initiative between the Central Bank and Access to Information (a2i), a digital inclusion programme under the Office of the Prime Minister. DFS studied the Unique Identification Authority of India (UIDAI), which enrolled over 1 billion people in five years using biometric information such as fingerprints and iris scans.[27] DFS research showed that beneficiaries in Bangladesh could save as much as 58 per cent in time, 32 per cent in cost and 80 per cent in the number of visits if government safety net payments were digitized.[28]

The Digital Financial System is collaborating with the private sector and civil society in offering agent banking and mobile financial services in more than 1,900 Digital Centres across the country.[29] The Digital Centres are one-stop shops, mainly in rural areas, which provide access to Internet, e-government services and ICT training. DFS aims to increase payment digitalisation, assisted e-commerce, account usage and financial literacy among poor farmers in rural villages, especially in the remote pockets of Bangladesh.[30]

Source: http://a2i.pmo.gov.bd/digital-financial-services/

At the same time, such opportunities highlight the challenges that a lack of e-inclusion can bring to those who remain offline. As more people gain digital identities and are able to take advantage of socio-economic opportunities, those who do not have one risk falling even further behind.

2.2.2. E-participation

The concept of leaving no one behind extends to inclusive digital participation. The use of online tools can enhance access to information and public services, as well as promote better public policy decision-making (*see chapter 5 for further details*). E-participation can serve as a catalyst for citizen engagement and in achieving the objectives of the 2030 Agenda.

The Crystal Urn initiative in Colombia (Urna de Cristal) was created by the Colombian government to increase citizen participation and government transparency.[31] The programme allows citizens to ask questions, access information, and participate in policy consultation exercises. Citizens can access the Crystal Urn website or use social media. Those without access to the Internet can also participate through radio, call-centres and SMS. For example, in December 2017, the National Planning Department conducted a consultation about food supplements in schools via SMS, sending approximately 315,000 messages and receiving nearly 31,000 responses.[32] In 2017, the programme received an honourable mention by the Ministry of Public Functions for the national senior management award (Premio Nacional de Alta Gerencia).

The opportunity to gain access to more information and participate in online engagement with their government can also serve as a stimulus to bring more people online for public engagement. For example, if vulnerable populations feel that their voice is heard through e-participation, they might be more likely to go online, and more frequently. This in turn could increase utilization of other e-government services, as users, once online, may discover the benefits of other online public-sector services. Simultaneously, those who remain offline or do not have the skills to use e-participation may feel even more excluded from public discourse, yet another reason to tackle multiple digital divides.

2.3 Digital divides

The "digital divide" was once considered to be a lack of access to the Internet and hardware, such as computers, phone, and mobile devices. But access has improved through technological progress and affordability, such as access to mobile phones. However, new digital divides have emerged, such as the speed and quality of those devices, and in digital literacy or the know-how to use them. Hence, the debate has moved from "a" digital divide to "multiple" digital divides," which are not only a global challenge but also local contextualized problems in terms of availability of content, bandwidth, and skills, among other issues. The WSIS+10 General Assembly resolution recognized this distinction.[33] Table 2.1 shows a selection of digital divides.

Table 2.1. A selection of digital divides – from access to useful usage[34]

Divide	Description
Access	It starts with access or the lack thereof: although Internet penetration has increased, it continues to be a key barrier as more people globally remain offline rather than online
Affordability	The gap between rich and poor affects affordability of ICTs and serves as an important difference in adoption within countries as much as between them
Age	Older people are generally using ICTs to a lesser extent than younger populations, despite the notion that they could benefit from online social and health services
Bandwidth	International bandwidth and the capacity to transmit and receive information over networks varies greatly between countries but also within them, limiting potential useful endeavours
Content	Relevant content in local language(s) is important to stimulate adoption
Disability	Those with disabilities face additional hurdles to use ICTs if websites are not compliant with web accessibility guidelines
Education	Like social divides, education and literacy rates are fundamental challenges to bridge digital divides
Gender	There is a small but persistent difference in online usage between men and women
Migration	Migrants may not possess the same levels of digital skills as the population in their new country and if they do, may be subject to content and language divides
Location	Rural and remote areas are often at a disadvantage in terms of speed and quality of services as compared to their urban counterparts
Mobile	Mobile devices provide opportunities to bridge the access gap but can also introduce new forms of divides in terms of technology, speed and usage
Speed	The gap between basic and broadband access is creating a new divide as speed is important to reap the full benefits of a digital society
Useful usage	What people do with their access is a key difference in whether users take full advantage of ICTs, such as e-government services

Note: The above table is intended to be illustrative and not exhaustive

Strategies tackling digital divides implicitly mean greater dependency on ICTs generally and with respect to e-government specifically. Such dependency may have unintended consequences and create new digital divides. A combination of gross national income (GNI) per capita as a proxy for socio-economic opportunities, and Internet usage as a reflection of the digital society, highlight the degree of digital dependency. Such a matrix of GNI and Internet usage can help countries identify emerging

digital divide challenges by looking at countries ahead of them in the digital development.[35,36,37] For example, countries with low GNI and low Internet usage often face an infrastructure challenge whereas Member States with high numbers often struggle with bringing the last proportion of the population online to avoid leaving those people further behind.

There have been numerous attempts to measure various aspects of digital divides considering the importance of e-inclusion. Research shows that lower-income families, those with less education, persons with disabilities, minorities, and rural residents generally lag behind in both broadband adoption and computer usage.[38] Recognizing the multitude of digital divides today, the need for "useful usage," a term coined to describe the difference between access and what people do with it, surfaces as a key difference-maker in terms of whether people can take advantage of e-government services, which also requires investment in developing digital skills.[39]

Collection of data and statistics related to all digital divides should therefore be enhanced, especially given technology progress. Currently, countries mainly track information on traditional yardsticks of digital divides such as access to technologies rather than delving into the underpinning factors that prevent usage of available e-government services, such as lack of local content or web accessibility conformance. Governments indeed face a tall order in bridging numerous digital divides depending on where they find themselves in their digital development: from upgrading basic infrastructure and promoting the benefits to all - including women - to addressing new challenges, such as web accessibility and digital first.

2.3.1. Infrastructure divides

To reap the full benefits of e-government moving forward, high-speed broadband access and greater bandwidth are necessary components. Although both fixed- and mobile-broadband subscriptions have increased significantly around the world, the proportion of people who do not have access continues to far outnumber those who do.[40] Lack of access remains a particular problem in low-income countries where in 2016, only 12 out of every 100 people were Internet users, according to the latest data available.[41] The middle-income countries rated higher in terms of having more Internet users - about 42 people per 100 - although a majority of their populations remains offline.

Mobile connectivity was once considered a unique opportunity to bridge access divides, but countries are increasingly realizing the importance of fixed-line infrastructure to enhance e-inclusion and equal opportunity for all. This is made even clearer with the introduction of 5G mobile networks which require fibre networks. Governments around the world are formulating a wide variety of plans to bridge the connectivity divide. Countries with a clear broadband strategy are also credited with a higher penetration rate than those without a plan.[42] There are, however, big differences in funding capacities and national approaches.

Contrary to notions of leapfrogging into mobile-only solutions, emerging markets are also investing in fixed-line broadband networks. In India, for example, the government created the National Optical Fiber Network in 2011 to connect all 250,000 villages (Gram Panchayats) with fixed-line broadband.[43] European countries, such as France, are focusing government investment almost entirely on rural areas, in part due to European Union funding guidelines preventing support for urban areas where private sector operators are investing. In Australia, the Government is building and funding a national broadband network combining fixed, mobile, and satellite connectivity.[44]

The quality and speed of mobile connections must also increase to reap the full benefits of connectivity. The rapid rise of mobile adoption in emerging markets is proving helpful in bridging the connectivity divide. However, network quality and speed remain a challenge if economies want to reap the benefits offered by transferring greater amounts of data over mobile networks. The population covered by a 3G network—considered the minimum speed required for "smart" data functions—remains at 85 per cent globally.[45] However, next-generation networks, such as 4G mobile-broadband subscriptions, are lagging behind.

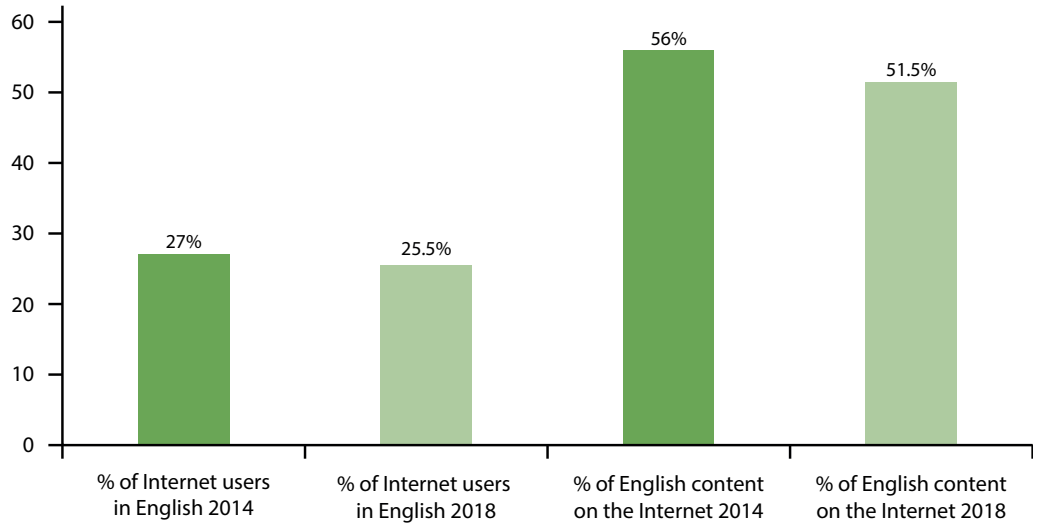
2.3.2. A perceived lack of benefits

Lack of Internet connectivity and usage can also stem from a lack of perceived value. In the United States, according to a 2013 report from National Telecommunications and Information Administration, about one-half of those who do not use the Internet say they are just not interested.[46] More recent research from Brazil similarly reveals that 7 in 10 people show a lack of interest or skills to go online.[47]

Those findings highlight the need for local services to meet local needs. For example, rural Chinese farmers can purchase new agricultural products, but there may be a lack of information in the local language on how to use them.[48] Similarly, in India, a country with 26 languages, finding content in the local language is a big challenge.[49] The trend of declining proportions in English-speaking users and content is not absolute but rather reflect the rise in online usage among non-English speaking countries (*see Figure 2.6*). Despite progress, providing local, relevant and useful content, in addition to raising awareness about it, requires significant effort.

While the mechanisms for providing e-government services to vulnerable groups vary, providing e-services through partnerships tend to reach more vulnerable groups more effectively. Multi-stakeholder partnerships with the private sector and non-governmental organizations are helping governments find innovative solutions to addressing traditional problems related to poverty and social exclusion. They can expand access to e-government and help develop dedicated services targeted at vulnerable groups.

Figure 2.6. English language dominance



Source: https://w3techs.com/technologies/overview/content_language/all; https://www.internetworldstats.com/stats7.htm

Successful examples of local content are often linked to economic incentives. In the South Indian province of Kerala, fishermen are using their mobile phones to get price information on what different markets would pay for their catch. This demonstrates the clear benefits of mobile usage, as the fishermen's profits improved by 8 per cent.[50]

2.3.3. A gender divide

Cultural or social acceptance of Internet use, particularly for women, is another aspect of the connectivity divide. ITU research finds that a woman in the developing world is 21 per cent less likely to own a mobile phone.[51] In 2013, the Broadband Commission for Digital Development established a target calling for gender equality in access to broadband by 2020.[52] In 2017, about 51 per cent of men globally were online compared to about 45 per cent of women.[53] One reason may be a lack of supply-side content targeting women (*see Box 2.4. on case study on Asia-Pacific*). For example, according to Oncology Services International, about one-third of Member States, or roughly 74 countries, do not provide information about reproductive health-care services.

Box 2.4. Asia-Pacific: E-government for women toolkit

Research shows that globally there are fewer women than men online.[54] That gender divide raises concerns regarding e-inclusion generally and the opportunity to take advantage of e-government specifically. In response, several global organizations, such as the International Telecommunication Union (ITU), have embarked on promoting greater Internet access for women, including awareness-raising events such as Girls in ICT Day.[55]

In this context, the United Nations Department of Economic and Social Affairs (UN DESA), Division for Public Institutions and Digital Government (DPIDG) through its Project Office on Governance (UNPOG), and the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) jointly launched the EGov4Women Toolkit (https://egov4women.unescapsdd.org/toolkit) in early 2018. The toolkit is a set of five training modules that promotes e-government that bridges gender divide and aims for social inclusion. This online platform is an innovative public resource related to the design and implementation of gender-responsive E-Government institutional ecosystems in the Asia-Pacific region. The toolkit represents the first region-wide toolbox to support the gender-mainstreaming of E-Government. Through a set of 5 comprehensive modules, it provides key pointers for policymakers on gender-responsive design of e-service delivery, e-participation and connectivity initiatives, and introduces a capabilities-based approach to outcome evaluation of E-Government for women's empowerment.[56]

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Source: https://egov4women.unescapsdd.org/toolkit

Another reason cited for lower Internet use among women may be the lack of content geared towards them. According to the Online Service Index, approximately one-third of United Nations Member States do not provide information about reproductive health-care services, for example.

Efforts to promote female inclusion from a demand-side perspective are under way. In South Africa, for example, Lwazi, an initiative of the Department of Telecommunications and Postal Services, helps victims of gender-based violence learn how to leverage ICTs to reduce the digital skills gap for women.[57] The programme teaches ICT skills, such as basic coding and entrepreneurship, to interested women and girls, and encourages them to use ICTs to combat the social challenges facing them.[58] In Malaysia, the "Digi Wanita Era Digital (DigiWED)" nationwide initiative – a public-private partnership between Digi Telecommunications (Digi), the Malaysian Communications and Multimedia Commission (MCMC) and the National Council of Women's Organizations (NCWO) – is seeking to educate and integrate women into the online community. DigiWED is using the 1Malaysia Internet Centers to conduct basic ICT training and to introduce women to safe usage of smart devices and the Internet.[59]

2.3.4. Web accessibility

Persons with such disabilities as sight impairment are often excluded from access because most websites are not adequately designed to handle technologies such as screen readers.[60] People who rely on screen readers to read the content of websites, also rely on websites to be properly designed[61]. Such barriers hamper use of e-government services, among others. In Europe, for example, 49 per cent of individuals used the Internet for interaction with public-sector authorities in 2017.[62] Yet, only one-third of Europe's government websites are fully accessible to persons with disabilities.[63] In the 2018 Survey, only 76 UN Member States were fully compliant with web accessibility standards, according to an automated test, leaving much room for necessary improvement.[64]

One challenge to web accessibility has been a lack of regulation or monitoring. In Norway, a new law mandates that both public- and private-sector websites should be web accessible, but implementation appears uneven.[65] The web accessibility gap is being bridged primarily by civil society and private-sector entities looking for a competitive edge in attracting customers. For instance, the World Wide Web Consortium creates standards for web accessibility.[66] This is helpful to users with disabilities but can be difficult to monitor effectively. This is among the reasons for the European Commission's Directive on the accessibility of public-sector websites and mobile applications that not only impose compliance with accessibility requirements but also require that they be monitored on a regular basis.[67]

2.3.5. Digital first

The digital divides become more apparent as an increasing number of government services are provided online. By promoting a "digital first" approach, governments may inadvertently create new digital divides by excluding those who cannot use online services. Thus, supplementing online services with technology-enabled offline services is increasingly important as countries move towards adopting a more digital government with the aim of promoting efficiency and inclusiveness. To leverage digital use, some countries are making services "digital by default" designed primarily for use online but when some services are not available offline, the potential implications are significant.

Denmark has taken a "digital first" approach where electronic interaction is now legally mandatory. Help is available offline to those who are unable to complete the transactions themselves. Similarly, the United Kingdom has developed digital assistance initiatives. To measure progress, the Government is using a performance-tracking dashboard for service managers, which enables them to track service usage on both digital and non-digital channels.[68] For instance, in processing driving license renewals, the dashboard shows the number of digital transactions taking place, with data breakdowns by device, such as desktop, mobile, or table, and user satisfaction.[69]

The public sector is inadvertently creating new digital divides by advancing e-government services at the expense of those who cannot take advantage of them. A survey by Go ON UK[70,71], a non-governmental organization (NGO), and the British Broadcasting Corporation found that one in five, or 21 per cent of the population in the United Kingdom do not have the skills or ability to communicate via email, use a search engine or conduct transactions online. There are non-technology related measures that could ensure that e-government benefits reach those who are the furthest behind. It is important that governments use various communication mediums such as call centres and community centres to serve vulnerable groups.

2.4 Digital literacy

It is widely recognized that digital skills can help improve social inclusion. Thus, these skills should be taught to schoolchildren and enhanced among civil servants, the private and public sectors. Additionally, digital assistance initiatives should be spearheaded to support members of society who are unable to access online services themselves. Underpinning these efforts is the aspiration to meet the evolving needs of citizens and businesses.

In Singapore, the Government has established programmes, such as the Silver Infocomm Initiative (SII), bridging the connectivity divide for older people by addressing their lack of education or digital skills, where it exits.[72] The European Union Commission has noted that improving digital skills among public-sector servants is vital to reaping the benefits of e-government.[73]

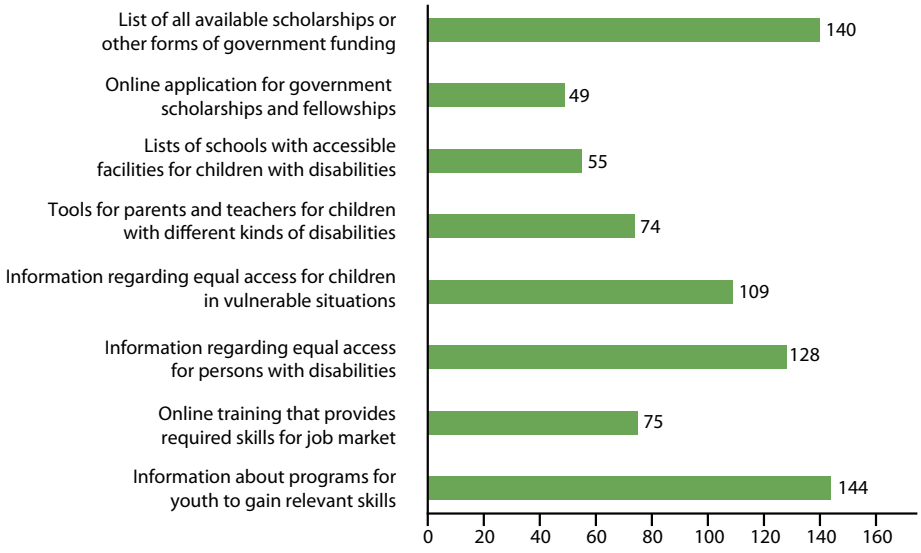
Box 2.5. Portugal: Citizen Spots combat the digital divide

In 2014, the Portuguese Agency for Administrative Modernization launched the Citizen Spot initiative, a helpdesk with specialized attendants delivering services related to both public administration and the private sector. The programme targets those who are not comfortable in an online environment. Citizen Spots provide face-to-face support by trained civil servants or private attendants who guide citizen-clients in obtaining online services. The human interaction facilitates online use, teaches digital literacy, and aims to reduce the digital divide. The Agency aimed to launch 1000 Citizen Spots by 2016, and provide coverage to all 278 municipalities in mainland Portugal.[74]

In 2017, there were 533 Citizen Spots, offering approximately 200 public services.[75] They are mainly located in town halls, parishes or post offices.[76] Implementation has been slower than expected. But despite the delays in building out the network, the initiative has been successful in reducing costs due to maximizing the usage of existing resources and cost-sharing between the public and private entities that share the responsibilities of operating the Citizen Spots.[77] Citizen Spots have been used approximately 320,000 times since implementation.[78]

Source: https://www.portaldocidadao.pt/home

Figure 2.7. Educational access



Source: 2018 UN E-Government Survey

The need to raise skill levels across different population groups is increasingly evident around the world, in response to the so-called fourth industrial revolution. A United Nations' study warned that about 56 per cent of those employed in Southeast Asian outsourcing hubs, such as in Viet Nam as well as Cambodia, Indonesia, the Philippines, and Thailand are at elevated risk of losing their jobs to automation, especially in those textile and manufacturing industries.[79] In response, Viet Nam, for example, is seeking to revise its education and training systems to develop higher-end skills.[80]

Box 2.6. Europe: Developing digital skills

The fourth industrial revolution (Industry 4.0) is expected to have a significant impact on employment. The World Economic Forum has predicted a net loss of 5 million jobs in 15 developed and emerging markets by 2020 as robots replace humans.[81] Countries around the world are therefore looking to enhance skills among the labour force to create higher value-added jobs and counter the potential negative impact of Industry 4.0.

Europe may be particularly vulnerable to potential job losses as labour costs and automation adoption are both high. It is estimated that 9 out of 10 jobs in the region will require digital skills in the future. Presently, however, less than one-half (44 per cent) of those between 16 and 74 years possess such skills.[82]

The European Commission has established several initiatives to address the challenges of Industry 4.0 and to promote better education. The Digital Skills and Jobs Coalition, for example, brings together Member States, businesses, non-profit organizations, and educational institutions to improve digital skills for all citizens, enhance digital skills in the labour force, develop digital skills for ICT professionals, and transform education to prepare for the future.[83]

Source: http://ec.europa.eu/

2.5 Emerging divides: migrants, restrictions on access, and net neutrality

Technological advancements create new capabilities for communication and are used as tools to gain and share information and to learn the skills needed to participate in a globalized economy.[84] Emerging technologies such as artificial intelligence, cloud computing, big data & analytics, and machine-learning all have the potential to improve the level of social inclusion in a society, including e-health and e-education, among others.

2.5.1. Migrants

Migration has moved up the global policy agenda in recent years. In 2015, for example, an estimated 160,000 people arrived in Sweden (a country with a population of about 10 million).[85] From an e-government perspective, the growth in migration necessitates a shift in providing services to a more diverse group of people (*see Box 2.7. case study on Finland*). The Swedish Migration Agency website is offered in several languages to provide information to migrants.[86] Such tailored services, however, do not extend to most government websites.

This illustrates that there are institutional gaps in bridging the range of digital divides, especially with emerging divides. Typically, one ministry only serves a segment of the population, such as migrants. Yet tackling digital divides requires a strategic holistic view, and integrated policy actions across government agencies and at local levels.

Box 2.7. Finland: blockchain for identity management and financial inclusion

Between January 2014 and June 2017, the Finnish immigration authority received more than 41,000 applications for asylum and those who were accepted faced long waiting times to process residence permits and local identity papers. During the waiting period, refugees could not access the banking system and monthly Government-to-Citizen payments had to be made in cash.[87]

In 2015, the government partnered with MONI, a Finnish start-up, to launch a pilot digital financial services programme enabling refugees to receive money and pay bills without opening a bank account. MONI developed a prepaid debit card (Mastercard) linked to a unique digital identity stored on a blockchain which does not require a bank account or identity papers. The service simplifies social welfare payments between the government and refugees and creates a digital trail that allows for credit scoring and increased access to other financial products such as credit.[88] Account holders can apply for a loan through their mobile phone, either from friends or financial companies. The digital trail allows users to lend money to each other, setting a maximum amount. Loans between users have no fees and no interest, and the service is free to use.[89]

As of September 2017, the programme had about 4,000 active accounts and activity has expanded as refugee users find jobs, pay bills and transfer money to relatives. In the fourth quarter of 2017, the programme was launched across the European Economic Area (EEA) allowing adults over 18 to sign up online using a phone number and a residential address.[90]

Source: http://migri.fi/vastaanottoraha

2.5.2. Country restrictions on information access

The use of global cloud services is creating a new digital divide among local authorities; they are facing challenges in accessing and controlling data within their jurisdictions. Sovereign clouds, or data localization regulations, where information is required to be stored in a certain geographic area are becoming a global trend. This could make information inaccessible to those who are outside the jurisdictions, which could limit access to government information and services for overseas migrants.

While acknowledging the importance of cybersecurity, countries need to recognize the consequences of disguising it as national security, which can limit widespread uptake of ICTs by undermining trust and leading to geographic information divides. Given the challenges ahead, there remains a need for the global community to work together in setting international objectives that affect digital divides while acknowledging the need for local contexts and regulations.

2.5.3. Net neutrality

The debate surrounding net neutrality -- whether Internet service providers can discriminate against distinct types of usage or should treat all data as the same – has been ongoing for some time. However, the decision of the United States' administration in December 2017 to reverse previous American policies, and, in effect, repeal net neutrality, brought the issue to the forefront of the technology policy debate.[91] The effect of that decision remains to be seen. From an e-government perspective, service providers could, in theory, charge money for access to public- sector websites or slow down the speed with which they could be accessed. Although that is an unlikely scenario, the debate has raised issues of openness and access, such as whether private-sector websites could be restricted in a way that limited access to information from a variety of sources, such as from news.[92] Hence, the larger concern is whether potential new barriers to access content will have an impact on access to information more generally, especially as different countries have different approaches and there are no existing global agreements on this topic.

2.6 Conclusion

Research on e-inclusion has moved beyond identifying whether access is available—the prime focus of early reports on the digital divide—to assessing what people do with their access. A World Bank report in 2016 on "digital dividends", another term for "useful usage" or potential digital productivity, indicates that while global connectivity and service delivery has improved, it has not necessarily improved socio-economic outcomes due to uneven distribution, which highlights the need to bridge digital divides.[93] Since improved socio-economic status for all people is the fundamental point of e-inclusion, this is a concerning gap which will need greater attention moving forward.

To reap the enormous dividends of the information society for sustainable development, countries around the world must tackle current and emerging digital divides. While there is a role for different stakeholders, governments must take the lead in setting standards, deploying strategic instruments, and providing e-government services. Multi-stakeholder partnerships should be forged with civil society and the private sector to stimulate demand for e-government in support of the implementation of the 2030 Agenda. Recommendations include:

- Greater recognition that digital divides exist in all countries and that digital progress can create new divides. In many ways, segments of the population that remain offline in leading e-government countries are at greater risk of being socially excluded if they cannot use "digital first" policy-enforced e-government services.

- Special attention needs to be paid to vulnerable groups as there is a strong correlation between digital exclusion and social exclusion. Persons with disabilities, for example, are often as vulnerable online (due to lack of web accessibility) as they are to offline services.

- There remains a need to bring people online in the first instance. In some cases, this remains a problem due to lack of access to ICT infrastructure. Governments must raise awareness of the value of online services to motivate usage. In this effort, relevant and sufficient content should be provided in local language and at local levels.

- The role of government is critical to ensuring that no one is left behind in implementing the 2030 Agenda. E-participation can serve as a catalyst towards greater e-inclusion.

- Greater attention should also be paid to digital literacy, among the population at large, but also among civil servants. Implementation and delivery of e-services rely on the ability of users to use them. Given the potential socio-economic benefits for citizens and governments alike, greater emphasis should be placed on skills development.

- Raising awareness on information and services and promoting their use require partnerships with other actors, such as civil society and the private sector. The government is a supplier of services, but the demand for them should be promoted across sectors to overcome multiple challenges of different population segments.

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E-resilience through e-government: global and regional perspectives

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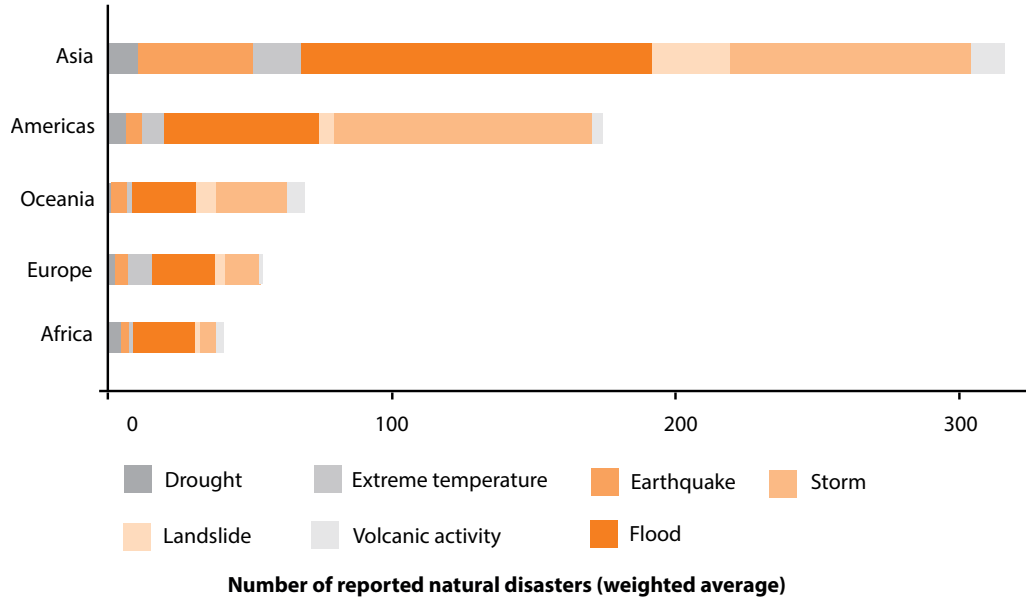
3.1 Introduction: Impact of Natural Disasters and Role of Policy and ICT in Disaster Risk Management

Natural disasters constrain government efforts in achieving the 2030 Agenda for Sustainable Development. The results of natural disasters are cataclysmic—from human loss and suffering to devastating economic repercussions, all of which erodes development gains. Not only are natural disasters hurting past and present development initiatives, but they are also forestalling new opportunities for growth and prosperity, causing harm to future generations.

Since 1970, the number of disasters[1] worldwide has more than quadrupled to approximately 400 a year. Although 2006 to 2016 saw a gradual decline in terms of numbers, their impact, in terms of casualties and monetary damage, has continued to soar. The total number of people affected by disasters in 2016 was 569.4 million, the highest since 2006 and far above the 2006-2015 annual average of 224.1 million. Losses from natural disasters have increased eight-fold in economic terms during the last four decades. Topping US $154 billion, it was up by 12 per cent in 2016 compared to the 2006-2015 annual averages. The cost of natural disasters doubled in 2017 to $306 billion compared to the previous year's tally. Disasters claimed more than 11,000 victims in 2017.[2,3]

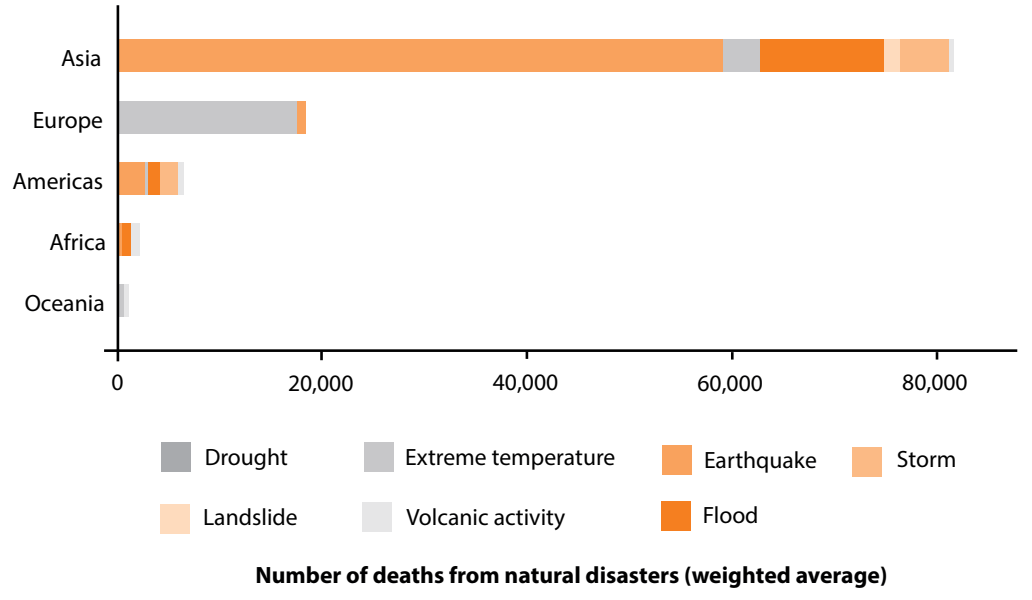
Asia and the Pacific experienced the highest number of natural disasters between 2000 and 2017 (Figure 3.1). The region suffered the most human casualties during the same period, owing to those events (Figure 3.2). More than half of the top 20 countries with the highest number of deaths from natural disasters worldwide from 2000-2017 comes from the region. China and the United States registered the highest number of casualties, generated in large part by storms and floods. Earthquakes were the deadliest natural disaster in Asia (Figure 3.3).

Figure 3.1. Number of reported natural disaster occurrences by region, between 2000 and 2017, per million of inhabitants.[4]



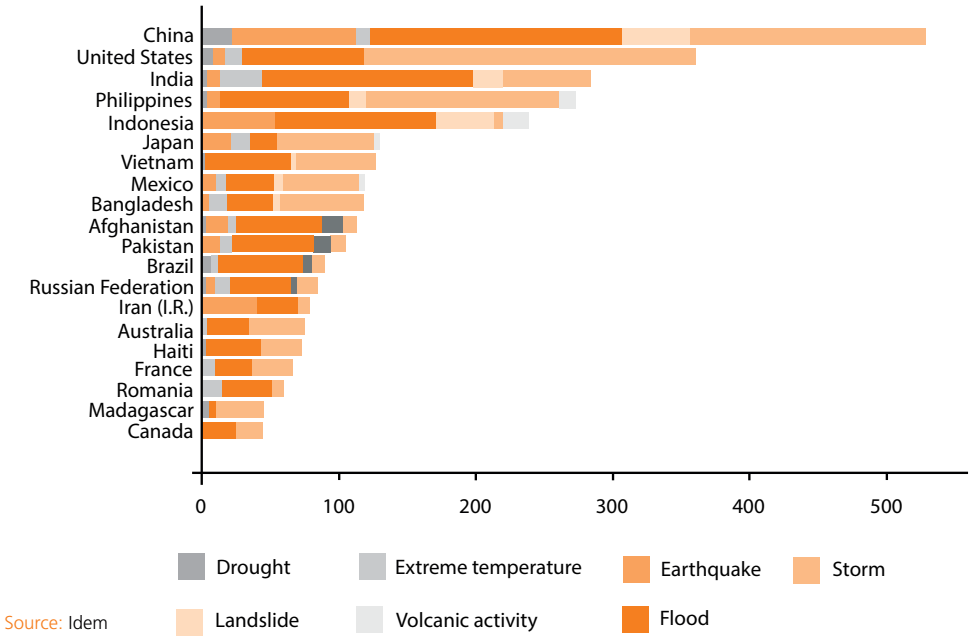
Source: Author's calculation based on data compiled from Centre for Research on the Epidemiology of Disasters (CRED) and Emergency Events Database (EM-DAT)

Figure 3.2. Total number of deaths from natural disasters (2000 - 2017), by major regions



Source: Idem

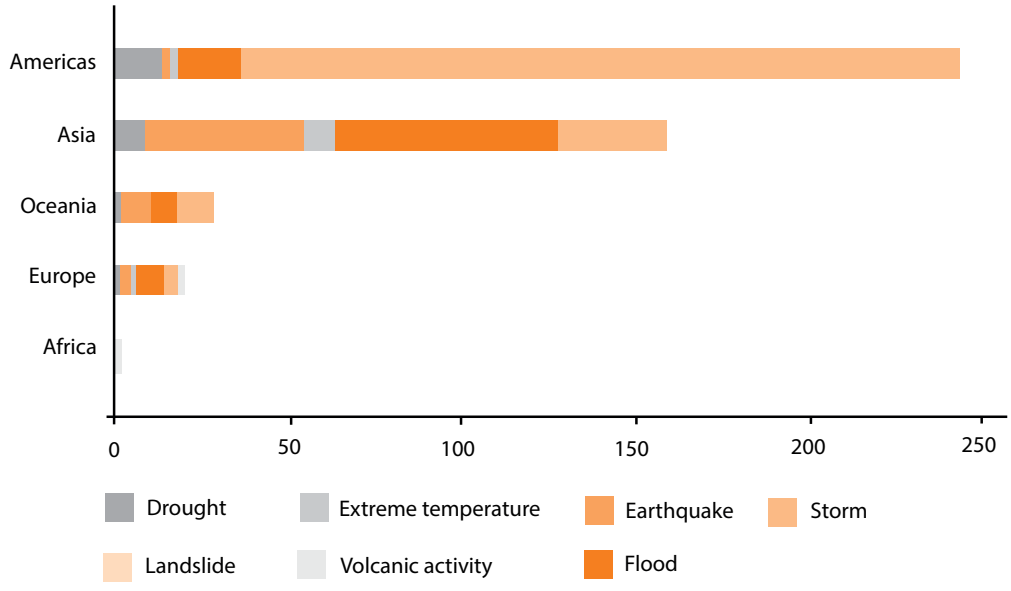
Figure 3.3. Number of reported natural disasters (2000-2017), Top 20 economies



Source: Idem

From an economic perspective, Asia and the Pacific[5] once more emerges as one of the most affected regions, second to the Americas where the year 2017 was the costliest for weather disasters in the United States (Figure 3.4). An ESCAP report notes that natural disasters[6] in 2016 alone caused 4,987 deaths, affecting 35 million people with an estimated damage of USD 77 billion in Asia and the Pacific[7].

Figure 3.4. Total damages from natural disasters (USD billion) (2000 - 2017) by major regions[8]



Source: Idem

Higher-income countries generally have better coping capacities against natural hazards, which often translate into fewer human casualties. Typically, the greatest exposure and impact is born by the poorest countries, which have scant capacity to prepare for and respond to the manifold disasters, to which they are prone. These countries include the least developed countries, the landlocked developing countries, and small island developing States. This is well illustrated in the case of the Asia and the Pacific region (Table 3.1.).

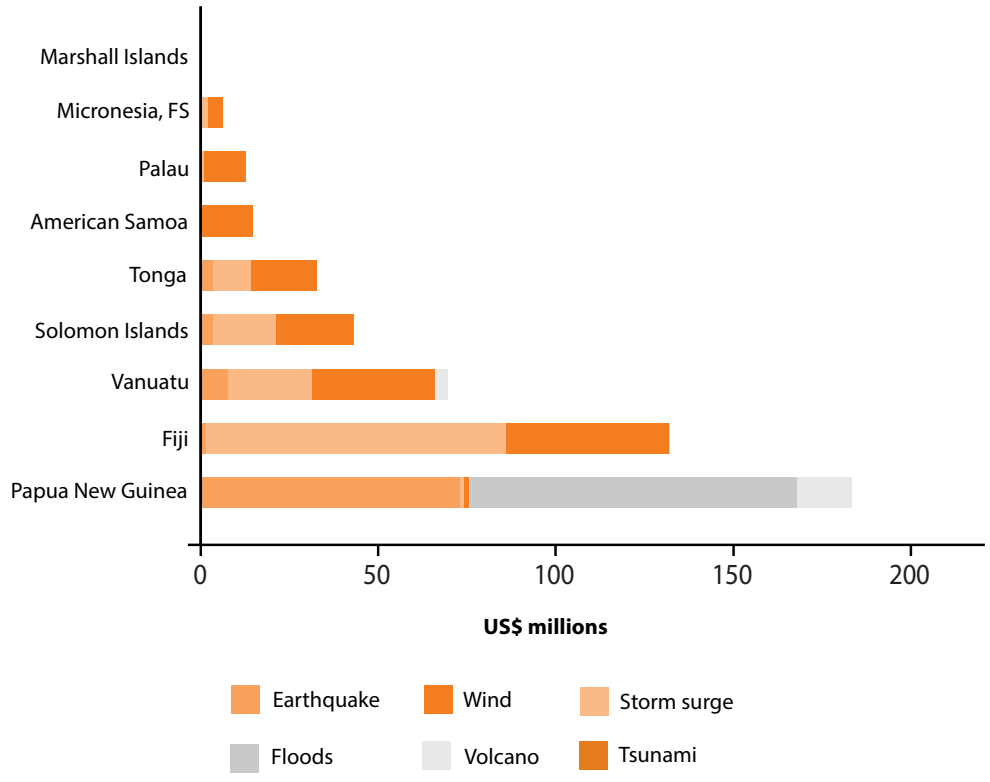
Table 3.1. Top 10 Member States with the highest commitment to cybersecurity

Country	Exposure		Coping Capacities (%)	GDP Per Capita (Current USD)
Vanuatu	63.66	Very High	Low	2,861
Tonga	55.27	Very High	Low	3,749
Philippines	52.46	Very High	Low	2,951
Japan	45.91	Very High	Very High	38,901
Brimeo Darussalam	41.1	Very High	High	26,939
Bangladesh	31.7	Very High	Very Low	1,359
Solomon Islands	29.98	Very High	Very Low	2,005
Fiji	27.71	Very High	Low	5,233
Cambodia	27.65	Very High	Very Low	1,270
Timor-Leste	25.73	Very High	Low	1,405

Source: ESCAP (2017) Asia-Pacific Disaster Report 2017. GDP Per Capita is obtained from the World Development Indicators. Accessed in March 2018.

Pacific countries, especially the small island developing States (SIDS), are particularly susceptible to natural disasters.[9] Between 2000 and 2016, the Pacific sub-region experienced 225 natural disasters, causing 1,752 fatalities, affecting 4.7 million people, and generating nearly USD 50 billion worth of damages. Since 2000, SIDS have lost over 1 per cent of their respective gross domestic product, or GDP, to disasters, compared with 0.4 per cent for all countries except the countries in special situations.[10] Estimates of the savings that those countries must set aside annually to cover the cost of long-term losses incurred from any unexpected hazard[11], known as the average annual loss (AAL), are telling (Figure 3.5.).

Figure 3.5. AAL figures for Pacific Island countries by hazard type[12]



Source: idem

One recent case in Fiji illustrates the intensity and extent of damages (Box 3.1.).

Box 3.1. Disaster Response and Recovery: Impact of Cyclone Winston on Fiji in 2016

On 20 February 2016, tropical cyclone Winston (category 5) struck Fiji affecting 540,400 people, or 62 per cent of the population. The estimated cost of the damages was USD $0.6 billion-$0.9 billion, or approximately onefifth of the country's GDP.

The immediate damage in communication and electricity infrastructure triggered the loss of cellular, fixed-line, radio and television services. The cyclone disabled power and communication networks; 80 per cent of the population lost electricity. The total damage to the communication sector[13] was estimated to be near USD 24 million. The cyclone damaged cellular transmission towers and equipment. While mobile network services were partially restored in the aftermath of the disaster, up to 50 per cent of all sites operated on generators for a period due to the disruption of electricity networks. In places where fixed-line services were affected, the service provider, Fiji Telecom Limited, offered free wireless devices.

The lessons learned were many. The Government expressed its willingness to assist the private sector in building more disaster-resilient infrastructure through public-private partnerships and infrastructure-sharing arrangements. In addition, other mechanisms such as early warning systems were found to be critical for preparedness. As a result of post-disaster needs assessment, Fiji cooperated with the World Meteorological Organization (WMO) to boost its resilience to weather events, through the creation of early warning systems; feasibility studies on future investments related to disaster risk management, particularly in rural and remote areas were prepared.[14]

Source: Government of Fiji, 2016

In addition to post-disaster studies and technical solutions, policy plays a pivotal role in disaster risk management. The United Nations, in 2005, organized the first global meeting on natural disasters, in Kobe, Japan, which culminated in the adoption of the Hyogo Framework of Action 2005-2015. The Framework aimed at guiding disaster preparation and management. Building on the accord, the United Nations World Summit on Disaster Risk Reduction was organized in 2015 in Sendai, Japan, following the devastating tsunami in Japan. The outcome document, The Sendai Framework for Disaster Risk Reduction 2015-2030[15], shifted Hyogo's focus from responding to disasters to anticipating them so as to reduce and manage their disaster risk. The Sendai Framework proposed seven global targets and priority actions including: understanding disaster risk; strengthening disaster risk governance; investing in disaster risk reduction; enhancing disaster risk management; improving preparedness to respond to disasters and to duly implementing the Framework's "Build Back Better" priority.[16]

Like public policy, information and communications technologies are an essential element in disaster risk management. During disasters, ICTs, including geospatial technology and space applications, can be instrumental in providing swift response and ensuring emergency communication services. ICTs can support the operation of critical infrastructure in the energy and health sectors, as well as in natural resource management and transport, and can assist in weather forecasting, all of which have a role in the timely and effective dispatch of humanitarian aid in the aftermath of a disaster. They are vital to identifying, managing and mitigating risk before a disaster strikes, and can ensure continuous and critical communication and service delivery across all phases of disaster management.[17] Two examples come from Madagascar and Uganda (Box 3.2.).

Box 3.2. Disaster Communications Management, Prevention and Response in Madagascar and Uganda

Source: http://www.mid.gov.mg/

In **Madagascar,** the National Bureau for Risk and Disaster Management was set up within the Ministry of the Interior and Decentralisation. It is responsible for coordinating programmes and activities related to emergency response and relief, preparation and prevention, and disaster mitigation, and data collection. The data is used to evaluate the availability of food, sanitation facilities, equipment, shelter and medical needs and assistance. Various groups and stakeholders, such health and medical professionals, have access to available ICT channels to relay data to the disaster risk management system including through 1) telephone (free emergency number available to all operators); 2) Short Message Service (periodic messages regarding the current situation), and 3) data transmission (images from satellites or agents on the ground).

Source: Government of Uganda, 2014

The **Uganda** Communications Commission in collaboration with the Office of the Prime Minister, the Ministry of Water and Environment, and the District Local Government of Butaleja, jointly implemented a pilot project on setting up two flood early warning systems along the R. Manafwa basin in Butaleja district in Eastern Uganda. One of the systems installed in the Namulo Primary School in the Manafwa District was activated in September 2014 to warn the community about possible flooding, allowing many to run to higher ground for safety. The installation of the early warning systems has brought hope of saving lives and property to the people of Butaleja.

ICTs themselves are critical infrastructure to be protected from disasters, as discussed more extensively in Chapter 4. The following section concentrates on the role of ICTs and e-government in different disaster risk management stages and introduces the concept and practice of e-resilience.

3.2 E-resilience and its linkages to ICT and E-government[18]

Resilience is "ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions".[19] E-resilience is ICT contributions to resilience, particularly at the community level.[20] In other words, e-resilience is the use of ICTs during all phases of disaster risk management —prevention, reduction, preparedness, response and recovery — towards reducing risk and impact and maintaining the gains made towards sustainable development, including through e-government.

E-resilience entails two main dimensions (Table 3.2.): ICTs for disaster risk prevention, risk reduction and preparedness, as well as for disaster response and recovery, including the rapid restoration of ICT infrastructure and services.[21]

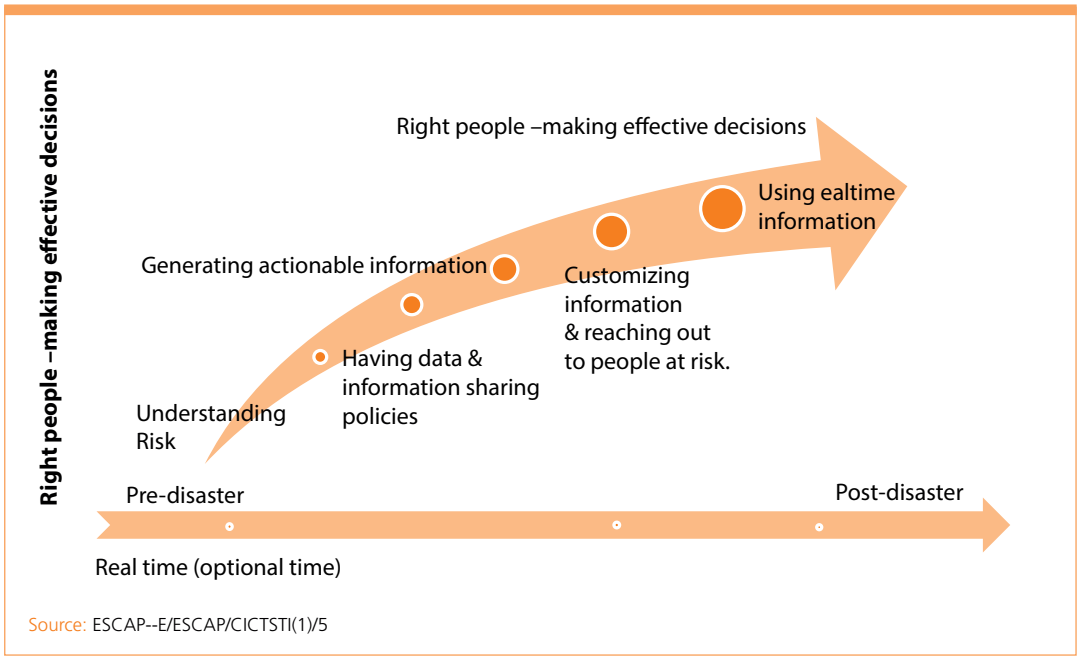
Table 3.2. E-resilience and Role of ICT in Disaster Risk Management

DRM Phases / ICT Roles	Prevention	Reduction	Preparedness	Response	Recovery
Key Tasks	Improving risk information as basis for investments and business strategies / operations	Reducing the chance of disasters and mitigating the level of disruptions, damage & losses	Planning and getting adequately and appropriately ready to respond to any disaster eventuality, in a timely manner	Saving lives, preventing further damage and losses and meeting immediate needs during disasters	Being able to restore functions, recover assets and operations, and build back better
ICT for its own resilience (ICT Sector)	• Not to create/ increase risks • Not to exacerbate existing risks • Avoid and transfer risks	• Address the underlying factors of risks • Reduce vulnerability • Increase capacity/ protection • Undertake retrofitting • Reduce exposure • Invest in early warning	• Plan System/network continuity • Implement system redundancy/backup • Ensure response readiness • Conduct training and drills • Set up emergency response and communication mechanisms	• Gather data and information on any damage and disruptions to the ICT infrastructure, facilities and services • Restore and repair services, data, facilities and equipment • Activate emergency communication systems, such as satellite systems and mobile communication units	• Conduct rapid assessment of damage and losses • Assess needs for recovery • Factor in additional investment to reduce future risks
ICT for society's resilience (non-ICT Sectors)	• Make ICTs available to improve risk assessments • ICT as crucial instruments for analysis • ICT to enhance development/ business investment planning	• Set up risk databases • Introduce Geo-Referenced Information Systems (GIS) for decision making, planning and mitigation • Expand ICT as a tool for disaster knowledge, innovation, education • Enhance coordination via ICT • Enhance risk observation, assessment and early warning by ICT	• Plan and put in place emergency decision making tools (assessment, mapping, databases, planning) with ICT • Set up and enhance emergency/humanitarian communication, application and coordination • Position ICT as one of comon services to all sectors	• Gather data and information on casualties, losses and damage for coordinated responses • Request for satellite imagery of affected areas • Activate data backup in case socioeconomic data is lost. • Inform citizens of available emergency services and information via SMS, website, radio or PA	• Enhance rapid assessments and detailed Post Disaster Needs Assessment (PDNA) • Use ICT systems and applications to facilitate disaster response efforts • Inform more robust future investment within the recovery framework

Source: ESCAP--E/ESCAP/CICTSTI(1)/5

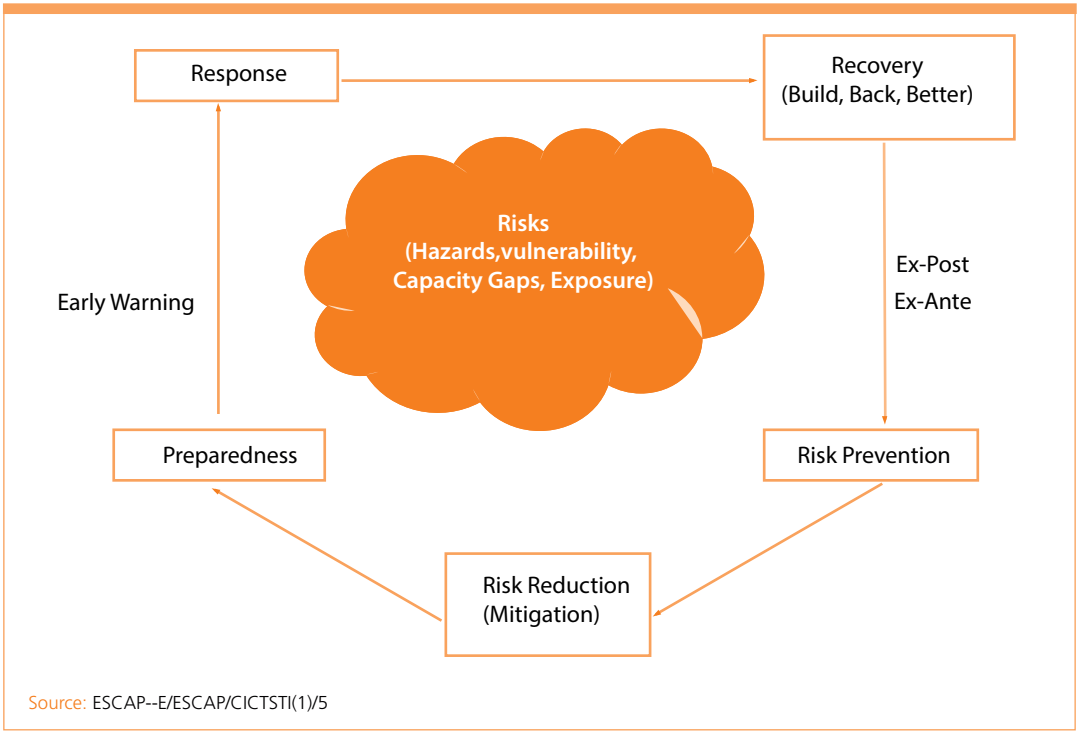
The Asia Pacific Disaster Report 2015 identified five essential steps and guiding principles to enhance e-resilience including through e-government initiatives, as follows: understanding risk; installing data- and information-sharing policies; generating actionable information; customizing that information and reaching out to people at risk; and using real-time information (Figure 3.6.). These steps are applicable to all stages of the disaster risk management cycle (Figure 3.7.).

Figure 3.6. E-resilience guiding principles



Source: ESCAP--E/ESCAP/CICTSTI(1)/5

Figure 3.7. Disaster Management Cycle



Source: ESCAP--E/ESCAP/CICTSTI(1)/5

Given the increasing recognition of the key role ICTs across the different phases of disaster risk reduction and management, Member States have been requesting more support in building and strengthening their eresilience, including in designing and implementing ICT applications and services and embedding them in egovernment initiatives as part of their overall disaster risk management systems and strategies. Addressed holistically, e-resilience has the potential to reduce disaster risks and improve disaster management, and it can be instrumental in reducing economic loss and preventing human casualties. Some e-resilience illustrations come from Bhutan and Japan (Box 3.3).

Box 3.3. Disaster Risk Prevention, Reduction and Response: DHMS Weather Monitoring and Early Warning in Bhutan and E-resilience in Japan

In **Bhutan,** the Department of Hydro Med Services (DHMS) website provides hazard related information on meteorology, hydrology, snow and glacier early warnings[22]. Each hazard monitoring system is linked to sensors, which send real time data generating actionable information, which then activates sirens to warn people in high-risk areas. This online weather information service of DHMS is an integral part of disaster risk reduction, preparedness and response contributing to the e-resilience of the country.

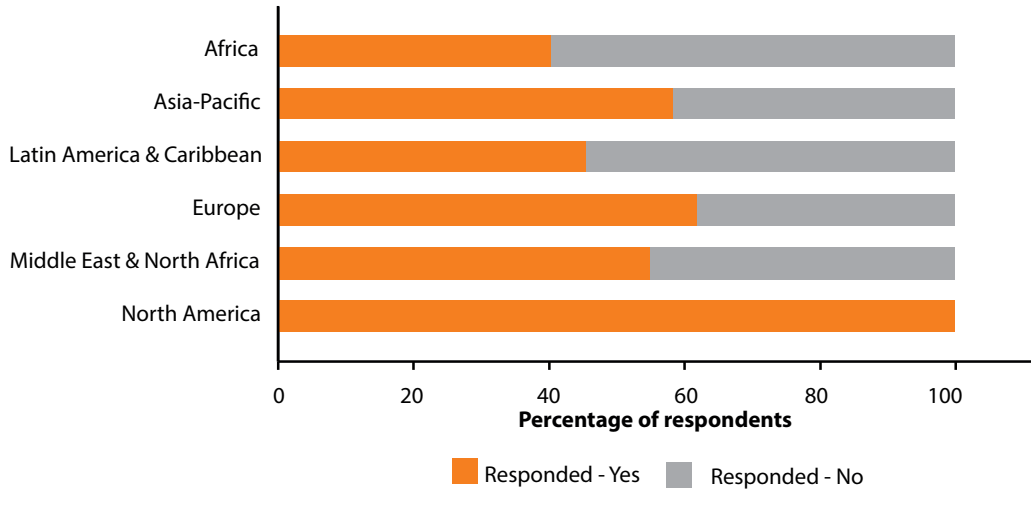
Source: http://www.hydromet.gov.bt

In **Japan,** the tsunami that followed the Great East Japan Earthquake, or Tohoku Earthquake in 2011 (magnitude 9.0) led to damages, among others, to ICT infrastructure such as underground (1700 Km) and overhead cables (6300 Km), causing communications breakdowns in the affected areas. This prompted Japan to start a national project to strengthen ICT infrastructure, develop applications and network control technologies, ranging from WiFi to satellite communications. Some of the measures taken were (a) relocation of communication offices/facilities to higher grounds, (b) deployment of dynamo-electric generators, (c) installation of new long-life battery system in active seismic zones, and (d) installation of underground fiber optic cable to strengthen ICT network resilience. A robust wireless mesh network using wireless and satellite technologies was also developed.[23]

Source: http://www.unescap.org

The data collected for the 2018 United Nations E-government Survey sheds light on the available functions and readiness of e-government in addressing challenges and creating opportunities associated with managing disaster risks and enhancing e-resilience. A preliminary regression analysis, which studied the relationship between broadband connectivity and disaster impact, shows that as broadband connectivity was increased disaster impact was reduced. Likewise, countries that provided relevant weather- and disaster-related information on their e-government websites had lower casualties as result of natural disasters.[24] Figures 3.8. and 3.9. below show the weather and agriculture updates, and energy-related e-government services.

Figure 3.8. Percentage of countries with e-government sites that share updates and information on electricity or power outage.



Sample size: North America ((n=2)), Latin America & Caribbean (n= 33), Europe (n=42), Asia-Pacific (n=48), Middle East & Africa (n=20) & Africa (n=47)

Source: UN DESA E-Govt 2018

Integrating e-resilience into e-government initiatives is thus paramount. The first step is to assess the specific disaster risks and their potential impact. Different disaster management tools and initiatives are needed for e-resilience of cyclone/typhoon-prone countries versus countries in a seismic zone. Similarly, preparedness efforts, in terms of data, application, back-up and communication methods, would take different forms. But integrating these tools and initiatives could save lives and minimise economic loss, as well as contain damage, with significant impact on sustainable development.

3.3 Emerging uses of artificial intelligence, social media, space technology applications and geospatial information for e-resilience

Many innovative disaster and crisis management tools are designed to consolidate structured and unstructured data for quick and effective decision-making. Some of these tools include Artificial Intelligence, social media, space technology applications and geospatial data.[25] These technologies along with enhanced data availability, analytics and functionalities hold much promise for advancing e-resilience initiatives towards the achievement of sustainable development.

Artificial Intelligence refers to "a set of computer science techniques that enable systems to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making and language translation"[26]. It includes, inter alia, the Internet of Things (IoT), fixed and mobile broadband, cloud computing, and big data.[27, 28] IoT collects and exchanges biometric data, behavioural information and unstructured information using network-connected sensors and devices. Big data are large data sets of voice, administrative records, electronic transactions, online activities and data transmissions collected mostly through mobile and broadband cloud computing technologies.[29] AI technology does not necessarily involve pre-defined behavioural algorithms since it can build on past iterations, characterized as machine learning or deep learning.[30]

Many examples illustrate the innovative applications of Artificial Intelligence on e-resilience. For instance, kinetic sensors are installed at the bottom of the Indian Ocean and are detecting waves and water flows, and transmitting data via sonic buoys and satellite links to emergency agencies. Drones are being used in effectively assessing damage after disasters, such as the series of earthquakes in Nepal in 2015. In the south of Thailand, a network of cameras is providing real-time monitoring of water flows and using closed-circuit television to aid with warnings of potential flooding. AI-based methods, including the IoT technologies, are being applied successfully on a range of hydrological problems in Australia.[31] Two examples come from Chile and Sri Lanka (Box 3.4.).

Box 3.4. Disaster Preparedness: Sensor Detection for Early Warning: The Cases of Chile and Sri Lanka

Chile is one of the most disaster-prone countries as it lies on the "ring of fire" plate. The 8.8 magnitude earthquake that occurred there in 2010 was the sixth strongest in the world since 1900.[32] In its aftermath, the government of Chile took progressive steps toward establishing a tsunami early warning alert system[33]. A network of pressure sensors was installed near the main fault lines in the Peru-Chile Trench. The sensors detect the number of seismic occurrences and the software estimates the magnitude and epicenter. The algorithm analyzes and interprets the data before transmitting it to the warning centers. The early warning messages are broadcasted through mobile phone network.

Source: http://www.shoa.cl/php/inicio.php

Sri Lanka's Disaster Management Initiative, Sahana, was created in the aftermath of the 26 December 2004 tsunami that hit several countries in Asia bordering the Indian Ocean. The Sri Lankan ICTs industry created Sahana to help track families and coordinate work among relief organizations. Sahana is a free open-source software, consisting of a series of integrated web-based disaster management applications. It automatically collates, aggregates, and calculates data, and provides situation and needs assessment in real-time.[34] Sahana fills a unique niche in the toolkit of emergency and disaster response agencies by facilitating information sharing and coordination of efforts across all types of organizations and individuals.

Source: UNDP-APDIP, 2006

While most practical applications of big data in disaster scenarios are still experimental, useful cases have emerged, such as in connection with the Haitian earthquake of 2010. A recent survey conducted by the Ministry of Internal Affairs and Communications of Japan has concluded that big data is expected to make significant contributions to disaster risk reduction in the country.[35] Mobile network big data has an immense potential in that regard. Mobility data collected in the aftermath of a disaster can help relief operations by locating affected populations and potential disease outbreaks.[36]

Social media and its various uses are also critical for e-resilience. Some examples come from Qatar, Austria and Germany (Box 3.5.).

Box 3.5. Disaster Preparedness and Response: Artificial Intelligence using Social Media

Qatar's Artificial Intelligence for Disaster Response (AIDR)[37] is a free and open source software that automatically collects and classifies social media feeds including tweets that are posted during humanitarian crises. AIDR maximises the use of machine intelligence and assists in making sense of significant amounts of data, video, images and texts on social media whenever disaster strikes. Once the collection starts and tweets begin to gather, different keywords and hashtags are created, such as #Medical Needs or #Shelter. The AIDR team works closely with United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA), International Committee of the Red Cross (ICRC) and other organizations in carrying out the deployment of AIDR.

Source: http://aidr.qcri.org/

In **Austria** and **Germany,** researchers conducted studies on multi-stakeholder disaster response coordination and developed a public display application called City-Share. It aims to crowdsource relief activities to unaffiliated volunteers and emergent citizen groups within neighborhoods. As such, it supports self-help and civil society initiatives, and contributes to the alignment of activities between public authorities and other actors including aid organizations. It also assists public authorities in gathering information on loosely structured data, emergent citizen groups and their related activities.

Source: Zettl and others, 2017

Space technology applications and geographic information systems also play important roles in disaster risk management. By comparing satellite images before and after disasters, disaster management authorities can estimate the type and magnitude of the potential or actual damage. Such disaster data overlaid with other socioeconomic data such as on transport, infrastructure, medical facilities and population statistics, can be decisive in making timely and accurate decisions. Space technology applications and geographic information systems also contribute to assessing vulnerabilities, reducing risk and preventing and preparing for disasters.

One example is ESCAP's Regional Space Applications Programme for Sustainable Development in Asia-Pacific, which aims to enable countries with advanced space technologies to assist low-capacity and high-risk countries. The mechanism provides tools, services, capacity building and information to help drought-prone countries design drought management programmes that are tailored to their specific needs. One specific application of this mechanism comes from Mongolia (Box 3.6.).

Box 3.6. Disaster Risk Prevention, Reduction and Preparedness: Socio-economic Information to Supplement Drought Data

Eighty per cent of the land in Mongolia is capable of agricultural production, primarily extensive livestock production, while arable land occupies only 0.09 per cent of the total land area. Figure a. shows an example of a drought early warning product developed in June 2015 in a collaboration among Mongolian institutes, based on the ESCAP Regional Drought Mechanism. When compared with a land cover map of Mongolia (Figure b), it shows that drought was forecast primarily for pasture lands.

Figure a. Drought early warning for June 2015

Figure b. Land cover map of Mongolia

Figure c provides an overview of poverty by province and district and Figure d provides an overview of livestock, identifying those farmers at high risk of having their livestock affected by localized drought. This early warning product helps in the identification of localized pockets of intervention, relief and mitigation assessments and priorities, as well as the calculation of mitigation cost for livestock feed and other productive assets.

Figure c. Poverty headcount based on census data

Figure d. Livestock density, heads per Km^2

Figure e shows the state of desertification and land degradation in Mongolia while Figure f shows the vegetation index, both of which provide an overview of the average stress on vegetation including soil stress and other environmental degradation. This informs relief and intervention activities including the assessment for parametric insurance products and initiatives.

Figure e. Desertification and land degradation in 2014

Figure f. MODIS NDVI, vegetation index

Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Similar initiatives are also being implemented in other drought-prone regions such as in Africa where livelihoods are closely intertwined with climate variability. Princeton University in collaboration with the International Hydrological Programme and the Information for Arid Zones of the United Nations Educational, Scientific and Cultural Organization (UNESCO)[38] has developed the African Flood and Drought monitor,[39] which monitors and forecasts meteorological, agricultural and hydrological drought at various temporal and spatial scales. It enables users to access the system's input and output data. It also contains a multi-decadal, historical reconstruction of the terrestrial water cycle. In the last two years, the data has been used in a wide range of e-resilience building initiatives including drought resilience, irrigation, health and epidemiology, and migratory movements.

Box 3.7. Using Spatial Technologies and Science-Based Modelling in Disaster Risk Management: Perspectives from Africa and the Caribbean

T**he African Risk Capacity (ARC)** was established in 2012 as a specialized agency of the African Union to help Member States improve their capacities to prepare for, plan and respond to extreme weather events and natural disasters, thereby protecting the food security, safety, health and well-being of their vulnerable populations.

Extreme Climate Facility (XCF) provides eligible ARC countries with additional funds should extreme weather events in their region increase in magnitude and/or frequency, as reflected by an objective data-driven index.

Outbreak and Epidemic Response (O&E) and contingency plans support ARC countries based on quantitative models of epidemic risk. Pay-outs are triggered as result of accurate detection of distinct epidemiologic events in a country. The first pilot country implementation is taking place in 2018.

Replica Coverage is a science-based risk modelling and government-led risk management system to assess drought probability. If rainfall levels fall below a pre-defined threshold, preventive disbursement of funds from the ARC Members, international community and donors is triggered.

As of 2018, ARC Member States include: Benin, Burkina Faso, Burundi, Central African Republic, Chad, Republic of the Congo, Côte d'Ivoire, Comoros, Djibouti, Gabon, Gambia, Ghana, Guinea, Guinea Bissau, Kenya, Liberia, Libya, Madagascar, Malawi, Mali, Mauritania, Mozambique, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Sudan, Togo, Zambia, and Zimbabwe, in addition to the Sahrawi Arab Democratic Republic.

Source: http://www.africanriskcapacity.org/

The Caribbean Catastrophe Risk Insurance Facility SCP was developed in 2004 to help mitigate the short-term cash flow problems from which small developing economies suffer after major natural disasters. It is the first multi-country risk pool in the world, and a regional catastrophe fund for Caribbean governments (and Nicaragua), designed to limit the financial impact of devastating hurricanes and earthquakes by quickly providing financial liquidity.

Member States as of 2018 include: Anguilla, Antigua & Barbuda, Bahamas, Barbados, Belize, Dominica, Grenada, Haiti, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago, and Nicaragua, as well as Bermuda, Cayman Islands and Turks and Caicos.

The Facility spearheads environmental management initiatives, aimed directly at reducing vulnerability and enhancing resilience at the community level. Examples include watershed management projects in degraded areas, and parametric insurance, which disburses funds based on the occurrence of a pre-defined level of hazard and impact without having to wait for an on-site loss assessment. The Facility's parametric model includes hazard, exposure, vulnerability, damage and loss modules, and applies to three types of disasters – earthquakes, hurricanes and excessive rainfall. It triggers payouts, from independently provided data, based on hazard inputs related to wind speed and storm surge in the case of tropical cyclones, ground shaking for earthquakes and rainfall amounts for excessive rainfall events. These hazard levels are then applied to pre-defined government exposure levels to produce a loss estimate.

Source: https://www.ccrif.org/

Additional innovative schemes for development financing are also using spatial technologies and geographic information systems, including, but not limited to, African Union's specialized agency, African Risk Capacity and its various tools and products of disaster risk management, and the Caribbean Catastrophe Risk Insurance Facility SPC[40], which offers earthquake, tropical cyclone and excess rainfall policies (Box 3.7).

Computational innovations and high-speed Internet have allowed geospatial data and various applications to be incorporated into early warning systems, resulting in increased operational efficiency. As disaster data are location-specific, using space-based technology and geospatial data becomes essential for the entire early warning phase and disaster management cycle. Such information provides answers to location-based questions as well as on disaster impact and supply routes for effective first response.

3.4 Mainstreaming e-resilience within e-government framework

From a development perspective, mainstreaming e-resilience in all phases of disaster management requires concerted efforts by various actors in myriad sectors, as well as coherent policy and a sound budget. E-government initiatives could be designed and implemented to facilitate the mainstreaming with an eye on the principles of the Sendai Framework and other comparable and supporting global initiatives of resilience through innovative applications of ICTs (Box 3.8).

Box 3.8. Global-level initiatives of disaster risk management and ICT

****Global Partnership for Preparedness**–Upon the call of the United Nations Secretary-General to enhance the emergency response capacity of the 20 highest risk countries by 2020, the Vulnerable 20 (V20) Group of Ministers of Finance of the Climate Vulnerable Forum representing 48 high risk developing nations launched this partnership together with the United Nations agencies to support risk-prone countries to better prepare for responding to, and recovering from, disasters caused by natural hazards. (Source:https://www.agendaforhumanity.org/initiatives/3840)

****One Billion Coalition for Resilience (1BC)**–Using data analytics and other related tools, the 1BC initiative maps the resilience of local communities and offers local action preparedness starter kits and grants. It aims to collectively enhance the impact of resilience building by integrating actions and strategies of individuals, households and communities on the ground. (Source: http://media.ifrc.org/1bc/)

****Insurance Development Forum (IDF)**–First announced at the United Nations Conference of the Parties Paris Climate summit in 2015, IDF was launched by the United Nations, World Bank and the insurance industry in 2016. It addresses the risks associated with catastrophic weather and climate-related hazards through the design and dissemination of solutions for risk-sharing and transfer to increase global resilience.

****Platform on Disaster Displacement**–Employing various data gathering mechanisms, this State-led Platform aims to address the protection needs of people displaced across boarders in the context of natural disasters and climate change. Its main goal is to implement the recommendations of the Nansen Initiative Protection Agenda of October 2015. (Source: https://www.agendaforhumanity.org/initiatives/3833)

****Inform (Index for Risk Management)**–Inform is a global, open-source risk assessment for humanitarian crises and disasters. Its model is based on three specific dimensions of risk: hazards and exposure, vulnerability and lack of coping capacity dimensions. (Source: http://www.inform-index.org/InDepth)

Source: Authors' compilation and elaboration of select initiatives for illustrative purposes.

From a public administration perspective, internal mechanics of governments and State capacity[41] are important in mainstreaming e-resilience into e-government frameworks. Mediating factors between formal and information institutions, such as management practices, task structures and standard operating procedures as well as the organizational, institutional and technological change across various layers of government, play a critical role. Also significant is the degree of embeddedness of public and disaster policies in e-government initiatives and the extent to which they can benefit the public sector.[42] Finally, central government leadership in promoting and implementing e-resilience initiatives is paramount. [43]

To ensure that no one is left behind, Member States, the private sector, civil society organizations and various other partners should ensure that e-resilience initiatives reach the vulnerable groups, including those in remote and rural areas. While exponential growth in mobile and fixed broadband availability has been seen across the globe, there are still countries with low connectivity and groups of people that are unconnected altogether. Where the services are available, the alert messages and information communicated should be understandable and take into consideration the various linguistic and cultural diversities. While many e-government initiatives seek to tackle these challenges, the need for such considerations becomes acute when a disaster strikes and there is no time to translate the alert in different languages.

3.5 Conclusions and Policy Recommendations

E-resilience and sustainable development are highly interrelated. E-resilience and the use of ICTs in disaster risk management are part of key e-government initiatives and, used together, can support both the Sendai Framework and the 2030 Agenda for Sustainable Development. Artificial Intelligence,

Box 3.9. United Nations Economic and Social Commission for Asia and the Pacific (ESCAP): Linking disaster risk management with e-resilience

Asia and the Pacific remains the region most affected by natural disasters. ESCAP has been assisting Member States in building their capacities to withstand disasters, including through enhanced e-resilience. Some of ESCAP's initiatives include:

a) Intergovernmental cooperation platforms such as the Asia-Pacific Information Superhighway Steering Committee (AP-IS) initiative, which promotes affordable broadband connectivity and network resilience to reduce disaster risk.[45]

b) Regional early warning systems such as the Regional Space Applications Programme for Sustainable Development in Asia and the Pacific (RESAP), which draws on space applications like satellite-derived imageries, geographic information system, big data; the Typhoon Committee and the Panel on Tropical Cyclones, established together with the World Meteorological Organization.

c) Advisory technical cooperation organisations such as the Pacific Centre for the Development for Disaster Information Management which addresses transboundary disasters including earthquakes, droughts, and sand and dust storms.

d) Advocacy and awareness-raising activities such as the ICT and DRR Gateway and the Asia-Pacific E-resilience Toolkit, online platforms which facilitate information sharing on the use of ICTs for disaster risk management and e-resilience.

e) Capacity building and training institutions and funds such as the Trust Fund on Tsunami, Disaster and Climate Preparedness, which strengthens institutional capacity for e-resilience in high-risk, low-capacity countries; and the Asian and Pacific Training Centre for ICT for Development, which trains government officials in disaster risk management and the use of ICTs.

Note: Figure shows some of the analytical research and publications produced by the ESCAP Secretariat to support the listed initiatives.

Source: http://www.unescap.org/

its associated digital technologies, space technology applications and geo-spatial technologies can buttress e-resilience initiatives contributing to all phases of disaster risk management.

Government leadership, both at national and local levels, also is vital. Disaster resilience in cities, particularly in the context of smart city ecosystems, is critical given that disasters pose higher risks for human and financial loss in urban than in rural areas.[44] The need for institutional and individual capacity development in designing and implementing e-resilience initiatives, particularly in countries in special situations, is significant. Some relevant initiatives come from ESCAP (Box 3.9).

Three key recommendations for policy-makers and practitioners working at the intersection of e-resilience and disaster risk management are the following:

Systematic and sustained efforts towards e-resilience

Knowing the specific disaster risks, and degrees and types of vulnerabilities is critical to designing and implementing appropriate e-resilience initiatives. If a country is on the path of seasonal cyclones or on a seismic zone, for instance, preparedness as well as measures for risk prevention and reduction will be different. Risk and vulnerability assessment is expected to identify infrastructure, data, applications, facilities and communities at risk, which will help design and improve e-resilience initiatives. Coherent and integrated ICT and disaster risk management policies should clearly map out organizational roles and responsibilities, including between central and local administrations. They should include budget allocations and division of tasks related to follow-up, monitoring and evaluation. They should harness and hone the instrumental role of emerging technologies for sustainable development. Systematic and sustained efforts will help mainstream disaster risk management for the implementation of both the Sendai Framework of Action and the 2030 Agenda for Sustainable Development.

Awareness raising, participation and capacity development

There are already capacity-building programmes, which assist government officials and partners in e-resilience, but awareness of disaster risks and e-resilience could be raised among ICT and disaster management authorities. Awareness-raising on emerging technologies, such as IoT, big data and cloud computing, deserves systematic support from international and regional partners, including the private sector, civil society and academia. There is also a need to go beyond tried-and-tested approaches and to include all citizens, in addition to technical experts, in a polycentric manner. Seeking and obtaining community buy-in early on, an approach which some have likened to "citizen science", is pivotal to the provision of extensive and real-time information for risk management (Paul and others, 2018). Such concerted efforts can prompt increased investment in e-resilience initiatives, including resilient infrastructure development and early warning systems. They can also ramp up ownership by linking knowledge management with resilience.

Sharing of good practices and lessons learned across the globe

Some disasters, such as floods, cyclones/typhoons and droughts are transboundary in nature. Glacial lake outbursts or monsoon rains upstream will have devastating impact in downstream areas and countries. Information and data sharing, coordination and cooperation in e-resilience among concerned countries are of utmost importance. Smaller economies might not have sufficient budgets or government manpower to take charge of all the phases of disaster risk management for all hazards. Resources such as remote sensing data collection and analysis could be supported through partnerships and global and regional cooperation.

This chapter presented a global and regional overview of natural disasters and their aftermath, and how those disasters affect regions and countries differently. Particularly worrisome are the inadequate coping mechanisms of countries in special conditions, such as landlocked and least developed countries, and small island developing States. This chapter also examined the global frameworks which encourage the mainstreaming of disaster risk concerns into all sectors, in cooperation with relevant stakeholders. It concluded that e-resilience through egovernment can be vital in managing disasters and their associated risks and in moving the world towards sustainable development.

References

1 Note: For reasons of space and scope, this chapter covers natural disasters, and excludes health and financial crises as well as man-made emergencies. It examines both sudden onset natural disasters such as earthquakes, and crises that unfold over a period of time, such as drought.

2 Note: Data is compiled based on various sources including Reliefweb, UNISDR and SwissRe.

3 Guha-Sapir, D., Hoyois, P., Wallenmacq, P. & Below, R. (2017). Annual Disaster Statistical Review 2016: The numbers and trends. Centre for Research on the Epidemiology of Disasters. Brussels. October 2017. Available at www.emdat.be/sites/default/files/adsr_2016.pdf

4 Note: Countries may have different capacities and procedures for systematic reporting. This may result in under-reporting of incidents. EM-DAT is considered one of the most comprehensive disaster databases. For more, see http://www.emdat.be/. Accessed in January 2018.

5 Note: In this chapter, Asia and the Pacific is defined by the countries covered by ESCAP. Please see the list at http://www.unescap.org/about/member-states

6 Note: According to the 2015 Global Assessment Report on Disaster Risk Reduction, "disaster risk is considered as a function of the severity and frequency of the hazard, numbers of people and assets exposed to the hazard, and of their vulnerability or susceptibility to damage." (UNISDR 2015).

7 ESCAP (2017a). Disaster Resilience for Sustainable Development. Asia-Pacific Disaster Report 2017. Available at: http://www.unescap.org/sites/default/files/publications/0_Disaster%20Report%202017%20High%20res.pdf

8 Note: The calculation depends on the economic value of the damaged facilities, properties and assets. EM-DAT guidelines on the measures can be found at http://www.emdat.be/explanatory-notes

9 ESCAP (2018). Broadband Connectivity in Pacific Island Countries. 15 January. Available at: http://www.unescap.org/resources/broadband-connectivity-pacific-island-countries

10 ESCAP (2017a). Disaster Resilience for Sustainable Development. Asia-Pacific Disaster Report 2017. p.7. Available at: http://www.unescap.org/sites/default/files/publications/0_Disaster%20Report%202017%20High%20res.pdf

11 UNISDR (2015). Multi-hazard Average Annual Loss. Humanitarian Data Exchange. Available at: https://data.humdata.org/dataset/multi-hazard-average-annual-loss.

12 Note: The high-income economies of Australia, New Zealand and New Caledonia were excluded to highlight the issues of low-income countries with special needs.

13 Note: The sector includes private and public corporations, including Telecom Fiji Limited (TFL), state-owned and the sole provider of fixed-line telephone services; two mobile service operators (Vodafone and Digicel); two broadband service providers (Connect and Unwired); and other ICT support services (including televisions and radio broadcasters).

14 World Meteorological Organization (2017). Shoring up early warning systems for Asia-Pacific SIDS. Available at: https://public.wmo.int/en/media/news/shoring-early-warning-systems-asia-pacific-sids

15 United Nations (2015). Sendai Framework for Disaster Risk Reduction 2015-2030. Geneva: Switzerland. pp. 12-14. Available at: https://www.unisdr.org/files/43291_sendaiframeworkfordrren.pdf

16 ESCAP (2016a). Building e-resilience, Enhancing the role of ICTs for Disaster Risk Management (DRM). Available at: http://www.unescap.org/resources/building-e-resilience-enhancing-role-icts-disaster-risk-management-drm

17 ESCAP (2016). Space application as a critical tool for enhanced e-resilience. 15 August. E/ESCAP/CICTSTI(1)/5. Available at: http://www.unescap.org/sites/default/files/Space_applications_as_a_critical_tool_for_enhanced_e-resilience_Eng.pdf and ESCAP (2016). ICT in Disaster Risk Management Initiatives in Asia and the Pacific. 4 March. Available at: www.unescap.org/sites/default/files/ICT4DRR%20Iniatives%20in%20Asia-Pacific_0.pdf

18 Note: This section draws on research and publications of ESCAP, including, notably, the Report found at http://www.unescap.org/sites/default/files/Space_applications_as_a_critical_tool_for_enhanced_e-resilience_Eng.pdf

19 UNISDR (2009). 2009 UNISDR terminology on disaster risk reduction. p.24. Available at: https://www.unisdr.org/we/inform/publications/7817

20 Heeks, R. & Ospina, A. (2018). Conceptualizing the Link Between Information Systems and Resilience: a developing country field study. Information Systems Journal. 29 January. DOI: 10.1111/isj.12177

21 ESCAP (2016). Space application as a critical tool for enhanced e-resilience. 15 August. E/ESCAP/CICTSTI(1)/5. Available at: http://www.unescap.org/sites/default/files/Space_applications_as_a_critical_tool_for_enhanced_e-resilience_Eng.pdf and ESCAP (2016). ICT in Disaster Risk Management Initiatives in Asia and the Pacific. 4 March. Available at: www.unescap.org/sites/default/files/ICT4DRR%20Iniatives%20in%20Asia-Pacific_0.pdf

22 National Center for Hydrology and Meteorology Royal Government of Bhutan (2013). Flood Early Warning. Available at: http://www.hydromet.gov.bt/?q=warning

23 ESCAP (2016). Space application as a critical tool for enhanced e-resilience. 15 August. E/ESCAP/CICTSTI(1)/5. Available at: http://www.unescap.org/sites/default/files/Space_applications_as_a_critical_tool_for_enhanced_e-resilience_Eng.pdf and ESCAP (2016). ICT in Disaster Risk Management Initiatives in Asia and the Pacific. 4 March. Available at: www.unescap.org/sites/default/files/ICT4DRR%20Iniatives%20in%20Asia-Pacific_0.pdf

24 Note: Preliminary regression analysis is available upon request. It is an assessment based on one point in time, i.e., 2016 data of the UN E-government Survey. Two questions were examined based on the data from the UN E-government Survey dataset:(i) Do countries currently providing e-government services on weather or health related information minimize deaths incurred from natural disasters? (ii)Do countries with better broadband connectivity deliver more effective e-government services, thereby

minimizing deaths emanating from natural disasters? To examine these two questions, two binary (yes/no) variables from the UN E-government Survey 2018 dataset were used as independent variables: (i). Can people subscribe (via SMS, an email list, etc.) to keep updated about weather? and (ii). Can users subscribe to updates or alerts on Health services?). F-test was found to be statistically significant (p-value<0.01) for both dependent variables. In addition, the model specified was found to explain a high variation of the dependent variable—number of deaths of natural disasters (Adjusted-R2 = 0.73) for both the fixed broadband and mobile broadband variables.

25 ESCAP (2016). Space application as a critical tool for enhanced e-resilience. 15 August. E/ESCAP/CICTSTI(1)/5. Available at: http://www.unescap.org/sites/default/files/Space_applications_as_a_critical_tool_for_enhanced_e-resilience_Eng.pdf and ESCAP (2016). ICT in Disaster Risk Management Initiatives in Asia and the Pacific. 4 March. Available at: www.unescap.org/sites/default/files/ICT4DRR%20Iniatives%20in%20Asia-Pacific_0.pdf

26 ESCAP (2017b). Artificial Intelligence and Broadband Divide: State of ICT Connectivity in Asia and the Pacific 2017. 27 October. p.6. Available at: http://www.unescap.org/resources/artificial-intelligence-and-broadband-divide-state-ict-connectivity-asia-and-pacific-2017

27 Note: This composition is determined using the framework developed by the Korean Ministry of Science, ICT and Future Planning, "Mid- to Long-Term Master Plan in Preparation for the Intelligent Information Society: Managing the Fourth Industrial Revolution", Available at: http://www.msip.go.kr/dynamic/file/afieldfile/msse56/1352869/2017/07/20/Master%20Plan%20for%20the%20intelligent%20information%20society.pdf.

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32 Note: For more, see athttp://www.earthquakenewz.com/10-strongest-earthquakes-in-history and https://www.usnews.com/news/world/articles/2016-04-17/the-worlds-strongest-earthquakes-since-1900

33 Center for Excellence in Disaster Management & Humanitarian Assistance (2017). Chile. Disaster Management Reference Handbook. Available at: https://reliefweb.int/sites/reliefweb.int/files/resources/Chile-2017-draft6-lowres.pdf.

34 Prutsalis, M. (2010). Developing a service industry to support the Sahana disaster management system. Technology Innovation Management Review. December 2010. Available at: http://www.timreview.ca/article/400

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36 Lu, X., Bengtssona, L. and Holmea, P. (2012) Predictability of population displacement after the 2010 Haiti earthquake. PNAS, 109(29), p. 11576–11581. Available at: http://www.pnas.org/content/pnas/109/29/11576.full.pdf.

37 Note: For more, see https://github.com/qcri-social/AIDR/wiki/AIDR-Overview

38 Note: UNESCO's programme for Water and Development Information for Arid Lands – a Global Network (G-WADI)

39 Note: For more, see http://stream.princeton.edu/AWCM/WEBPAGE/interface.php

40 Note: SPC stands for segregated portfolio company

41 Fountain, J. E. (2007). Bureaucratic Reform and E-Government in the United States: An Institutional Perspective, NCDG Working Paper, 07(006). Available at: https://scholarworks.umass.edu/ncdg/7/

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45 Note: Other such committees and platforms include Committees on Information and Communications Technology, Science, Technology and Innovation and on Disaster Risk Reduction, Asia-Pacific Forums on Sustainable Development, and others.

Building the resilience of e-government

4.1. Introduction: Need for a resilient e-government system

Internet use has proliferated since its inception. By 2017, it was estimated that 3.7 billion people, approximately half of the world's population, have access to and continuously use the Internet.[1] With big data, machine learning, and the Internet of Things, some experts anticipate that the number of Internet connections may grow to nearly a trillion by 2035.[2] Similarly, there has been an ever increasing amount of government services that are conducted online. Egovernment development by Member States has progressed with the use of the latest tools and Internet technologies as featured in the current and past editions of the *United Nations E-Government Surveys*. Digital technologies and e-government have provided advanced tools and resources for governments to deliver public services, engage citizens in policy making, improve transparency and monitor development plans. As these tools increasingly become more essential for a dependable and smooth flow of services, threats of disruption, such as cyber-attacks or natural disasters, are never far behind.

The multiplicity of uses of these tools and resources varies across governments, whose individual departments often introduce diverse levels of coherence and consistency among the adopted ICT approaches to service delivery. A disjointed approach also results in degrees of risk, relating to technological threats across the different organizations, departments, systems, platforms and applications.

It is important, therefore, for governments to improve management of ICT-driven approaches for the sake of continuity of online services as well as to protect people's data and privacy. This requires robust platforms that are resilient to cyber-attacks, other threats and emergencies such as natural disasters, including fires, floods and earthquakes. Deployment of ICT mechanisms increases transparency, trust, security and stability in the cyber environment. There is also a tendency to connect technologies and tools to create an open-source computing platform that brings together governments, citizens and innovative companies.[3,4]

Although, constant development and deployment of resilient ICT tools indisputably boosts egovernment services, technology, by its nature, spawns threatening side effects. Rapid technological developments and globalization have brought new challenges for the protection of sensitive information and personal data. This requires a decidedly stronger and more coherent framework of protection at national and international levels, backed by effective enforcement. At the national level, creating a comprehensive cybersecurity framework implies a thorough analysis of Internet-infrastructure dependencies and vulnerabilities. Thus, Member

Photo credit: pixabay.com

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States should continue to adopt appropriate measures aimed at reducing the risk of cybersecurity attacks. As United Nations Secretary-General António Guterres said, governments and international organizations may not be prepared for rapid developments in the cyber environment, and existing regulations on how to address cybercrime may no longer be applicable. The growing rate of cybersecurity attacks is a vivid example of how Internet capacities are being used, not only for the benefit or empowerment of societies, but also to "degrade and enslave".[5] Considering the fast pace of cyber technology development, it is imperative to amend the existing legal frameworks so as to protect individual privacy, enhance cooperation among government bodies and address the problems stemming from cybercrime.

This chapter introduces a new concept of e-resilience modelled on the Global Cybersecurity Index (GCI) of the International Telecommunication Union (ITU), which assesses the legal, technical, organizational, capacity-building and cooperation frameworks necessary to ensure a robust and resilient e-government system. It also includes a discussion on the use of cybersecurity in improving e-government resilience.

Moreover, the chapter discusses the digital transformation of governments towards e-governance, wherein a clear vision of digital technology and the Internet is essential. It notes the importance of investing in new technologies such as cloud computing to ensure ongoing access to systems and records, and to protect data assets in case of damage to facilities, regardless of the level of e-government development. Attention to cybersecurity is important, as without it, disastrous data breaches can occur. Undoubtedly, recognizing the importance of this domain benefits the e-government system. However, this requires not only a change in existing procedures, but also in the behaviour of public servants. Civic engagement should not be overlooked, as it is critical to the system's functioning.[6] It is also crucial for agencies to create a feedback mechanism for cooperation aimed at sharing knowledge and best practices.

4.2. Global view in cybersecurity

Over the past several years, experts and policymakers have expressed increasing concerns about cyberattacks. Secretary-General Guterres, in his address to the Opening Ceremony of the Munich Security Conference, referred to the lack of response to the cybersecurity threat as an existential threat to humankind.[7]

There is a broad agreement among researchers that modern day e-government systems are susceptible to cyber threats. It is estimated that the cost of addressing cybercrime will double from $3 trillion in 2015 to $6 trillion by 2021. One reason is the increasing interdependence of ICT devices and components, where the disruption of one may cascade and affect many other services. More than a third of cybersecurity breaches are caused by "successful" exploitation of known vulnerabilities. Cyberattacks vary, but their effects can be devastating. For example, in May 2017, the "WannaCry" ransomware attack affected 150 countries, wreaking havoc on societies and resulting in financial damages. This included the United Kingdom, where the National Health Service (NHS) systems were targeted. At least 81 of the 236 NHS organizations known as "trusts" were affected, destroying key medical equipment and risking patient safety.[8] The economic impact of that cyberattack was estimated to be more than $100 million.[9]

Other types of cybercrimes are also costly and erode gross domestic product (GDP). For example, the Netherlands lost 10 billion euros to e-crime, identity and intellectual property theft, which eroded its GDP by 2 per cent. Intellectual property theft alone caused a loss of $300 billion in the United States, while Germany lost 24 billion euros.[10]

The response to the aforementioned attacks has been an increase in global spending on cybersecurity products and services. Cybersecurity Ventures predicts that worldwide, this will exceed $1 trillion cumulatively by 2021.[11] It is also predicted that global spending on security awareness training for employees will reach $10 billion by 2027, up from some $1 billion in 2014. Such investments are aimed at expanding ICT use in cybersecurity strategies and preventing future damage from cyberattacks. Long-term economic opportunity, however, lay in modernizing industrial infrastructure, the cost of which is estimated at $32 trillion.

The Global Cybersecurity Index (see Box 4.1) developed by the International Telecommunication Union can serve as reference for government officials in the process of designing secure egovernment systems. Through use of the Index, governments can assess progress in the effective deployment of ICTs and development of cybersecurity strategies. It provides governments with an assessment of the level of their cybersecurity wellness and offers solutions to addressing e-government risks. More specifically, the Index measures the type, level and evolution of cybersecurity commitment in countries,[12] which will eventually give experts an opportunity to assess the performance of those commitments from both regional and global perspectives.

It is crucial to protect critical information infrastructures, or CIIs, the interconnected information systems and networks, the disruption or destruction of which, would seriously impact the health, safety, security, the economic well-being of citizens, and potentially, the effective functioning of the government or economy. Also essential for a nation's security is a well-established and protected CII framework that interacts well with the government. Thus, in designing e-government systems, it is important to consider CIIs and how these may affect online services. Given the need to protect information infrastructures from risk or threat, government officials must be made aware of the potential devastating effects of its disruption, so as to improve the effectiveness of mitigation.

The Global Cybersecurity Index 2017 reveals that 50 per cent of the surveyed countries have no cybersecurity strategy, and only 25 per cent have legislation or regulation that impose the implementation of cybersecurity measures on CIIs. It was also found that only 31 per cent of the subject countries included a section on the protection of CIIs in their cybersecurity strategy. These

Box 4.1. ITU Global Cybersecurity Index[13]

The Global Cybersecurity Index is a composite Index combining 25 indicators into one benchmark measure to monitor the cybersecurity commitments of the 193 ITU Member States in the five pillars identified by high-level experts (see Figure 4.2). It revolves around the Global Cybersecurity Agenda,[14] a framework for international cooperation launched by the International Telecommunication Union in 2007 to enhance confidence and security in the information society.[15] A first iteration of the global Index was conducted between 2013 and 2014, in partnership with ABI Research, to which 105 out of 193 ITU Member States responded. The outcome was published in 2015. Following feedback received from various communities and Member States, a second iteration with more in-depth analysis was prepared in 2016. Participants included Member States, and interested individuals, experts and representatives from contributing partners such as the World Bank, the Red Team Cyber from the Australian Strategic Policy Institute, FIRST, Indiana University, the International Criminal Police, the ITU-Arab Regional Cybersecurity Centre in Oman, Korea Internet and Security Agency, National Telecommunications Regulatory Authority of Egypt, The Potomac Institute of Policy Studies, United Nations Interregional Crime and Justice Research Institute, University of Technology Jamaica, and the United Nations Office on Drugs and Crime. As a result of the high-level attention of Member States, media and other interested bodies who believe in the vision of the Global Cybersecurity Index, ITU is compiling a third iteration with an even broader multi-stakeholder participation.

Source: https://www.itu.int/en/ITU-D/Cybersecurity/Pages/GCI.aspx

results call for measures that will not only create awareness among governments of their position in the digitized world, but also ensure more resilient e-government systems and secure CIIs.

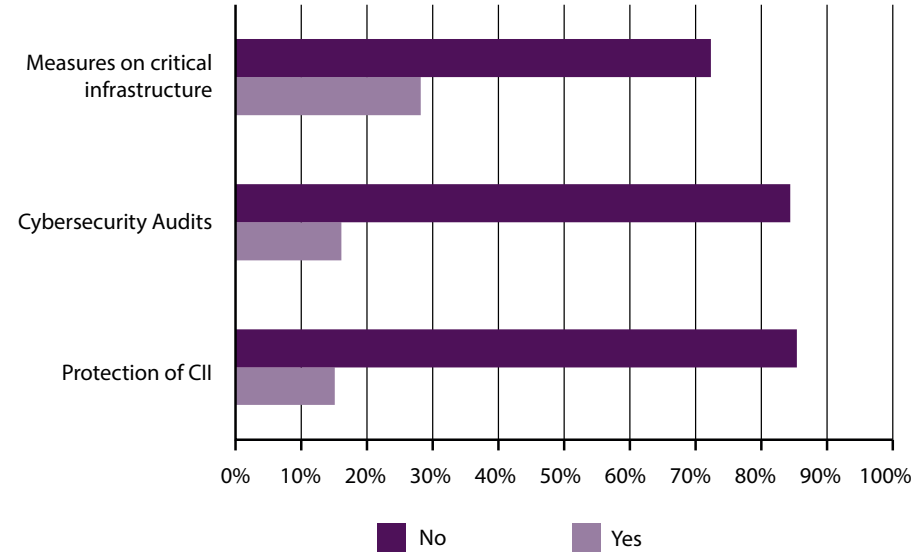
Table 4.1. Top 10 Member States with the highest commitment to cybersecurity

Country	GCI Score	Legal	Technical	Organizational	Capacity Building	Cooperation
Singapore	0.92	0.95	0.96	0.88	0.97	0.87
USA	0.91	1	0.96	0.92	1	0.73
Malaysia	0.89	0.87	0.96	0.77	1	0.87
Oman	0.87	0.98	0.82	0.85	0.95	0.75
Estonia	0.84	0.99	0.82	0.85	0.94	0.64
Mauritius	0.82	0.85	0.96	0.74	0.91	0.70
Australia	0.82	0.94	0.96	0.86	0.94	0.44
Georgia	0.81	0.91	0.77	0.82	0.90	0.70
France	0.81	0.94	0.96	0.60	1	0.61
Canada	0.81	0.94	0.93	0.71	0.82	0.70

Source: ITU, GCI Report 2017

Table 4.1. above shows the top 10 countries ranked according to their GCI score. It is clear that geographical location is irrelevant when it comes to cybersecurity commitments. These ten countries managed to establish coherent cybersecurity strategies while significantly improving their ICT mechanisms. Since these Member States are leaders in their regions, they could foster the creation and development of different forms of collaboration with neighbouring countries to improve regional cybersecurity cooperation.

Figure 4.1. Percentage of countries with CII protection included in their legislation or cybersecurity strategy



Source: ITU GCI report 2017

As seen in Figure 4.1. above, only less than one-fifth of United Nations Member States included protection of critical information structures in their legislation or cybersecurity strategy. Similarly, less than one-fifth conduct cybersecurity audits and have measures on critical infrastructure.

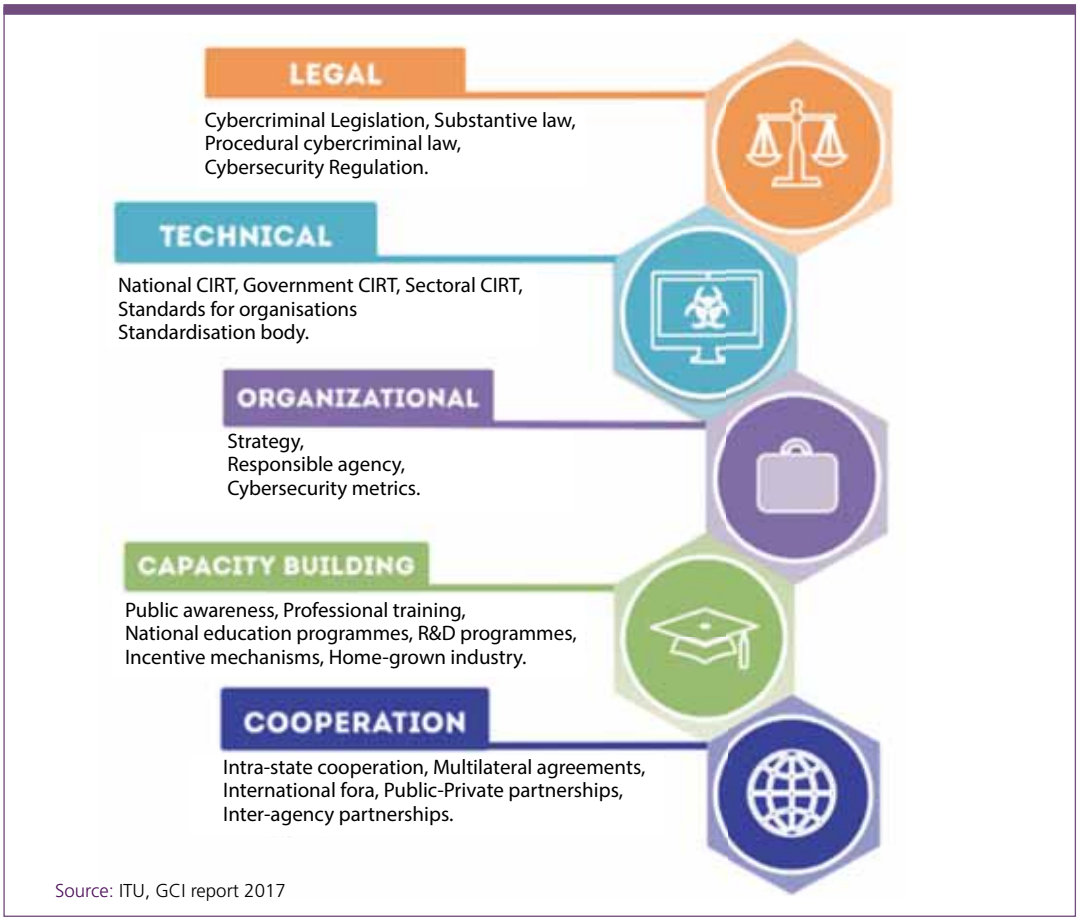
Critical information protection secures communications or information services that are essential to the functioning of a modern economy.[16] For example, the Australian Privacy Principle Act posits that all eligible entities "must take reasonable steps to protect personal information it holds from misuse, interference and loss, as well as unauthorized access, modification or disclosure."[17]

National protection of critical information infrastructures presents an organized view of strategic information services and available infrastructure resources. This requires an assessment of potential risks, threats and information components supporting critical infrastructures. It also defines risk management protocols essential to the health of the national economy and mitigates possible risks. Protection protocols overall have positive long-term stabilizing effects[18], whereas insufficient protection provides criminals with opportunities to exploit online vulnerabilities and conduct cyberattacks.

4.3. Designing a secure e-government system

There are five main pillars in ITU's Global Cybersecurity Agenda (see Figure 4.2) that lay a solid foundation for the creation of a secure e-government system – legal, technical, organizational, capacity building and cooperation. These measure different aspects of government cybersecurity

Figure 4.2. Five Pillars of ITU's Global Cybersecurity Agenda



Source: ITU, GCI report 2017

commitment as well as the progress with which governments ensure the confidentiality, integrity and availability of online information. The legal pillar seeks to develop advice on how criminal activities committed over ICTs could be dealt with through legislation in an internationally compatible manner. The technical pillar focuses on key measures for addressing vulnerabilities in software products, including accreditation schemes, protocols and standards. The organizational pillar considers generic frameworks and response strategies for the prevention, detection, response to and crisis management of cyberattacks, including the protection of countries' critical information infrastructure systems. The capacity-building pillar elaborates strategies for raising awareness, transferring know-how and boosting cybersecurity on the national policy agenda. The cooperation pillar aims to develop a strategy for international cooperation, dialogue and coordination in dealing with cyberthreats. All five foundational components work synergistically to ensure cybersecurity.

4.3.1. Legal framework

Legal measures allow governments and other stakeholders to define basic response mechanisms to cyberattacks, including within e-government systems. These mechanisms may involve investigation and prosecution of crimes and violation of norms, leading to the imposition of sanctions for non-compliance and legal breaches by nefarious agents or entities. A legislative framework sets the minimum standards of behaviour across the board, applicable to all, upon which further cybersecurity capabilities can be built. Ultimately, the goal is to enable all nations to have adequate legislation to harmonize practices and offer a setting for interoperable measures that facilitate international combat against cybercrime.

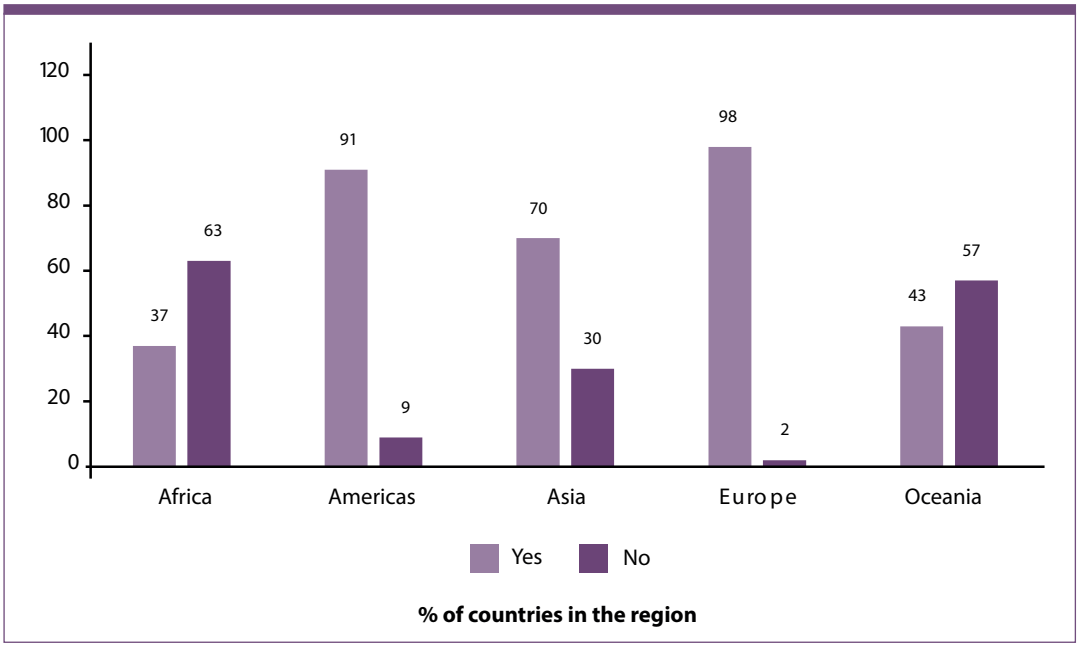
As Figure 4.3. shows, all European countries have cybersecurity legislation and regulations in place. However, only 60 per cent provide training in cybersecurity. The majority of countries in the Americas and Asia have both legislation and regulations. Oceania has the lowest indicators in all three categories. Notably, all regions have relatively low cybersecurity training indicators.

Figure 4.3. Total number of Member States with laws related to cybercrime in 2017

Source: ITU, GCI report 2017

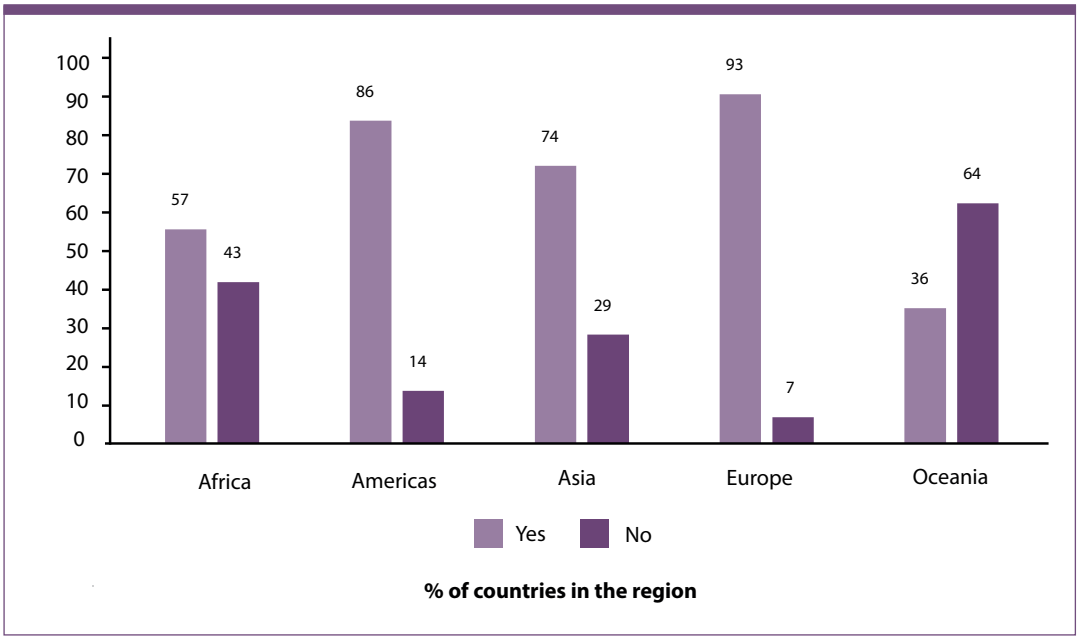
Figure 4.4. shows that 133 out of 193 United Nations Member States, or about 69 per cent, have laws pertaining to citizens' rights to access government information online. Of these countries, 20 are in Africa, 32 are in the Americas, 33 are in Asia, 42 are in Europe and 6 are in Oceania. As many as 34 African countries do not have government information or laws on citizens' rights to access it online. It is also absent in Cuba, Cyprus, Haiti, Monaco and Suriname.

Figure 4.4. Percentage of countries with Access to Information Act



As seen in Figure 4.5., the *United Nations E-Government Survey* highlights that 141 Member States, or 73 per cent, have legislation on personal data protection online. While the legislation may be available in the remaining 52 countries, this information is not accessible online.

Figure 4.5. Personal data protection legislation available online



Data protection is vital since it ensures the privacy of individuals, communities, and specific groups, and protects them from unauthorized surveillance and discriminatory monitoring. Personal data protection is regulated differently in every country. In Europe, the law protects personal data regardless of the technology used for processing that data.[19] In fact, the European Union is considered to have the strongest legal privacy provisions.[20] General Data Protection Regulation will be enacted in the Union in 2018, which will significantly affect data collection and analysis procedures.

Box 4.2. Data Protection Act of Switzerland

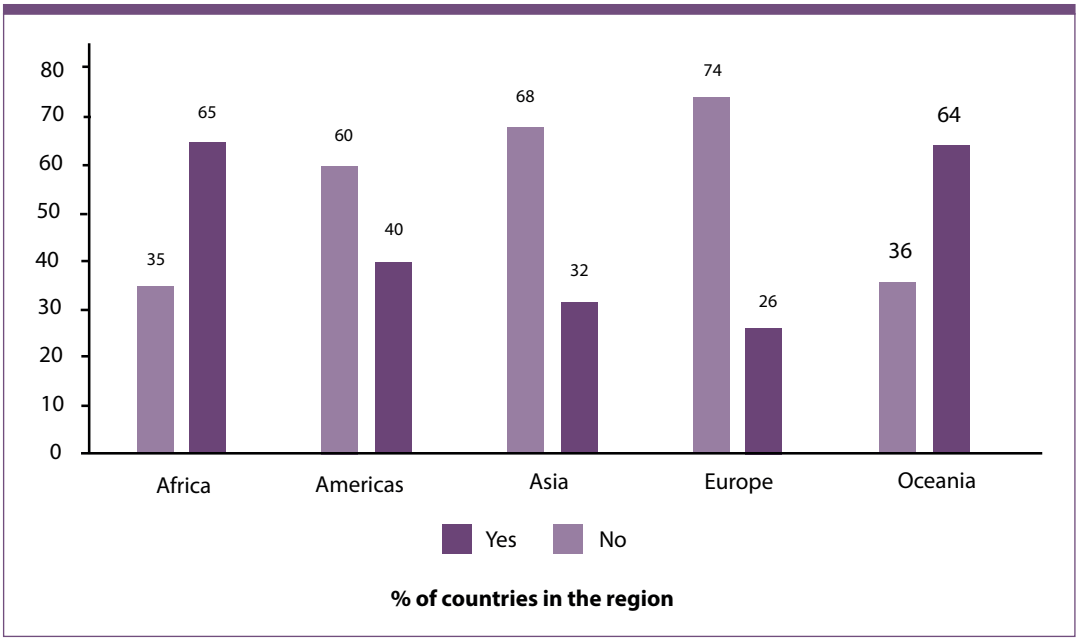
In 2017, the Swiss government issued a preliminary draft of a new Data Protection Act intended to amend existing provisions on digital technology and strengthen personal data protection. It was also crafted to maintain the European Commission knowledge of ways of securinf the free flow of personal data between the European Union countries and Switzerland.

Source: https://www.swlegal.ch/files/media/filer_public/68/68/6868d658-d977-41f0-948f-7468edcb8931 news_alert_september_2017_english.pdf

There are multiple ways of reducing the risks of breaches and unauthorized data retrieval. For starters, personal and sensitive data should be kept at minimum. All personal data could be encrypted and stored during a specific relevant period and destroyed thereafter. The number of actors involved in data collection and storage should be minimized with the assistance of trustworthy and reliable organizations. In order to mitigate risks to the integrity and continuity of available data, replications could be produced and stored off-site, domestically or abroad. The United States State Department and the Estonian Government have already implemented this strategy to ensure data security and the smooth operation of their e-government services.[21]

Figure 4.6. below shows that only 109 Member States have cybersecurity legislation, compared to the information in Figure 4.5., which highlights those with laws on access rights. Majority of the Member States in Asia and Europe have cybersecurity legislation online, while only 13 countries in Africa, 12 in the Americas and 4 in Oceania have it online.

Figure 4.6. Countries with cybersecurity legislation online



4.3.2. Organizational framework

It is important for Member States to have a cybersecurity strategy, a coordinating agency and a compilation of indicators for tracking cybercrime.

Governments should design and execute a robust cybersecurity strategy so as to secure its E-government system. An effective strategy should include the protection of critical information infrastructure and a national resiliency plan. Box 4.3. highlights the United Kingdom organizational framework for cybersecurity. The strategy's formulation should also be open for consultation with all the relevant stakeholders to create trust and transparency in the government and ensure that all reap the benefit. Ideally, cybersecurity strategies should be aligned with the national e-government strategy.

Governments also should consider establishing national agencies responsible for ensuring coherence in putting cybersecurity strategies into action and assessing their efficacy. This needs to be complemented by a commitment to human resource development and leadership. Without a national cybersecurity strategy, a governance model and a supervisory body, the efforts of various sectors and industries can become disparate and disconnected, which could thwart efforts to attain national harmonization and increase e-government resilience in the event of a cyberattack.

Equally important is the compilation of indicators for tracking cyber incidents. Measuring progress is vital, as is observing current and past trends, and putting in place appropriate future actions to implement a secure e-government system and develop further cyber strategies. The Netherlands uses metrics to measure its cybersecurity development, the result of which is summarized in the Cyber Security Assessment Netherlands report.[22] Their National Cyber Security Centre compiles disclosure reports, security advisories and incidents using a registration system. The metrics allow trends to be observed and addressed.

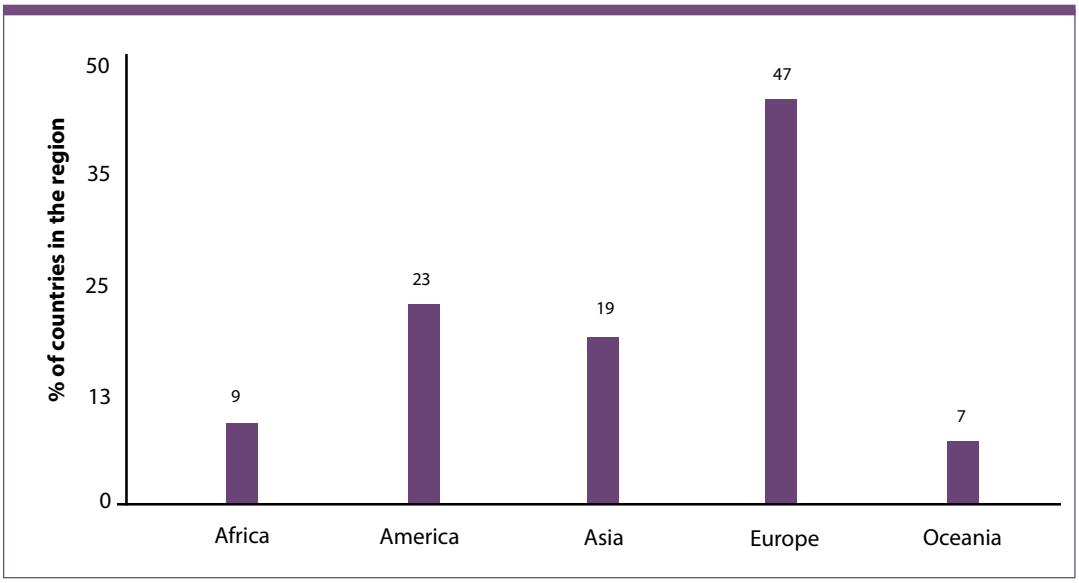
The presence of cybersecurity metrics is an indication that a country has a legally recognized set of measures to provide balanced and unbiased data on the performance of cybersecurity development. Such measures provide crucial data that better equip both the private and public sectors for further administrative decisions regarding e-government system upgrades. Figure 4.7. illustrates the relationship between the high presence of cybersecurity metrics in Europe and the region's advanced level of ICT mechanisms implementation.

Box 4.3. National Cybersecurity Strategy of the United Kingdom

The **United Kingdom** issued its second five-year National Cyber Security Strategy in 2016. The Strategy, established by the Cabinet Office, aims to make the country one of the safest places in the world for online business. Compared to its first Strategy, the new one has doubled its investment in cybersecurity. Some of its main objectives is to make United Kingdom more resilient to cyberattacks, enhance stable cyberspace in support of open societies, and create a stable and secure place for conducting business in cyberspace. All of these goals are directly related to the further development of e-government and cybersecurity, involving both private and public sectors.[23]

Source: https://www.gov.uk/government/publications/national-cyber-security-strategy-2016-to-2021

Figure 4.7. Countries with cybersecurity legislation online

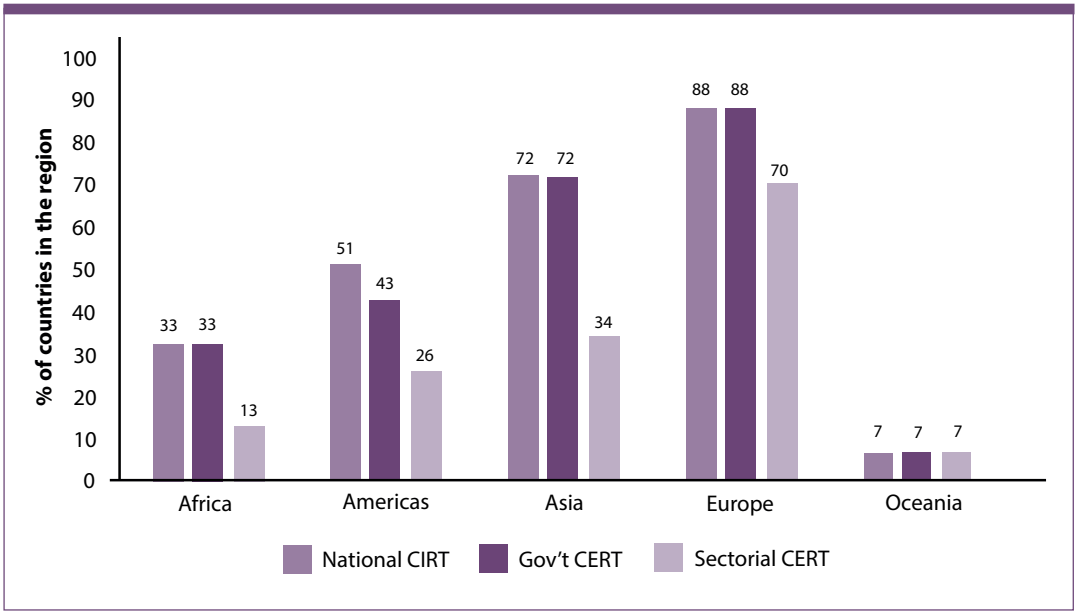


4.3.3. Technical framework

Establishing strong security features in communication networks and increasing resilience against network attacks involving access, modification or service denial, are prerequisites for successful e-government development. Threats to network security such as cyber terrorism, cyber espionage, advanced persistent threats, blended threats and others, are the result of the fast and continuous evolution in technology. Firewalls, antivirus software, Internet security software suites, antimalware, encryption and security fencing are among the measures used to prevent network security from being compromised. To ensure a more reliable and secure e-government system, governments must put in place a computer emergency response team (CERT) or a computer security incident response team (CSIRT) that responds to computer or cybersecurity incidents solely affecting government institutions. Also wise is to have specific government institutions, which protect the nation's entire infrastructure, including that of academia and the civil sector. Box 4.4. and Box 4.5. illustrate cases from United Arab Emirates and Georgia.

Figure 4.8. illustrates the presence of CSIRT as well as government and sectoral CERTs. The highest presence of these teams is in Europe followed by Asia, while Africa and Oceania have the lowest presence.

Figure 4.8. Regional view of CERT/CIRT/CSIRT



Box 4.4. The National Computer Emergency Response Team of the United Arab Emirates

The United Arab Emirates develops actionable intelligence from analysis of threat, incident and vulnerability data. It also provides constituents with proactive services in the form of preliminary alerts, remediation and recovery from security incidents, and advisories to improve the infrastructure as well as related security processes of their clients or citizens before an event occurs. The national CERT acts as the central point in disseminating information and advises all affected entities during high-profile targeted cyberattacks against critical national infrastructure. It also provides forensics services, including digital forensics investigations, computer forensics and mobile device forensics, data recovery and data wiping.

Source: https://www.tra.gov.ae

Box 4.5. Information Security Policy in Georgia

Georgia has established the Legal Entity of Public Law Data Exchange Agency as part of its Ministry of Justice. The Agency is tasked with establishing an infrastructure for data exchange for both public and private sectors and to implement its information security policy. Moreover, the national CERT of Georgia operates under the Agency and is responsible for handling critical incidents that occur within Georgian governmental networks and critical infrastructures. Georgia also established the Cyber Security Bureau, under its Minister of Defence. It is responsible for cybersecurity in the defence sector. The Council for State Security and Crisis Management acts on the national level as a coordinating body and operates directly under the Prime Minister.

Source: Government of Georgia, 2017

A well-designed cloud computing strategy can be made cost-effective by sharing platforms across various e-government applications, increasing resource utilization and providing scalability. Cloud computing can further increase the capacity for integration and interoperability across egovernment systems. In addition, by analyzing huge volumes of data, cloud computing allows for accelerated fraud detection capabilities, which provides opportunities to address corruption in the public sector.[24] While a proactive cloud computing strategy improves services, optimizes processes and gives more

opportunities for citizens to interact with the government, it comes with certain challenges. Hence, regular security audits should be performed to ensure proper functionality and system security. Furthermore, backups and restoration features should be in place to prevent data loss or absence of connection during natural disasters or similar events.

4.3.4. Capacity building and Cooperation

The cybersecurity of e-government systems requires inputs from all sectors and disciplines, given the rising interdependence of big data, machine learning and the Internet of things that are incorporated within the system. This includes cooperation at the intergovernmental level, among agencies at the national level, with the private sector, civil society and academia. Constant dialogue and sharing of best practices are necessary in responding to or defending against a cyberattack. Greater cooperation initiatives can enable the development of much stronger cybersecurity capabilities, help deter persistent online threats, and enable better investigation, apprehension and prosecution of malicious agents.

A good example for cooperation is taking place in Australia where the Government, business and the research communities are working closely to advance the country's cybersecurity agenda. The Government has directed resources towards increasing the number of cybersecurity professionals, and it has invested in tertiary education competitions. Beyond this, it is partnering with various sectors to improve and share cybersecurity information. This is further facilitated through the convening of annual cybersecurity leaders' meetings.[25]

Similarly, Azerbaijan has established an Electronic Security Centre, or CERT, which identifies cyber security threats and raises national awareness of existing and emerging threats. In collaboration with the national operator, the Ministry of Communications and Information Technologies and other authorities, this CERT conducts preventive measures to counter cyber threats and secure cyberspace.

The table below lists various international networks on e-government and cybersecurity providing platforms for hosting dialogues among governments concerning digitization. As egovernment cannot operate effectively without collaborating with organizational structures, it is essential for governments in transition to actively participate in these networks.

Table 4.2. Global cybersecurity activities

- The **United Nations Group of Governmental Experts on Developments in the Field of Information and Telecommunications in the Context of International Security (UN GGE)** was established with the aim of examining existing and potential threats from cybersphere and possible cooperative measures to address them. The mandate of the Group was reconfirmed in 2009, 2011, 2013 and 2015. The main outcome of the UN GGE 2013 Report was the reconfirmation of the principle that existing international law(s) apply to the use of ICT by States. In addition, the 2015 Report contained new provisions on norms and principles of responsible State behaviour in cyberspace, specifying, for example, that a State should not conduct or knowingly support ICT activity that intentionally damages or otherwise impairs the use and operation of critical infrastructure. The fifth UN GGE ended its fourth and final session in June 2017 without a consensus on a final report, leaving the dialogue on the conduct of States in cyberspace open.

- Cybersecurity has been very prominent in the agenda of the **Internet Governance Forum (IGF)** since its first meeting in 2006. The 2017 Best Practices Forum on Cybersecurity examined how a well-developed cybersecurity strategy helps to create an enabling environment for ICTs and Internet technologies to contribute towards achieving the SDGs.

- A fundamental role of ITU, based on the guidance of the World Summit on the Information Society and the ITU Plenipotentiary Conference, is to build confidence and security in the use of information and communication technologies. At the World Summit, world leaders entrusted ITU to be the Facilitator of Action Line C5, "Building confidence and security in the use of ICTs", in response to which, in 2017, ITU launched the Global Cybersecurity Agenda as a framework for international cooperation in this area.

- **The Global Forum on Cyber Expertise** has emerged as a series of conferences discussing principles related to governing behaviour in cyberspace. The first conference was held in London in 2011, followed by Budapest in 2012; Seoul in 2013; The Hague in 2015; and New Delhi in 2017.

- **The Global Commission on the Stability of Cyberspace** was inaugurated in 2017, with the mission to develop proposals for norms and policies to enhance international security and stability and to guide responsible State behaviour in cyberspace. It is composed of 27 Commissioners representing a wide range of geographic regions, as well as representatives from governments, the private sector, technical and civil society stakeholders.

4.4. Conclusion

The main conclusions of this Chapter are as follows:

- First and foremost, the adoption of a regionally and internationally harmonized set of legislation against the misuse of ICTs for criminal or other nefarious purposes is critical to providing a common regulatory basis, whether on prohibiting criminal conduct or establishing minimum regulatory requirements. Legal measures should allow each State to establish the basic response mechanisms to data or system breaches. Ultimately, the goal is to enable all States to have adequate legislation in place to harmonize practices internationally and to offer a setting for interoperable measures, thus, facilitating international combat against cybercrime.

- Organizational measures are necessary for the proper implementation of any national initiative. At the initial phase of transformation, a government should incorporate cybersecurity and risk management as an essential component of the e-government systems. A sub-section on the implementation of cybersecurity should be constituted to enhance security and protection in e-government. A national cybersecurity strategy, governance model and supervisory body should be created parallel to the e-government strategy to overcome attempts by various sectors to foil efforts to attain national harmonization in e-government development. A broad strategic objective should be set along with a comprehensive plan for implementation, delivery and measurement.

- Technology is the first line of defense against cyber threats and malicious online agents. Without adequate technical measures and the capabilities to detect and respond to cyberattacks, e-government systems and their respective entities are vulnerable. The emergence and success of ICTs can only truly prosper in a climate of trust and security. Governments therefore need to be capable of developing strategies to establish accepted minimum security criteria and accreditation schemes for software applications and systems. Moreover, governments must regularly assess systems to ensure that security precautions are being implemented by establishing a CIRT/CERT/CSIRT with a national responsibility capable of identifying, defending, responding to and managing cyber threats. Alongside these efforts, a national entity focused on dealing with cyber incidents should be created, or, at the very least, a responsible government agency be mandated to watch, warn and respond to incidents. The same agency could also provide support for the development of an organizational structure needed for coordinating responses to cyberattacks.

- With the increasing interest in knowledge-sharing and transfer in organizations, cooperation through collaboration and communication among relevant stakeholders such as central governments, local public authorities, the private sector, academia, civil society and international organizations, are crucial. The Internet is a highly interdependent system, and no single actor can adopt a fix-all solution to overcome threats that arise from its use. Without Internet, regardless of its obstacles and shortcomings, there can be no egovernment services. However, a secure e-government system requires collaboration among all stakeholders including vendors, industries, manufacturers, academia, government and civil society.

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Chapter 5. Global trends in e-government

5.1 Introduction

The 2030 Agenda for Sustainable Development introduces the concept of data-driven governance and highlights the challenge to "increase significantly the availability of high-quality, timely, reliable and disaggregated data by 2030".[1] This chapter presents a data-driven analysis of the key trends of e-government development in 2018 based on the assessment of the E-Government Development Index (EGDI). It also describes and analyzes global trends in electronic and mobile service delivery and sheds light on the distribution of online services by income level and sectors.

It starts by briefly analyzing the ranking of the 193 United Nations Member States according to EGDI subgroups (Very-High, High, Middle, and Low). The analysis also presents major drivers of EGDI such as progress in online transactional services delivery, trends in open government data and mobile services, and public engagement in the delivery of innovative public services. Multiple linkages to the sustainable development goals (SDGs) are highlighted relating to key services across selected goals and targets, such as health, education, social protection, gender equality, and decent work and employment. Also highlighted are the five key dimensions in Goal 16, including effectiveness, inclusion, openness, trustworthiness, and accountability. Selected themes or proxy themes related to e-government and sustainable development are also globally analyzed, including open government data, mobile-government and e-participation.

The sections below present the 2018 Survey findings by EGDI rankings at the global level. Where relevant, additional insights are provided based on comparisons of data from the 2014, 2016 and 2018 Surveys and relevant correlations between EGDI and its components, country income group classifications, and organization of e-services by sectors.

5.2 E-government rankings in 2018

The 2018 United Nations E-Government Survey is the tenth edition of tracking e-government development achieved by all Member States of the United Nations since the 2001 benchmarks. The Survey is not designed to capture e-government development in absolute terms. Rather, it aims to give an indicative assessment of the diffusion of e-government through performance rating of national governments relative to one another. As explained in the Methodology note (See Annexes), the E-Government Development Index is a weighted average of normalized scores on the three most important dimensions of e-government: the scope and quality of online services as indicated by the Online Service Index (OSI), the status of the development of telecommunication infrastructure rated through

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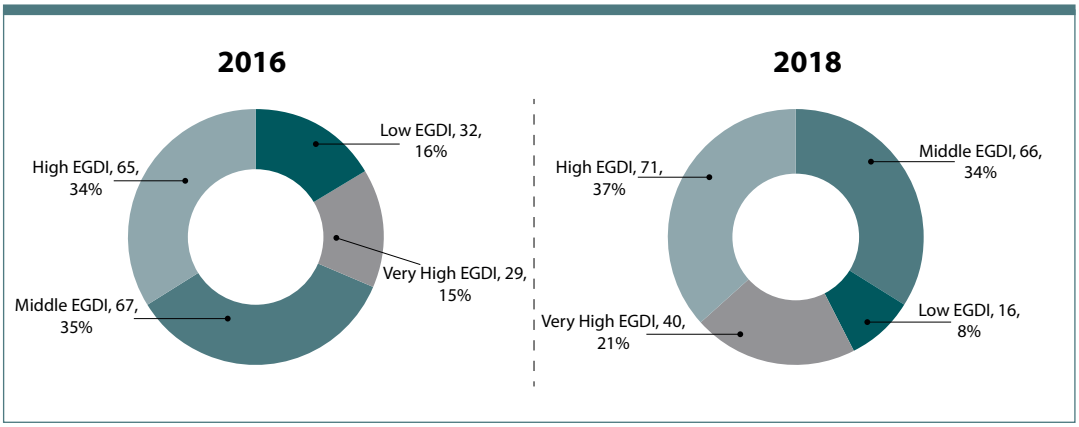
the Telecommunication Infrastructure Index (TII) and the inherent human capital scored through the Human Capital Index (HCI). Each of these indices is by itself a composite measure that can be extracted and analyzed independently. The composite value of each component index is then normalized to fall between the range of 0 to 1 and the overall EGDI is derived by taking the arithmetic average of the three component indices.

5.2.1 E-government development at a glance

E-government has been growing rapidly over the past 17 years since the first attempt of the United Nations to benchmark the state of e-government in 2001. The 2018 Survey highlights a persistent positive global trend towards higher levels of e-government development. In this edition, 40 countries score "Very-High", with EGDI values in the range of 0.75 to 1.00, as compared to only 10 countries in 2003, and 29 countries in 2016. Since 2014, all 193 Member States have been delivering some form of online presence.

Figure 5.1 shows the percentages of the different groupings based on EGDI in 2018 compared to 2016. Table 5.1 lists all countries grouped by E-Government Development Index (EGDI) levels in alphabetical order.

Figure 5.1 Number of countries grouped by E-Government Development Index (EGDI) in 2016 and 2018



High and Very-High EGDI Group

Notably, in 2018, there are more countries with High-and Very-High-EGDI or values between 0.50 and 1.00; and the share of countries in High and Very-High-EGDI level groups has increased by 3 and 6 per cent respectively. As a result, the cumulative percentage of countries with High and Very-High levels of e-government development has reached 58 per cent, close to two-thirds of the United Nations Member States.

About one-quarter of countries in the High-EGDI and Very-High-EGDI groups had transitioned to a higher EGDI level: from Middle- to High-EGDI, 17 out of 71 countries and High- to Very High-EGDI, 11 out of 40 countries. It is interesting to note that eight of the 17 new countries that moved from the Middle- to High-EGDI level group in 2018 belong to the small island developing States (SIDS) group, indicating that many SIDS are already well advanced in implementing e-government policies and strategies and incorporating these into their development plans and policies.

The other nine out of the 17 countries that transitioned from Middle- to High-EGDI level group include five from Asia (India, Indonesia, Iran, Maldives, Kyrgyzstan), three from the Pacific (Fiji, Palau, Tonga) and one from Africa (Ghana). Ghana is the only African country that made this transition, in part, by streamlining its institutional and policy frameworks to capitalize on ICT innovations. Since 2017, it has also been investing in improving online services delivery (see Box 5.1 below).

Box 5.1 e-Ghana and e-Transform projects

Ghana's economy experienced dramatic growth in 2017 when its GDP increased by 8.5 percent, compared with 3.7 percent in 2016[2]. The government of Ghana made significant contributions towards the development of ICTs under the e-Ghana and e-Transform projects. The Ghana Shared Growth and Development Agenda (GSGDA) incorporates an ICT strategy which implies increasing use of ICT across economic sectors, e-government, in implementing the National Electronic Security system and the proliferation of other ICT-related mechanisms for public benefit[3]. Various projects conducted by the National Information Technology Agency and the Ghana Investment Fund for Electronic Communication[4] are ensuring stable growth in the use of ICTs and are creating a favorable environment for further development and deployment of e-government mechanisms[5]. All these initiatives are securing Ghana's commitment towards the attainment of SDGs.

Source:
http://www.un-page.org/files/public/gsgda.pdf

The Latin America and the Caribbean (LAC) countries are demonstrating remarkable progress in advancing positions in the EGDI. In the 2018 Survey, eight countries in the region jumped to the High-EGDI group, reflecting improved online presence boosted by strategies linking digital policies to national development.

Middle-EGDI Group

While the number of countries in the Middle-EGDI level group with scores between 0.25 and 0.50 remained almost unchanged at 66 countries in 2018 compared to 67 in 2016, a significant improvement on e-government development is observed, as 18 or one-third of those countries have transitioned from a previous lower level. Only two countries (Democratic People's Republic of Korea and Sudan) have fallen from Middle- to Low-EGDI level due to adverse political, socio-economic and natural conditions. Twelve of the 18 countries are from Africa (Benin, Burkina Faso, Burundi, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Gambia, Liberia, Madagascar, Malawi, Mozambique, Sierra Leone), while two are from Asia (Afghanistan, Myanmar). The other three countries are part of SIDS (Haiti, Sao Tome and Principe, and Solomon Islands).

Low-EGDI Group

As evidence of the advancement of e-government development in the last two years, countries in the Low-EGDI level that scored 0.25 or lower have dropped by a significant 50 per cent or 16 countries compared to 32 countries in 2016. But despite some development gains and major investments made in several countries, the e-government divide and digital divides persist. Fourteen countries in the Low-EGDI group are African and belong to the least developed countries. Within these countries, there is a high risk that the divide could deepen between people who have access to the Internet and online services and those who do not.

Table 5.1 Countries grouped by EGDI levels

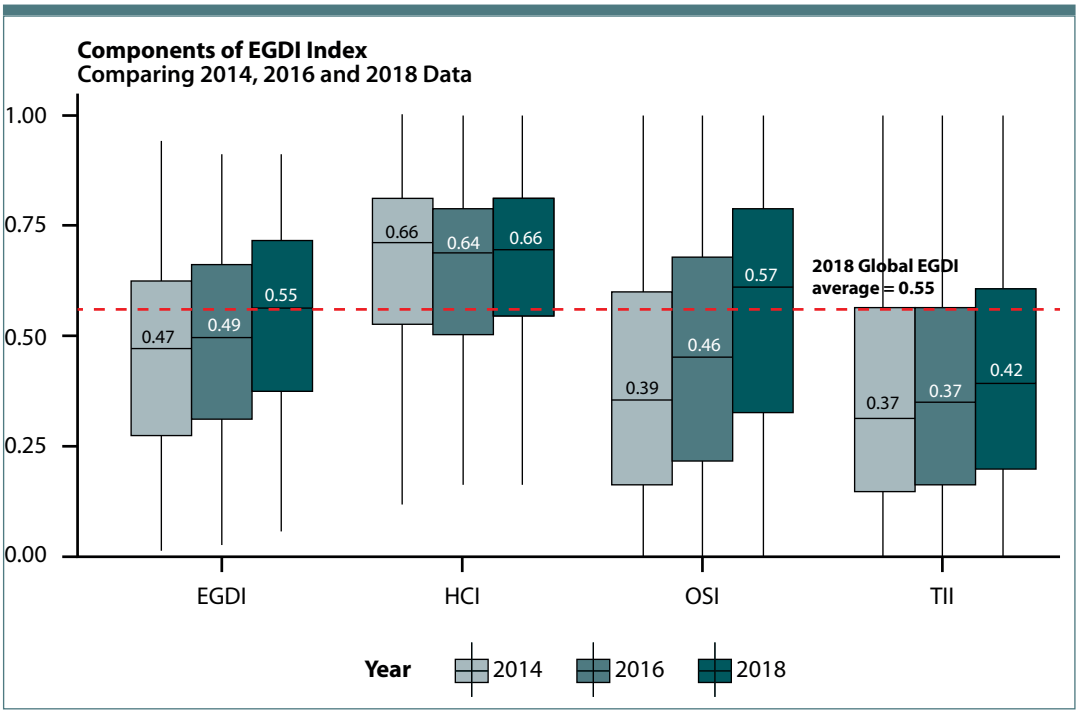
Very High EGDI 2018 (Greater than 0.75)	High EGDI 2018 (Between 0.50 and 0.75)	Middle EGDI 2018 (Between 0.25 to 0.50)	Low EGDI 2018 (Less than 0.25)
Australia	Albania	Afghanistan (+)	Central African Republic
Austria	Andorra	Algeria	Chad
Bahrain	Antigua and Barbuda (+)	Angola	Comoros
Belarus (+)	Argentina	Bangladesh	Democratic People's Republic of Korea (-)
Belgium	Armenia	Belize	Djibouti
Canada	Azerbaijan	Benin (+)	Equatorial Guinea
Cyprus (+)	Bahamas	Bhutan	Eritrea
Denmark	Barbados	Botswana	Guinea
Estonia	Bolivia (Plurinational State of) (+)	Burkina Faso (+)	Guinea-Bissau
Finland	Bosnia and Herzegovina	Burundi (+)	Mali
France	Brazil	Cambodia	Mauritania
Germany	Brunei Darussalam	Cameroon	Niger
Greece (+)	Bulgaria	Cabo Verde	Somalia
Iceland	Chile	Congo (+)	South Sudan
Ireland	China	Côte d'Ivoire (+)	Sudan (-)
Israel	Colombia	Cuba	Yemen
Italy	Costa Rica	Democratic Republic of the Congo (+)	Central African Republic
Japan	Croatia	Egypt	
Kazakhstan (+)	Czech Republic	Eswatini	
Liechtenstein (+)	Dominica (+)	Ethiopia	
Lithuania	Dominican Republic (+)	Gabon	
Luxembourg	Ecuador	Gambia (+)	
Malta (+)	El Salvador (+)	Guatemala	
Monaco (+)	Fiji (+)	Guyana	
Netherlands	Georgia	Haiti	
New Zealand	Ghana (+)	Honduras	
Norway	Grenada	Iraq	
Poland (+)	Hungary	Jamaica	
Portugal (+)	India (+)	Kenya	
Republic of Korea	Indonesia (+)	Kiribati	
Russian Federation (+)	Iran (Islamic Republic of) (+)	Lao People's Democratic Republic	
Singapore	Jordan	Lesotho	
Slovenia	Kuwait	Liberia (+)	
Spain	Kyrgyzstan (+)	Libya	
Sweden	Latvia	Madagascar (+)	
Switzerland	Lebanon	Malawi (+)	
United Arab Emirates	Malaysia	Marshall Islands	
United Kingdom of Great Britain and Northern Ireland	Maldives (+)	Micronesia	

Very High EGDI 2018 (Greater than 0.75)	High EGDI 2018 (Between 0.50 and 0.75)	Middle EGDI 2018 (Between 0.25 to 0.50)	Low EGDI 2018 (Less than 0.25)
United States of America	Mauritius	Mozambique (+)	
Uruguay (+)	Mexico	Myanmar (+)	
	Mongolia	Namibia	
	Montenegro	Nauru	
	Morocco	Nepal	
	Oman	Nicaragua	
	Palau (+)	Nigeria	
	Panama (+)	Pakistan	
	Paraguay (+)	Papua New Guinea (+)	
	Peru	Rwanda	
	Philippines	Saint Lucia	
	Qatar	Samoa	
	Republic of Moldova	Sao Tome and Principe (+)	
	Romania	Senegal	
	Saint Kitts and Nevis	Sierra Leone (+)	
	Saint Vincent and the Grenadines (+)	Solomon Islands (+)	
	San Marino	Suriname	
	Saudi Arabia	Syrian Arab Republic	
	Serbia	Tajikistan	
	Seychelles	Timor-Leste	
	Slovakia	Togo	
	South Africa	Turkmenistan	
	Sri Lanka	Tuvalu	
	Thailand	Uganda	
	The former Yugoslav Republic of Macedonia	United Republic of Tanzania	
	Tonga (+)	Vanuatu	
	Trinidad and Tobago	Zambia	
	Tunisia	Zimbabwe	
	Turkey		
	Ukraine		
	Uzbekistan		
	Venezuela (Bolivian Republic of)		
	Viet Nam		

Note: Countries with superscript (+) have advanced from a lower EGDI group to a higher EGDI group (e.g., from low-EGDI to middle-EGDI); countries with superscript (-) have dropped from a higher EGDI group to a lower EGDI group (e.g. from high-EGDI to middle-EGDI).

The average world EGDI has been increasing from 0.47 in 2014 to 0.55 in 2018 due to the continuous improvement of its subcomponent indices (see Figure 5.2). It is important to note that the improvement of the OSI Online Service Index average is the fastest - from 0.39 to 0.57 or by an average of 40 per cent. This suggests that globally, there has been steady progress in improving e-government and public services provision online.

Figure 5.2 Breakdown of EGDI Indices comparing data from 2014, 2016 and 2018



5.2.2 The leading e-government developed countries

In presenting the 2018 ranking, it is pertinent to reiterate that the E-Government Development Index is a normalized broad relative index. Dropping a few positions in rankings does not necessarily imply that a country had underperformed in that specific two-year survey period. Nor does higher ranking always mean better or more desirable outcomes, especially if it refers to a country belonging to the same EGDI level. Hence, analysts and policy-makers should caution against misinterpreting, even slightly, changes in ranking among closely ranked countries. Every country should determine the level and extent of its digital government objectives based on its specific national development context, capacity, strategy and programmes and never on an arbitrary assumption of its future position in the ranking. EGDI is a powerful and reliable benchmarking tool for development but only if it is used as a snapshot performance indicator and not an award conferred to worldwide leadership positions or outstanding advancements against the performance of others.

The list of the top-ranking countries in e-government development according to the findings of the 2018 Survey, are presented in Table 5.2 with corresponding EGDI values and its three components—OSI, TII and HCI. All the top 29 countries with Very-High-EGDI scores in 2016 remained in the same group in 2018.

Table 5.2 Leading countries in e-government development

Country Name	Region	OSI	HCI	TII	EGDI	2016 Rank	2018 Rank	EGDI Group change
Denmark	Europe	1.0000	0.9472	0.7978	0.9150	9	1	None
Australia	Oceania	0.9722	1.0000	0.7436	0.9053	2	2	None
Republic of Korea	Asia	0.9792	0.8743	0.8496	0.9010	3	3	None
United Kingdom of Great Britain and Northern Ireland	Europe	0.9792	0.9200	0.8004	0.8999	1	4	None
Sweden	Europe	0.9444	0.9366	0.7835	0.8882	6	5	None
Finland	Europe	0.9653	0.9509	0.7284	0.8815	5	6	None
Singapore	Asia	0.9861	0.8557	0.8019	0.8812	4	7	None
New Zealand	Oceania	0.9514	0.9450	0.7455	0.8806	8	8	None
France	Europe	0.9792	0.8598	0.7979	0.8790	10	9	None
Japan	Asia	0.9514	0.8428	0.8406	0.8783	11	10	None
United States of America	Americas	0.9861	0.8883	0.7564	0.8769	12	11	None
Germany	Europe	0.9306	0.9036	0.7952	0.8765	15	12	None
Netherlands	Europe	0.9306	0.9206	0.7758	0.8757	7	13	None
Norway	Europe	0.9514	0.9025	0.7131	0.8557	18	14	None
Switzerland	Europe	0.8472	0.8660	0.8428	0.8520	28	15	None
Estonia	Europe	0.9028	0.8818	0.7613	0.8486	13	16	None
Spain	Europe	0.9375	0.8885	0.6986	0.8415	17	17	None
Luxembourg	Europe	0.9236	0.7803	0.7964	0.8334	25	18	None
Iceland	Europe	0.7292	0.9365	0.8292	0.8316	27	19	None
Austria	Europe	0.8681	0.8505	0.7716	0.8301	16	20	None
United Arab Emirates	Asia	0.9444	0.6877	0.8564	0.8295	29	21	None
Ireland	Europe	0.8264	0.9626	0.6970	0.8287	26	22	None
Canada	Americas	0.9306	0.8744	0.6724	0.8258	14	23	None
Italy	Europe	0.9514	0.8341	0.6771	0.8209	22	24	None
Liechtenstein	Europe	0.7986	0.8237	0.8389	0.8204	32	25	H to VH
Bahrain	Asia	0.7986	0.7897	0.8466	0.8116	24	26	None
Belgium	Europe	0.7569	0.9740	0.6930	0.8080	19	27	None
Monaco	Europe	0.6250	0.7901	1.0000	0.8050	31	28	H to VH
Portugal	Europe	0.9306	0.8170	0.6617	0.8031	38	29	H to VH
Malta	Europe	0.8403	0.7973	0.7657	0.8011	30	30	H to VH
Israel	Asia	0.8264	0.8635	0.7095	0.7998	20	31	None
Russian Federation	Europe	0.9167	0.8522	0.6219	0.7969	35	32	H to VH
Poland	Europe	0.9306	0.8668	0.5805	0.7926	36	33	H to VH
Uruguay	Americas	0.8889	0.7719	0.6967	0.7858	34	34	H to VH
Greece	Europe	0.8194	0.8867	0.6439	0.7833	43	35	H to VH
Cyprus	Asia	0.7847	0.8083	0.7279	0.7736	64	36	H to VH
Slovenia	Europe	0.7986	0.8923	0.6232	0.7714	21	37	None
Belarus	Europe	0.7361	0.8681	0.6881	0.7641	49	38	H to VH
Kazakhstan	Asia	0.8681	0.8388	0.5723	0.7597	33	39	H to VH
Lithuania	Europe	0.7986	0.8323	0.6293	0.7534	23	40	None

Eight of the 11 new countries that joined the Very-High EGDI group in 2018 are from Europe (Belarus, Greece, Liechtenstein, Malta, Monaco, Poland, Portugal and the Russian Federation) while two are from Asia (Cyprus and Kazakhstan). Uruguay is the only Latin American country and one of the three countries from the Americas in this group, the other two being the United States and Canada. Eight of these 11 countries have significantly improved their online presence and services as reflected in their respective OSI scores.

All but two of the 40 countries in the Very-High-EGDI level group are high-income countries;[6] Belarus and Kazakhstan are upper-middle-income countries. As evidenced in previous editions of the Survey (United Nations, 2012, 2014 and 2016), the per capita income of a country, indicating economic capacity, has a strong influence on national e-government development.

Box 5.2 Belarus e-government development

Source: http://www.economy.gov.by/ru/

Belarus transitioned from High-EGDI in 2016 to Very-High-EGDI in 2018. This could be attributed to its National Strategy for Sustainable Social and Economic Development for the period up to 2030 incorporating several initiatives related to ICT development in various sectors of its economy. For example, the Strategy of Informatization of the Republic of Belarus for the period 2016 – 2022 was implemented in 2015 with the purpose of enhancing ICTs in the provision of e-government services. Another initiative, the State Program for the Development of the Digital Economy and the Information Society for 2016-2020 defines the vision for the "digital transformation" of the Belarusian economy and ensures the effective implementation of digital tools. This program was designed to digitalize already existing processes in healthcare, public procurement, education, among others. Presidential decrees and resolutions of the Council of Ministers contribute towards the coherent functioning of egovernment services in the Republic of Belarus.

The 10 top countries leading e-government development

Among the top 10 countries, Denmark ranks highest according to the 2018 Survey. In the independent assessment conducted by UNDESA on the provision of online services, Denmark got the highest score. Since 2016, Denmark has been implementing its Digital Strategy 2016-2020[7], setting the course for Danish public-sector digitization efforts as well as their interaction with businesses and industry. This strategy is aimed at building the basis for a strong and secure digital Denmark. Denmark has also made digital government-citizen interactions mandatory without excluding those unable to use digital services. Along with the private sector, public institutions at local, regional and central-government levels are taking advantage of the opportunities provided by digitization.

Australia ranks second in 2018 retaining its position in 2016. Notably, Australia leads the chart in human capital development and is in the top 10 in online services. The Australian Government is working to deliver the Digital Transformation Agenda. A Digital Transformation Roadmap issued in November 2016 sets out the goals of the Agenda, and snapshots of expected deliverables are being updated regularly[8].

The Republic of Korea also remains in the third spot, as in 2016. The country performed well in online service and technology infrastructure, but its human capital development was relatively low compared to other top ranked countries. The country facilitates convenient, efficient, and transparent government in enhancing citizens' satisfaction and government productivity and is constantly improving to provide better government services to its citizens in the face of rapid technology changes. An increasing number of developing countries have requested the Government of the

Republic of Korea to share its know-how in digital government strategies[9] resulting in e-government capacity-building and the training of more than 4,820 public officials from other countries in the past 10 years.

The United Kingdom ranks fourth in the 2018 Survey, a few spots down from being the top-ranking country in 2016. The drop is due to a relative decrease in the ranking of its human capital and online service indices. The British Government is providing more integrated online services through its one-stop platform GOV.UK. Its Government Transformation Strategy published in 2017[10] is setting the course for further e-government development through business transformation, growing the right people, culture and skills, building better tools, processes and governance for civil servants, making better use of data and creating shared platforms, components and reusable business capabilities.

In the fifth place, Sweden stepped up one position compared to its ranking in 2016, owing to relatively high scores in both human capital and technical infrastructure indices. In 2017, the Government presented a strategy outlining the focus of the Government's digital policy—how it will contribute to competitiveness, full employment, and economic, social and environmentally sustainable development. The strategy aims for Sweden to become the world leader in harnessing the opportunities of digital transformation.[11] Sweden has high rates of mobile broadband take-up and its market is characterized by a rapidly growing consumer demand for fast broadband. Ninety-one percent of Swedes are online and three-quarters of them have basic digital skills.

Finland stepped down from the fifth place in 2016 to sixth in 2018. Finland has been scoring consistently well in human capital and online service indices, while its technical infrastructure is relatively low compared to other high ranked countries. Its National Knowledge Society Strategy has been focusing on the provision of multichannel, interactive e-services together with interoperability of information systems in the public administration. According to its Strategic Government Programme in 2016[12], public services will be designed to be user-oriented and primarily digital, so as to achieve the desired productivity leap in public administration. Digitalization is a cross-cutting theme in the Government strategy. Principles for client-oriented public services are being drawn up and the public sector is being encouraged to commit to automation and the digitalization of their practices.

Singapore stepped down from the forth place in 2016 to the seventh in 2018. Singapore ranks second in online service delivery index together with United States behind Denmark. It dropped a few positions from 2016 due to its human capital index and technological infrastructure indices. The Singaporean Government had an e-government plan since the 1980s. In 2014, it announced its goal of becoming a Smart Nation, of which Digital Government is an integral aspect[13]. Singapore has been embracing e-government as a whole-of-government approach in its national development strategy. Its small population and land area, accompanied by a very high human development and high GNI per capita, allow the government to develop a full suite of online services for its citizens, businesses and visitors. Additionally, the high mobile and smartphone penetration rate in Singapore is enabling the government to provide e-access to citizens through seamless m-government applications with faster, easier and more convenient use of available online resources, especially in government-to-citizen (G2C) and government-to-business (G2B) transactions[14].

New Zealand scores well in both online services and human capital, ranking eight in EGDI in 2018 the same as in 2016. Alongside its ICT strategy[15], the Government of New Zealand has established a Digital Economy Work Programme ensuring that agencies are collectively focusing on the right initiatives, in the right areas. The government is supporting the growth of New Zealand's digital sector, the uptake and smart use of ICT across its economy, the citizens' secure use of digital technologies

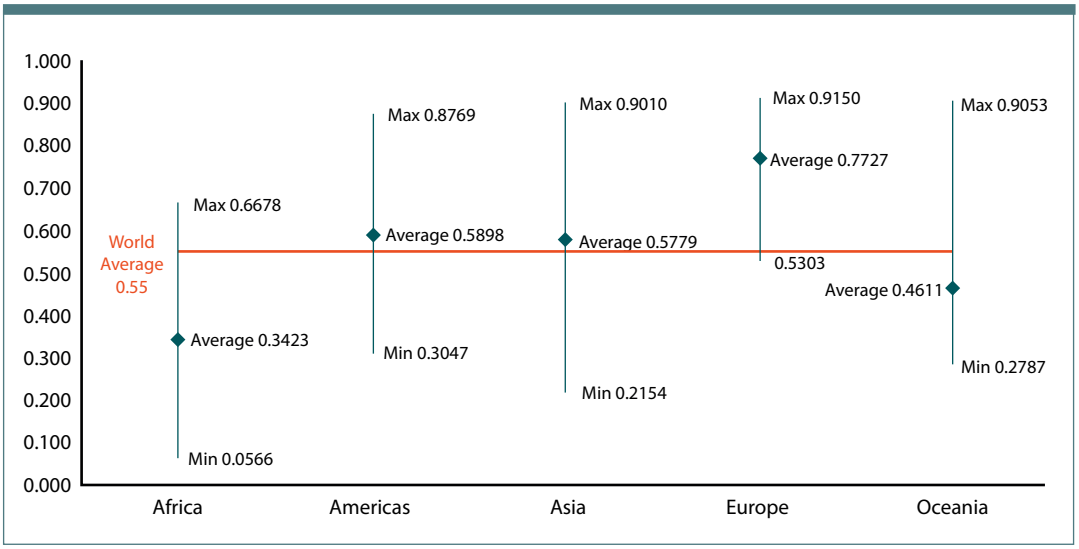
to support their personal, development and learning, access job opportunities, run businesses, and trade goods and services all over the world. More importantly, it charges the Government to use digital technologies for efficiency and to reduce paper-based processes[16].

France improved its ranking from the tenth position in 2016 to ninth in 2018. Among factors contributing to improved scores is governments vision to achieve digital transformation of the public service with an objective of 100% dematerialized public service by 2022. In October 2017 France has launched Public Action 2022: for a transformation of the public service[17] aiming, among others, to simplify and digitize administrative processes. The government of France has also launched a Coordinated Development Program of the Digital Territorial Administration (DCANT[18]) to build a common foundation of applications, digital bricks, repositories and shared frameworks to accelerate digital transformation and scale up digital transformation.

Japan completes the group of the top 10 leading countries moving up from eleventh position in 2016 to tenth position in 2018. It scored high in technology infrastructure and online service, which drove it to the top 10 performance country list, even though its human capital index was comparatively low compared to other top-ranking countries. In Japan, the Government is promoting initiatives such as online use of administrative procedures, electronic provision of government information, optimization of work and systems, improvement of government e-procurement, and information security measures[19]. Japan also has a "Digital Government Strategy" and a "Basic Plan for the Advancement of Utilizing Public and Private Sector Data". One of the three pillars of "Digital Government Strategy" is a platform for public-private partnerships aligned with SDG 8—promoting sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all[20].

At a glance, the regional EGDI averages in 2018 mirror those of previous Surveys. In 2018, Europe (0.7727) continues to lead with the highest regional EGDI, followed by the Americas (0.5898), Asia (0.5779), Oceania (0.4611) and finally Africa (0.3423). Examining previous trends, there has been no change in regional positions since 2003.

Figure 5.3 Regional averages with maximum and minimum values of EGDI in 2018

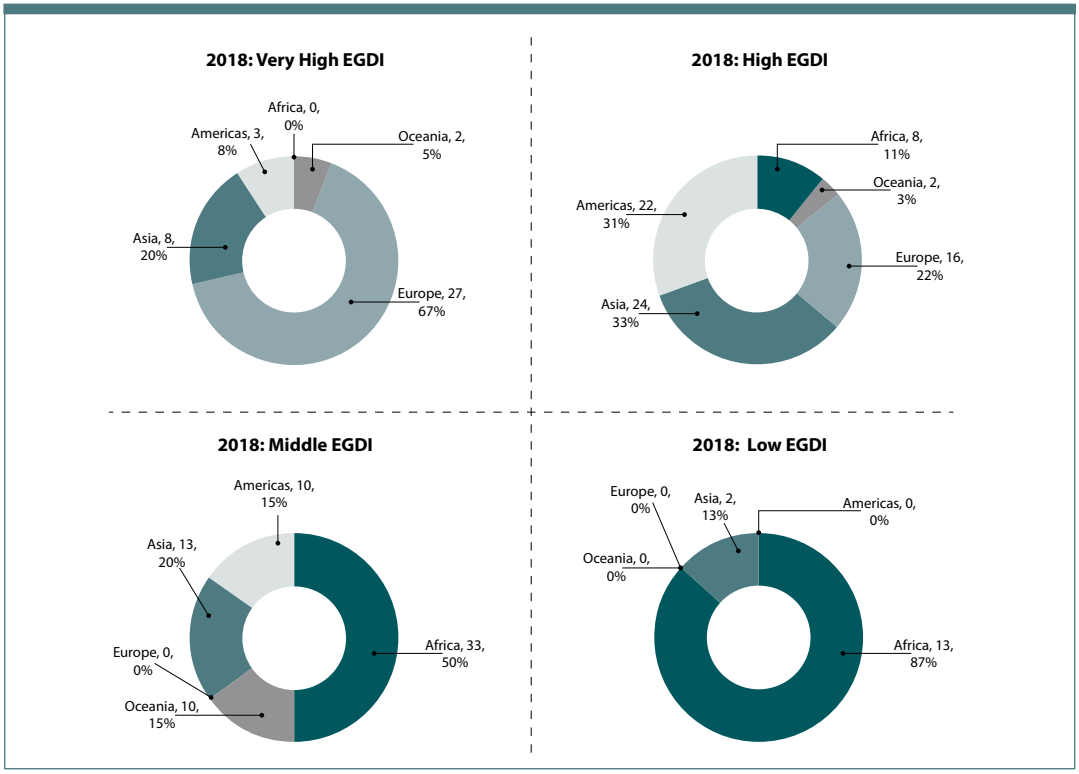


More specifically, as shown in Figure 5.4, in the Very-High-EGDI group, 67 per cent of all countries are from Europe, followed by Asia (20 per cent), Americas (8 per cent) and Oceania (5 per cent). In the High-EGDI group, the leaders are Asia and Americas regions (33 per cent and 31 per cent respectfully), followed by Europe (22 per cent), Africa (11 per cent), and Oceania (3 per cent). In the Middle-EGDI group, African countries comprise 50 per cent, the geographic distribution of countries from Americas and Oceania is similar (15 per cent), and Asia takes up to 20 per cent of the share in the group. No European country is in the Middle and Low EGDI-level groups. The majority of 15 countries in Low-EGDI-level group are from Africa (87 per cent) followed by 2 countries in Asia (13 per cent).

The Africa region overall lags in e-government development compared to the rest of the world. While the share of African countries with improved EGDI scores expanded in 2018, the upward movement has mainly been from low to middle EGDI-level groups. The number of African countries within High-EGDI level group remains at the relatively modest count of six, including Ghana, Mauritius, Morocco, Seychelles, South Africa, and Tunisia. Except Ghana, all other five countries were in this group in 2016.

The regional average EGDI scores for countries in Africa and Oceania are significantly lower than the world average, comprising 0.3423 for Africa and 0.4611 for Oceania. Australia and New Zealand are the only two countries in Oceania that have high EGDI scores of 0.9053 and 0.8806 respectively. The scores for the other 12 countries range between 0.2787 to 0.5348, below the world average, even though they have as high level of human development as in the Americas and Asia. The HCI for these countries ranges from 0.4732 to 0.8462 with an average of 0.6637. Their e-government advancement is stalled due to relatively poor telecommunications infrastructure, with TII scores ranging from 0.0773 to 0.3562.

Figure 5.4 Regional distribution by EGDI level, 2018



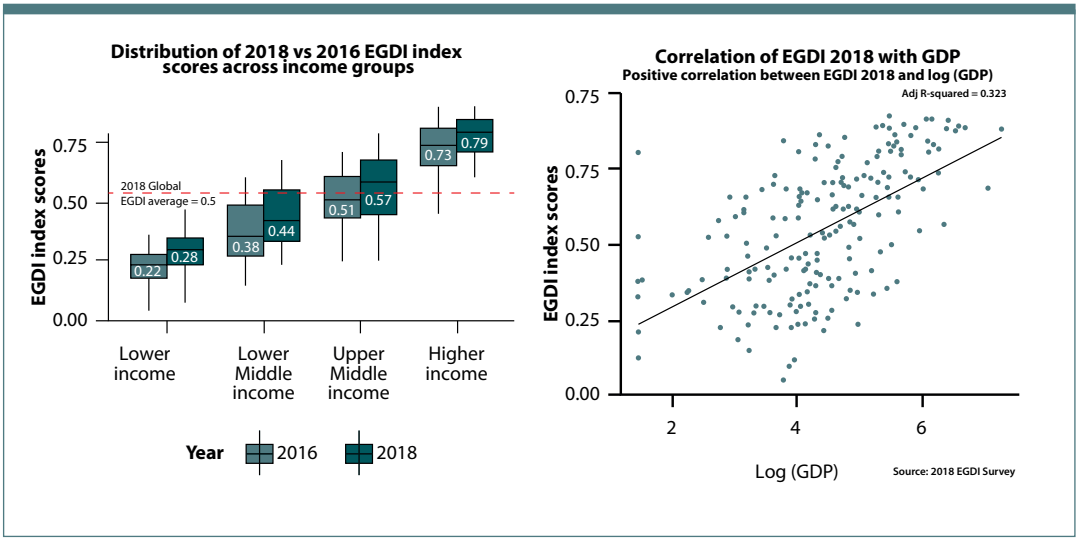
Similarly, only 4 countries out of 54 in Africa score higher than the world average of 0.55, whereas 14 countries, namely Central African Republic, Chad, Comoros, Djibouti, Equatorial Guinea, Eritrea, Guinea, Guinea-Bissau, Mali, Mauritania, Niger, Somalia, South Sudan, and Sudan have very low EGDI scores. These are also low-income countries, which face significant constraints in socio-economic development, creating additional pressure for prioritizing and allocating resources for e-government development.

In the Americas and Asia, the overall progress in e-government development is slow but noticeable. Two-thirds of the countries in Asia (31 out of 47) and almost half of the countries in the Americas (15 out of 32) score above the world average EGDI. In the Americas, Bolivia, El Salvador, Paraguay, Saint Vincent and the Grenadines rose from Middle- to High-EGDI, and Haiti from Low- to Middle-EGDI, in the last two years. In Asia, six countries recorded an improvement in their e-presence and provision of public services online— Pakistan, Nepal, Indonesia, from Middle- to High-OSI and Cambodia, Timor Leste and Tajikistan, from Low to Middle-OSI level.

5.2.3 National Income and e-Government Development

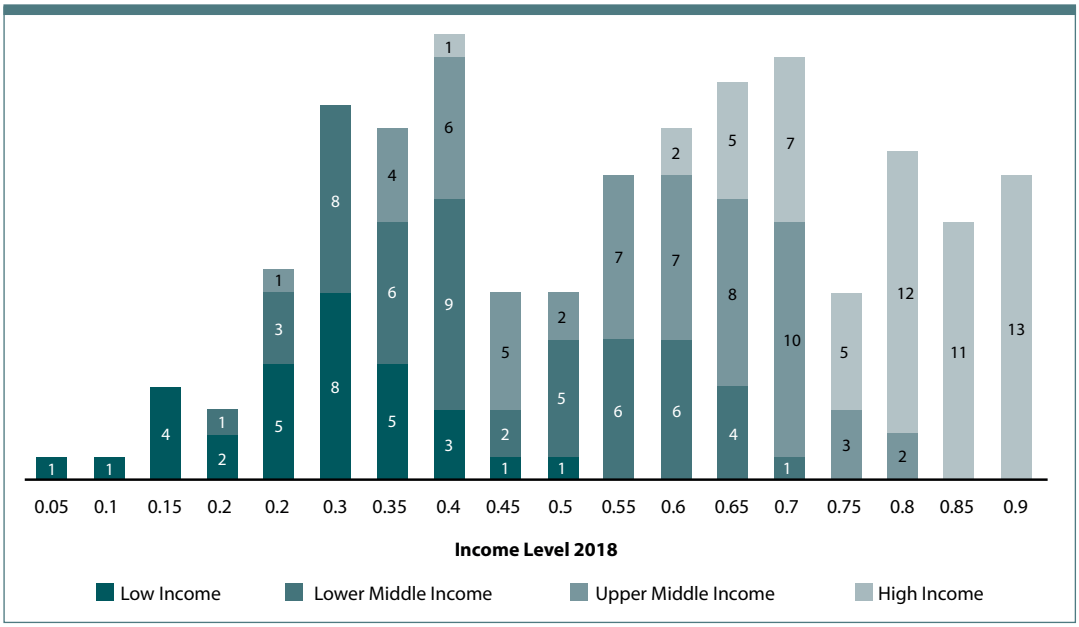
The average EGDI scores and its component indices have improved over time for all income groups, as shown in Figure 5.5. Moreover, there is a positive correlation between the country's income level and its e-government ranking, as presented in Figure 5.6. Most countries in high and upper middle-income groups tend to have higher than average EGDI scores with the only exception being Equatorial Guinea, which has a low EGDI score (0.2298) despite being an upper middle-income country. This trend is consistent with findings from previous Surveys. High-income countries progress faster by expanding the scope and quality of their online services (OSI) with already advanced levels telecommunications infrastructure and human capital development.

Figure 5.5 Correlation between EGDI and Income groups and GDP



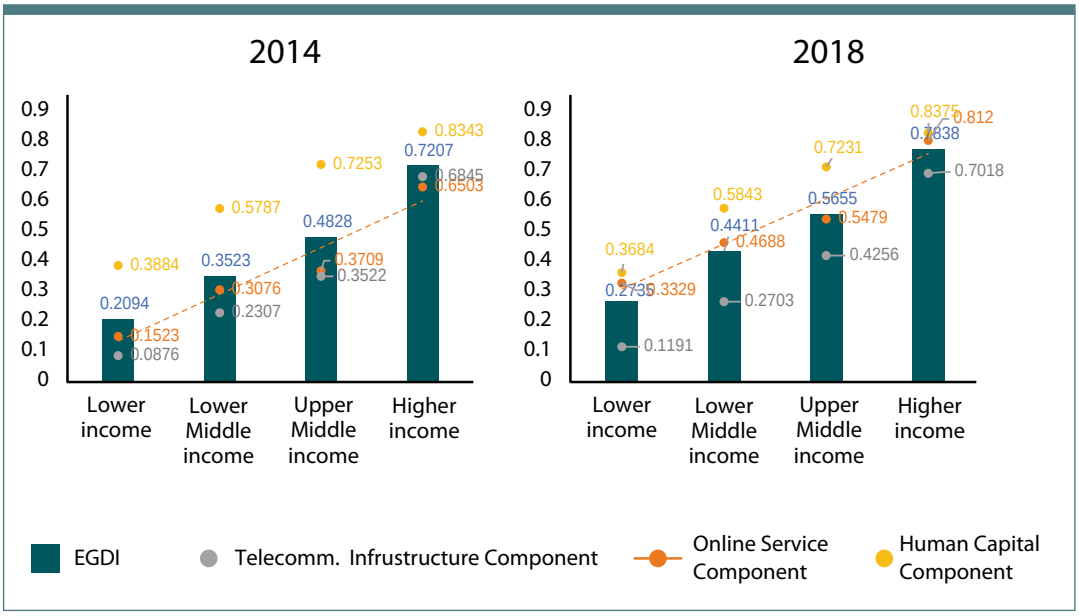
This is not universal, however. Twenty-two upper middle-income countries and 39 lower-middle income countries have EGDI scores ranging from 0.2154 to 0.5390, which is below the global EGDI average of 0.55. On the other hand, 10 countries in the lower middle-income group have scores above the global EGDI average — Armenia (0.5944), Georgia (0.6893), India (0.5669), Kyrgyzstan (0.5835), Philippines (0.6512), Republic of Moldova (0.6590), Sri Lanka (0.5751), Ukraine (0.6165), Uzbekistan (0.6207) and Viet Nam (0.5931). For these lower and upper-middle income countries, where telecommunications infrastructure permits, the efforts directed at improving online services delivery greatly enhance their e-government development overall.

Figure 5.6 Distribution of OSI values by income groups, 2018



It is important to note that in 2018, for the first time, the main contributor towards improving EGDI scores in all income groups is OSI (see Figure 5.7). Based on previous Survey results, high-income countries were expected to perform well on all EGDI components compared to other groups. Likewise, the gap between the component HCI, OSI, and TII scores is relatively narrower for high-income countries that already enjoy rather high levels of development of human capital and telecommunications infrastructure. For the low and middle-income countries, however, the ascending trend of TII and OSI scores over the last four years is encouraging. This suggests a continuous expansion of online services availability and quality leading to an overall improvement in e-government development (see Section 5.3.1. below for further details on key trends in transactional online services delivery).

Figure 5.7 EGDI and its component indices for 2014 and 2018



5.3 Progress in online service delivery

The Online Services Index component of the E-Government Development Index is a composite indicator measuring the use of ICTs by governments in delivering public services at the national level. It is based on a comprehensive survey of the online presence of all 193 Member States. The Survey assesses the technical features of national websites as well as e-government policies and strategies applied in general and by specific sectors in delivering services. The results are tabulated and presented as a set of standardized index values on a scale from zero to one, with one corresponding to the highest rated online services and zero to the lowest. As with the EGDI itself, the index values are not intended as absolute measurements. Rather, they capture the online performance of countries relative to each other at a particular point in time. Because the index is a comparative tool, a high score is an indication of best current practice rather than perfection. Similarly, a very low score, or a score that has not changed since the Survey's last edition in 2016, does not mean there has been no progress in e-government development.

Table 5.3 presents the OSI level grouping with corresponding EGDI level for 193 United Nations Member States.

Table 5.3 Countries grouping by Level of Online Service Index (OSI), 2018

Very High OSI		High OSI		Middle OSI		Low OSI	
Corresponding EGDI level		Corresponding EGDI level		Corresponding EGDI level		Corresponding EGDI level	
Australia	Very High	Albania	High	Afghanistan	Medium	Algeria	Medium
Austria	Very High	Andorra	High	Angola	Medium	Botswana	Medium
Bahrain	Very High	Argentina	High	Antigua and Barbuda	High	Cambodia	Medium
Bangladesh	Medium	Armenia	High	Belize	Medium	Central African Republic	Low
Belgium	Very High	Azerbaijan	High	Benin	Medium	Chad	Low
Brazil	High	Bahamas	High	Bhutan	Medium	Comoros	Low
Bulgaria	High	Barbados	High	Bosnia and Herzegovina	High	Congo	Medium
Canada	Very High	Belarus	Very High	Burundi	Medium	Côte d'Ivore	Medium
Chile	High	Bolivia (Plurinational state of)	High	Cameroon	Medium	Democratic People's Republic of Korea	Low
China	High	Brunei Darussalam	High	Cape Verde	Medium	Democratic Republic of the Congo	Medium

Very High OSI		High OSI		Middle OSI		Low OSI	
Corresponding EGDI level		Corresponding EGDI level		Corresponding EGDI level		Corresponding EGDI level	
Colombia	High	Burkina Faso	Medium	Cuba	Medium	Equatorial Guinea	Low
Cyprus	Very High	Costa Rica	High	Djibouti	Low	Eritrea	Low
Denmark	Very High	Croatia	High	Fiji	High	Gabon	Medium
Estonia	Very High	Czech Republic	High	Gambia	Medium	Guinea-Bissau	Low
Finland	Very High	Dominica	High	Grenada	High	Lao People's Democratic Republic	Medium
France	Very High	Dominican Republic	High	Guinea	Low	Lesotho	Medium
Germany	Very High	Ecuador	High	Guyana	Medium	Libya	Medium
Greece	Very High	Egypt	Medium	Haiti	Medium	Marshall Islands	Medium
India	High	El Salvador	High	Iraq	Medium	Mauritania	Low
Ireland	Very High	Ethiopia	Medium	Jamaica	Medium	Micronesia	Medium
Israel	Very High	Georgia	High	Jordan	High	Myanmar	Medium
Italy	Very High	Ghana	High	Kiribati	Medium	Nauru	Medium
Japan	Very High	Guatemala	Medium	Lebanon	High	Niger	Low
Kazakhistan	Very High	Honduras	Medium	Liberia	Medium	Sao Tome and Principe	Medium
Kuwait	High	Hungary	High	Madagascar	Medium	Solomon Islands	Medium
Liechtenstein	Very High	Iceland	Very High	Malawi	Medium	Somalia	Low
Lithuania	Very High	Indonesia	High	Maldives	High	South Sudan	Low
Luxembourg	Very High	Iran (Islamic Republic of)	High	Mali	Low	Sudan	Low
Malaysia	High	Kenya	Medium	Mozambique	Medium	Turkmenistan	Medium
Malta	Very High	Kyrgizistan	High	Namibia	Medium	Tuvalu	Medium
Mexico	High	Latvia	High	Nicaragua	Medium	Yemen	Low
Netherlands	Very High	Mauritius	High	Palau	High		
New Zealand	Very High	Monaco	Very High	Papua New Guinea	Medium		
Norway	Very High	Mongolia	High	Saint Lucia	Medium		
Oman	High	Montenegro	High	Saint Vincent and the Granadines	High		
Peru	High	Morocco	High	Samoa	Medium		
Philippines	High	Nepal	Medium	San Marino	High		
Poland	Very High	Nigeria	Medium	Senegal	Medium		
Portugal	Very High	Pakistan	Medium	Sierra Leone	Medium		
Qatar	High	Panama	High	Suriname	Medium		
Republic of Korea	Very High	Paraguay	High	eSwatini	Medium		
Republic of Moldova	High	Romania	High	Syrian Arab Republic	Medium		
Russian Federation	Very High	Rwanda	Medium	Tajikistan	Medium		
Saudi Arabia	High	Saint Kittis and Nevis	High	Timor-Leste	Medium		
Singapore	Very High	Serbia	High	Tonga	High		
Slovenia	Very High	Seychelles	High	Vanuatu	Medium		
South Africa	High	Slovakia	High	Venuzuela (Bolivian Republic of)	High		
Spain	Very High	Sri Lanka	High	Zambia	Medium		
Sweden	Very High	Thailand	High	Zimbabwe	Medium		
Switzerland	Very High	The former Yugoslav Republic of Macedonia	High				
Tunisa	High	Togo	Medium				
Turkey	High	Trinidad and Tobago	High				
United Arab Emirates	Very High	Uganda	Medium				
United Kingdom of Great Britain and Northern Ireland	Very High	Ukraine	High				
United States of America	Very High	United Republic of Tanzania	Medium				
Uruguay	Very High	Vietnam	High				
Uzbekistan	High						

As highlighted in earlier sections, the progress in online services provision correlates positively with the overall improvement of EDGI scores globally. The EGDI and OSI levels, as seen in Table 5.3, coincide for 62 per cent of the Member States, although there are also divergences where OSI levels are higher or lower than EGDI levels.

Of the 57 countries with Very High-OSI level, 19 are in the High-EGDI group— Brazil, Bulgaria, Chile, China, Colombia, India, Kuwait, Malaysia, Mexico, Oman, Peru, Philippines, Qatar, Republic of Moldova, Saudi Arabia, South Africa, Tunisia, Turkey, and Uzbekistan. In most of these countries, the human capital development indices are quite high (ranging from 0.5484 to 0.8339), but telecommunications infrastructure is unevenly developed (TII ranging from 0.2009 to 0.7394), resulting in lower EGDI scores despite having relatively advanced levels of online services delivery. The same is true for 13 countries with High OSI scores in the Middle EGDI group: Burkina Faso, Egypt, Ethiopia, Guatemala, Honduras, Kenya, Nepal, Nigeria, Pakistan, Rwanda, Togo, Uganda, and United Republic of Tanzania. Their average HCI score (0.7555) is significantly higher than their average TII score (0.4592).

Bangladesh is a notable example of a country with a Very High-OSI (0.7847) but a much lower EGDI score (0.4862), placing the country in the Middle-EGDI level group. The EGDI score for Bangladesh was pulled down by low levels of development in TII and HCI.

Three countries with High OSI scores, on the other hand, are in the Very High-EGDI level group: Iceland (EGDI=0.8316), Monaco (EGDI=0.8050) and Belarus (EGDI=0.7641). This suggests that the improvement of their e-government slightly outpaces online services delivery as they already enjoy rather high levels of telecommunications infrastructure and human capital development.

For the 36 countries that have higher OSI levels compared to their EGDI standing, their e-government advancement is constrained by the relatively slower progress in telecommunications infrastructure and human capital development. Investment in human capital and telecommunications infrastructure is important for many reasons, but primarily because it allows expanded access to online services for all population groups, including the most vulnerable, such as the poor, as well as people living in remote areas, women, older persons, persons with disabilities, youth, and those with limited digital literacy.

From the regional perspective, European countries form a majority in Very High and High OSI level groups (36 per cent) followed by Asia (28 per cent), Americas (20 per cent), Africa (13 per cent) and Oceania (2 per cent). While this is consistent with previous surveys, it is important to note the positive trends in advancement of online services in all regions. In Africa, for instance, 57 per cent of countries moved upwards and changed their position in OSI level standing. Most of them moved up from Low to Middle (Burundi, Djibouti, Gambia, Guinea, Liberia, Madagascar, Malawi, Mali, Mozambique, and Sierra Leone); six countries stepped up from Middle to High (Ghana, Egypt, Nigeria, Rwanda, Seychelles and Togo) and two countries rose from High to Very High (South Africa and Tunisia). Two countries - Benin and Burkina Faso recorded significant progress by moving two steps up from Low to High OSI level grouping. Altogether, 16 countries in Europe, 13 in the Americas, 21 in Asia, and 4 in Oceania improved their standing in online services delivery.

5.3.1 Trends in Transactional Online Services

All 193 Member States had national portals and back-end systems automating core administrative tasks, improving the availability of public services and promoting transparency and accountability. Although not all countries provide transactional online services, the coverage and availability of services in countries that do provide these services has increased from 18 per cent to 47 per cent in all service categories compared to 2016 (see Table 5.4 below). The three most commonly used online services in 2018 were paying for utilities (140 countries), submitting income taxes (139 countries), and registering new businesses (126 countries).

Table 5.4 Trends in transactional online services

Trends of transactional services online, 2014, 2016 and 2018	2014	2016	2018	Increase in percent of countries offering the service	
				2016 to 2018	2014 to 2018
Pay for utilities	41	104	140	26%	71%
Submit income taxs	73	114	139	18%	47%
Regoster a business	60	97	126	23%	52%
Pay fines	42	76	111	32%	62%
Apply for a birth certificate	44	55	86	36%	49%
Apply for marriage certificate	39	53	82	35%	52%
Register a motor vehicle	33	47	76	38%	57%
Apply for drivers licence	29	38	62	39%	53%
Apply for personal identity card	27	31	59	47%	54%

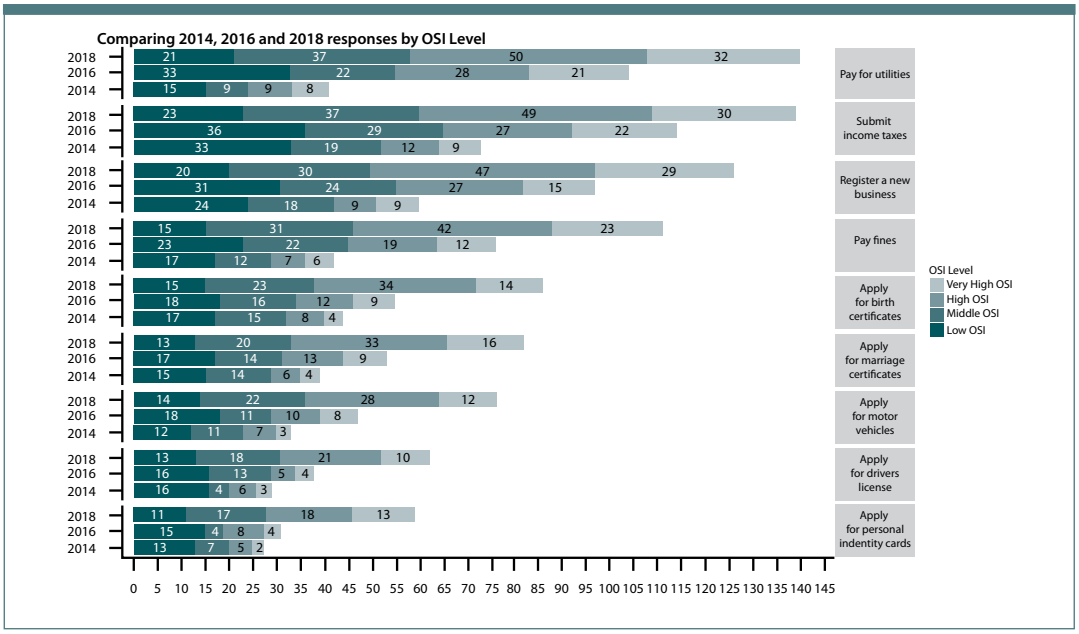
Identity registration at birth is a United Nations proclaimed human right being tracked by the 2030 Agenda target 16.9 (A/RES/70/1). In the period 2014-2018, the number of countries where citizens can apply for birth registration online has been rising significantly, almost doubling from 44 in 2016 to 86 in 2018. Still, this comprises only 45 per cent of the total United Nations Member States, and the service is not available to many of the world's poorer countries. Only 15 out of 31 countries in the Low-OSI level group and 23 out of 51 countries in Middle OSI level group offer online birth registration.

Box 5.3 Uruguay: Democratizing access to all government services

The Government of Uruguay committed to the digitalization of all services by 2020 as a presidential goal. As part of this strategy, all services should be started online by the last quarter of 2016, for example, filling out a form or scheduling an appointment. Following an international prize-winning enterprise architecture, services such as e-forms, e-notifications, epayments are being digitized using shared and reusable components, making them more user-friendly through standardization. One of these components is the "single-sign-in" allowing citizens to log in to all government services with a single user ID and password or by using the digital signature integrated into the Uruguayan ID card. The national portal currently in beta phase, is being transformed to GUB.UY to simplify interaction with the government through new integrated services already available such as the one-stop application tracking the status of every government service or the one-stop agenda for scheduling appointments. All these are being coordinated by the Agency for eGovernment and Information and Knowledge Society (Agesic) from the Office of the President, as part of the Uruguayan digital policy of transforming with equity.

Source: https://www.agesic.gub.uy/

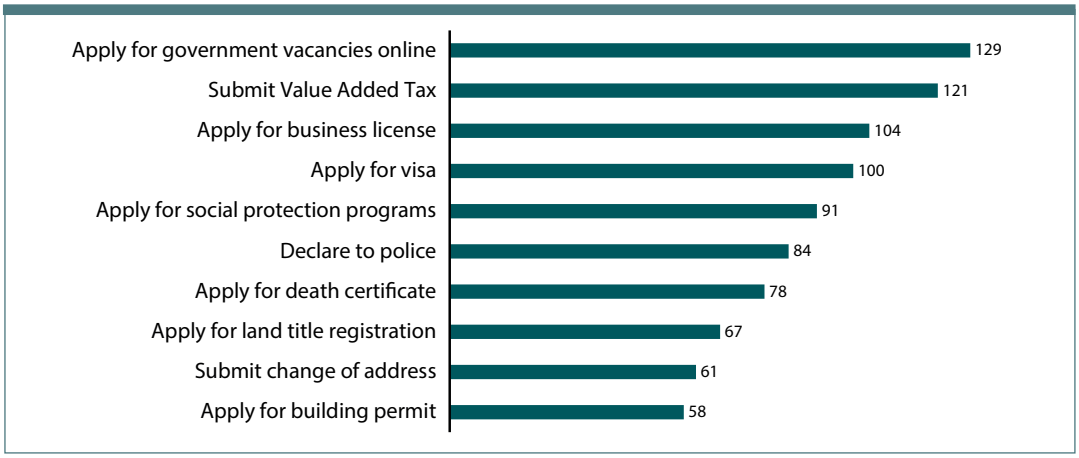
Figure 5.8 Trends in transactional services online



The trend of improvement in providing online services have been steady over the last four years in all OSI level groups including in 31 countries with Low-OSI level scores in 2018; 23 countries (or 74 per cent) are providing at least one kind of online service. The most commonly offered services among the Low-OSI level countries are submitting income taxes online (23 countries), paying for utilities (21 countries), registering a new business (20 countries), applying for birth certificates online and paying fines online (15 countries), registering vehicles online (14 countries), applying for marriage certificates and driving licenses (13 countries), for death certificates (12 countries), and for personal identification cards (11 countries).

Even though the share of Low-OSI countries providing online services in 2018 may seem relatively smaller compared to 2016 (see Figure 5.8 above), the reason for this is that the number of countries with Low OSI scores has significantly decreased from 53 to 31 in 2018 too. Further, four countries in the Low OSI group provide all the online services listed above, namely: Lesotho, Federated State of Micronesia, Sao Tome and Principe and Yemen.

Figure 5.9 Number of countries offering new transactional services assessed in 2018 survey

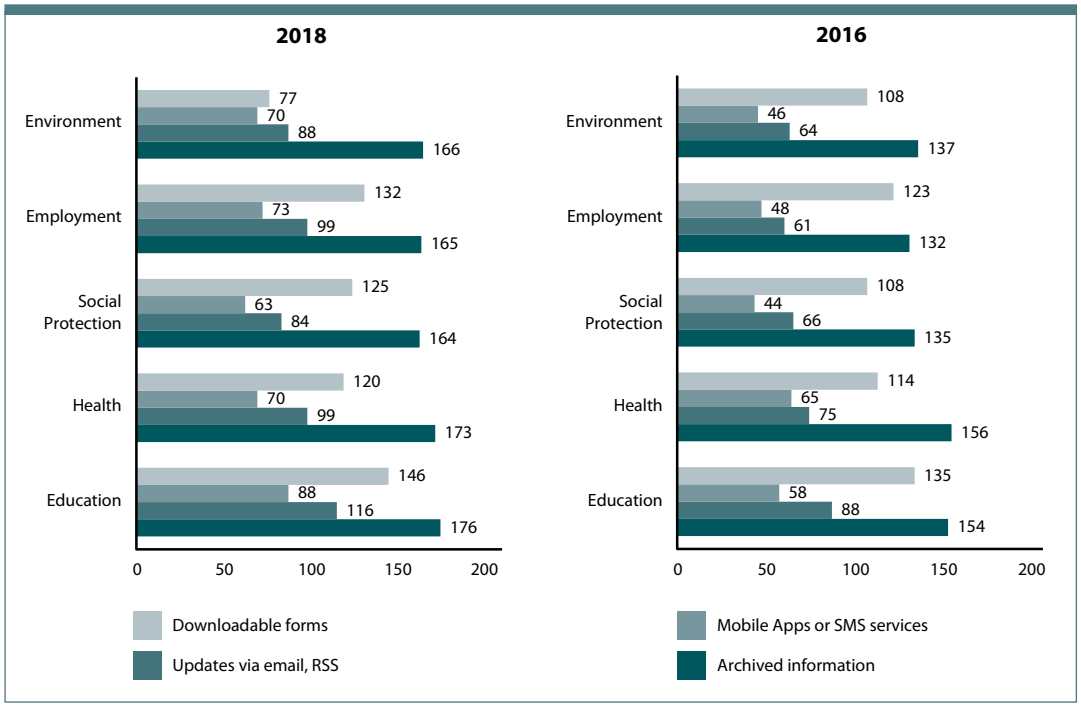


The 2018 Survey also tracked the expansion of online services globally and took note of new services being offered (see Figure 5.9) The top three new services for 2018 are applying for government vacancies online (129 countries), submitting value added taxes (121 countries) and applying for business licenses (104 countries).

5.3.2 Distribution of online services by sector

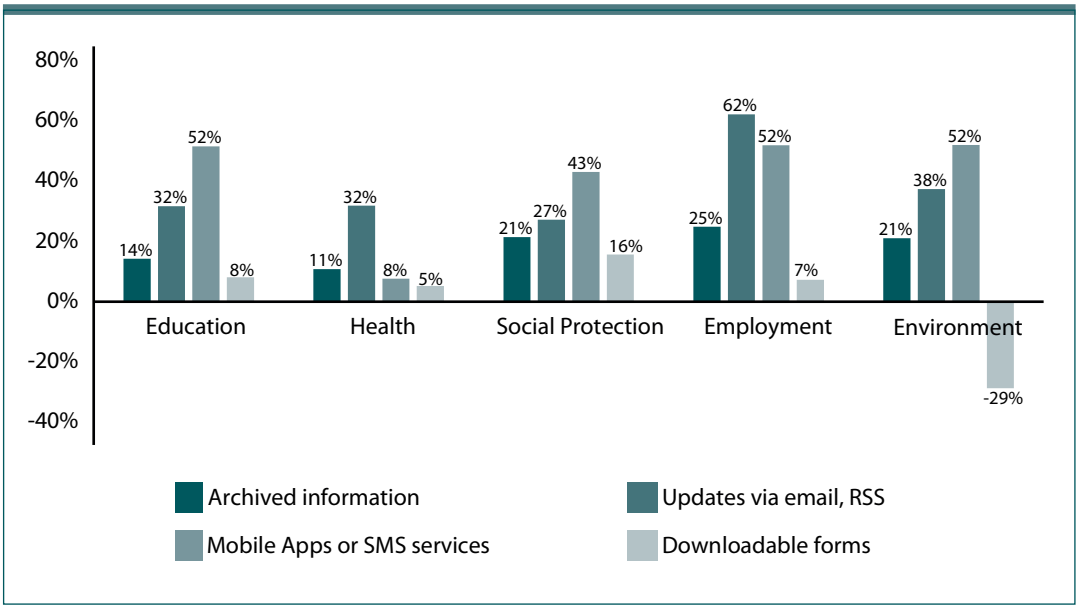
Various government sectors are continuing to adopt and use digital technologies—the Internet, mobile phones and other tools—to collect, store, analyze and share information digitally. According to the 2018 Survey, the number of countries providing online services through emails, SMS/RSS feed updates, mobile Apps and downloadable forms has increased in all sectors but the environment (see Figure 5.10). For instance, 176 countries are providing archived information online in education sector compared to 154 in 2016. Similarly, mobile Apps and SMS services in health sector are offered in 70 countries compared to 65 in 2016.

Figure 5.10 Types of online services by sector, 2016 and 2018



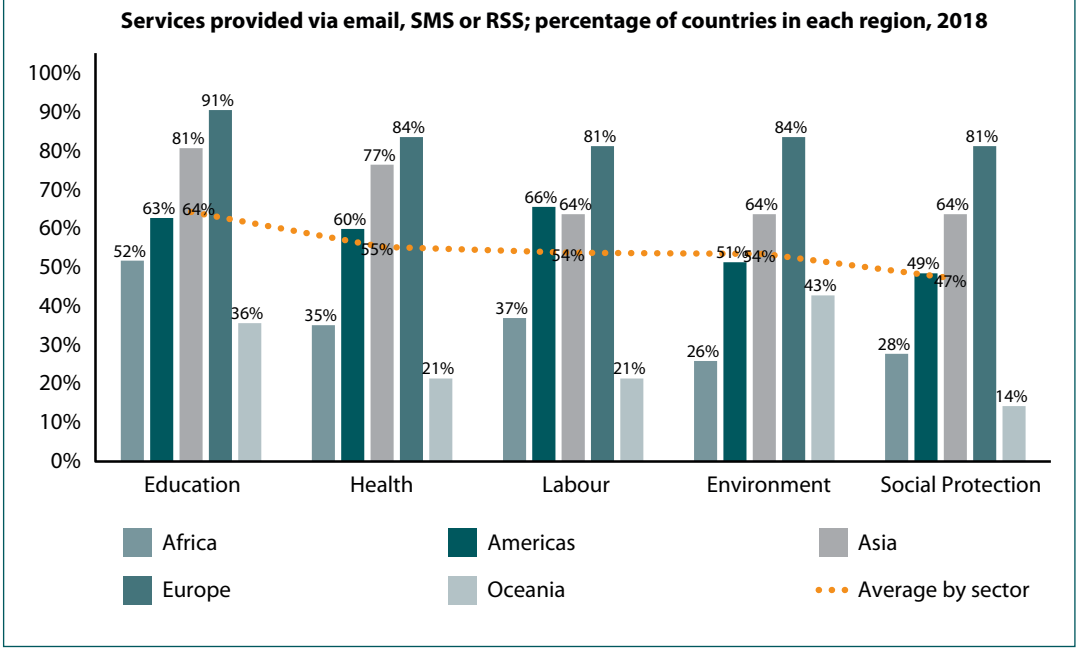
As shown on Figure 5.11, Services provided through mobile Apps are growing fastest, at 52 per cent, in the education, employment, environment sectors. Updates via email and RSS have increased the most, at 62 per cent, in the employment sector, followed by the environment sector, at 38 per cent. Interestingly, fewer countries offer downloadable forms in the environment sector in 2018 compared to 2016.

Figure 5.11 Changes in sector-specific online service provision, percentage



The regional distribution of countries that provide online services via email, SMS or RSS in the abovementioned sectors is as follows (see Figure 5.12): in average, 86 per cent of countries in Europe, 71 per cent in Asia, 59 per cent in Americas, 36 per cent in Africa, and 30 per cent in Oceania. Most frequently, the online services offered are in education (64 per cent in average), followed by health (55 per cent), labor (54 per cent), environment (54 per cent) and social protection (47 per cent).

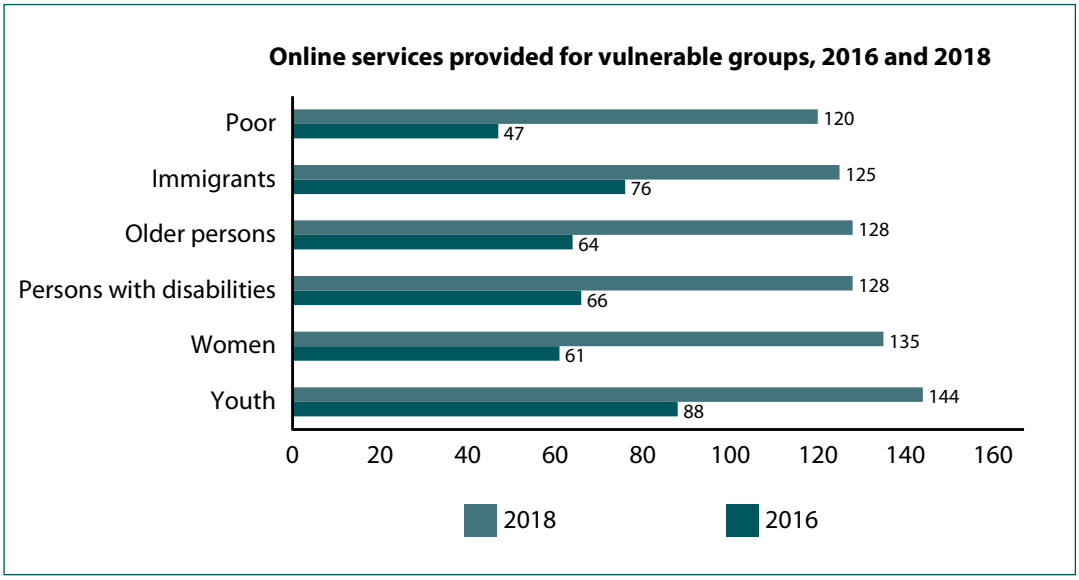
Figure 5.12 Services provided via email, SMS or RSS, percentage of countries in each region, 2018



5.3.3 Targeted services for vulnerable groups

One positive trend recorded in 2018 Survey is that increasingly more countries are providing online services targeting the most vulnerable groups. As illustrated in Figure 5.13, since 2016, the number of countries providing services to the poor has almost tripled, while those providing services tailored to the youth, women, migrants, refugees, older persons and persons with disabilities have nearly doubled. More specifically, services for young people were offered in 144 countries compared to 88 in 2016; services for women were offered in 135 countries compared to 61 countries previously; services for immigrants was available in 126 countries in 2018, up from 72 in 2016; while services for seniors and persons with disabilities doubled from 64/66 in 2016 to 128 countries in 2018.

Figure 5.13 Online services provided for vulnerable groups, 2016 and 2018



Online service delivery for all vulnerable groups in Europe has been growing, reaching almost universal coverage across the region or 81-89 per cent of all European countries. The percentage of countries offering services to vulnerable groups also rose from 69 to 86 per cent in the Americas, from 70 to 79 per cent in Asia, from 33 to 57 per cent in Africa, and from 4 to 15 per cent in Oceania.

Table 5.5 Online services provided to vulnerable groups, regional distribution, 2018

	Africa (54)		Americas (35)		Asia (47)		Europe (43)		Oceania (14)	
	number	percent	number	percent	number	percent	number	percent	number	percent
Poor people	20	37.0%	27	77.1%	33	70.2%	38	80.9%	2	4.3%
Persons with disabilities	18	33.3%	28	80.0%	36	76.6%	42	89.4%	4	8.5%
Older persons	20	37.0%	27	77.1%	37	78.7%	39	83.0%	5	10.6%
Immigrants	20	37.0%	24	68.6%	37	78.7%	39	83.0%	5	10.6%
Women	27	50.0%	28	80.0%	37	78.7%	39	83.0%	4	8.5%
Youth	31	57.4%	30	85.7%	34	72.3%	42	89.4%	7	14.9%

5.3.4 Key Dimensions of Governance for Sustainable Development

In promoting peaceful and inclusive societies for sustainable development, the 2030 Agenda places critical attention on building effective, accountable, inclusive institutions at all levels, as stated in Goal 16. In implementing the 2030 Agenda vision to lift people out of poverty and provide opportunities for prosperity to all while protecting our planet, the public institutions shall expand the access to quality public services, particularly for vulnerable groups.

In achieving progress in building such institutions, it is important to strengthen the trust in authorities and State institutions, as well as increase transparency and openness in governance processes. The use of information and communication technologies (ICTs) in government can effectively support an integrated and inclusive implementation of SDGs and can provide necessary tools to enable policy integration across economic, social and environmental dimensions. It can also eliminate "silos" in various sectors of the government helping institutions to join forces in pursuit of common objectives. It can help by providing online access to information generated by the government, and by reengineering information flows and decision-making processes for greater public participation in decision-making processes. All these efforts lead to increased transparency, accountability, effectiveness and inclusiveness.

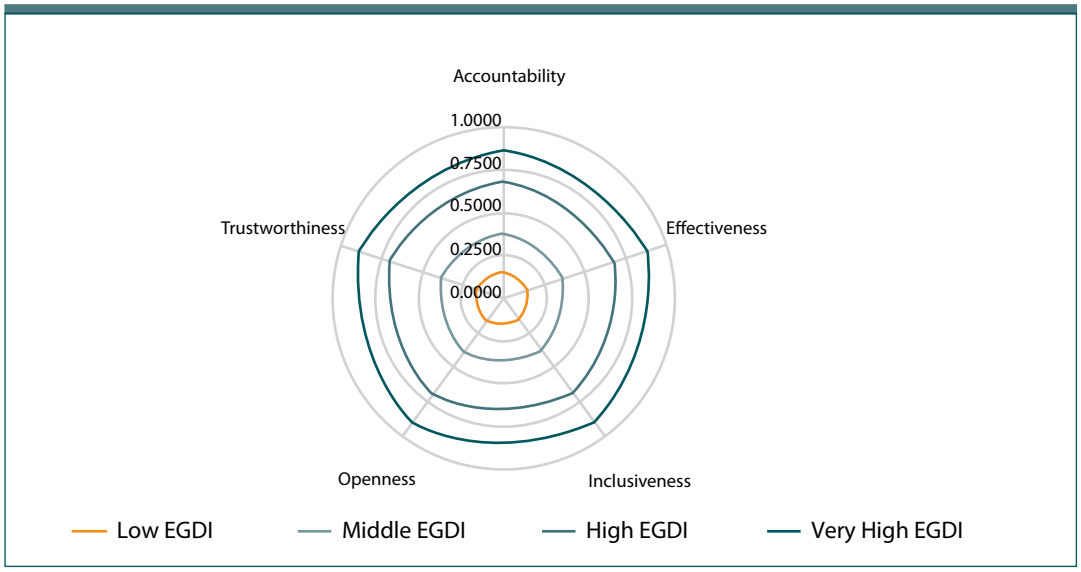
The E-government Survey 2018 has analyzed governments' efforts across the globe towards increasing accountability, effectiveness, inclusiveness, openness and transparency by assessing multiple features of the government platforms and their online services. This is contributing to enhancement of these key governance principles. For instance, detailed information in government websites about institutional arrangements, the availability of mechanisms for providing feedback or filing complaints about the quality of services provided, the ability to contact government agencies directly, among others, are contributing to transparency and openness of governments. Likewise, availability of legal information and state regulations preventing discrimination, protecting against misuse of personal data, and ensuring digital/cyber security for all citizens help to improve transparency and trustworthiness.

Increasingly, more governments give importance to disclosing information about procurement processes. In their efforts to strengthen accountability and openness, they offer online tools for monitoring and evaluating procurement contracts, tender results and primary government expenditures. To foster inclusiveness and effectiveness, governments are forging public-private partnerships offering more innovative public services online. They are also engaging in public e-consultations, organizing online deliberations on key strategic and policy issues, publishing the results of such e-consultations online, and creating targeted services for vulnerable groups.

Among the mechanisms for keeping public servants and institutions accountable is the availability of online reporting of cases on unethical behavior or corruption among public servants. People's ability to report their grievances, cases of discrimination, and legal violations are among the new features that governments are employing to improve accountability and effectiveness of public services delivery. All these measures are contributing towards achieving the 2030 Agenda's vision for accountable, effective and inclusive governance. The sections below highlight some of the 2018 Survey's findings on these key attributes of e-governance.

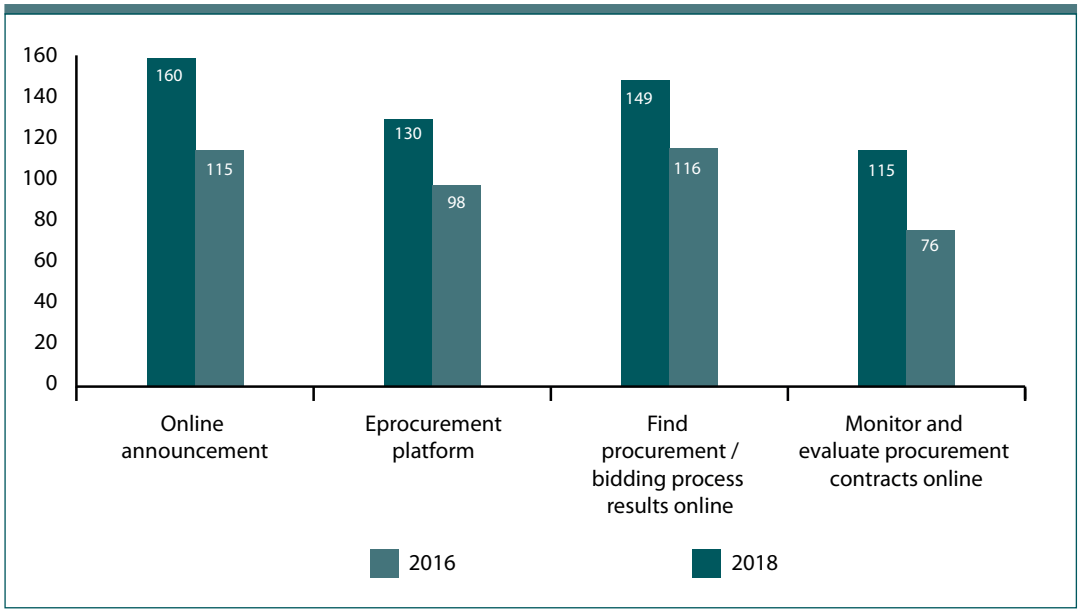
By and large, the countries with Very High EGDI level offer the most comprehensive websites and online services in keeping with these governance principles (see Figure 5.14). The countries in the Low EGDI group tend to cover lesser aspects of accountability, effectiveness, inclusiveness, openness and trustworthiness.

Figure 5.14 The aspects of governance assessed on websites, by EGDI level group, 2018



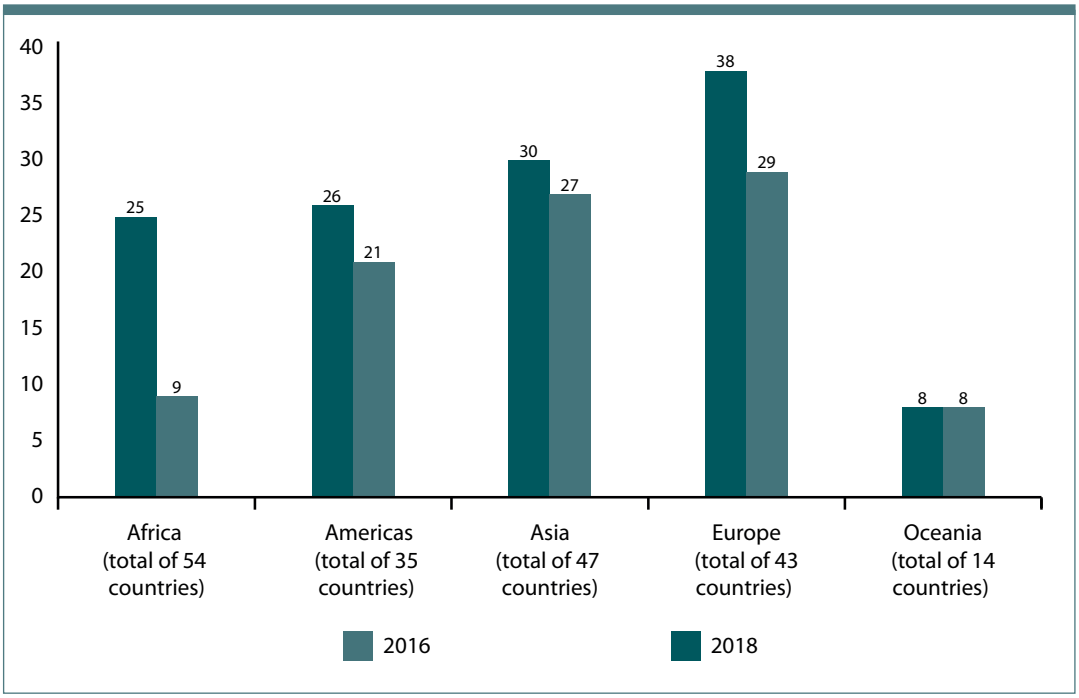
One of the indicators of openness, transparency and accountability on the part of government is the provision of public mechanisms to participate in e-procurement and public bidding processes. This may include the availability of e-procurement platforms, public announcements about e-procurement processes and bidding results, as well as online mechanisms to monitor and evaluate e-procurement contracts. The 2018 Survey shows that 130 out of 193 United Nations Member States have e-procurement platforms compared to only 98 in 2016 (see Figure 5.15). In 2018, more than two-thirds of the Member States are providing online announcements and sharing the results of the bidding processes, as well as providing information for monitoring and evaluating public procurements contracts, which is a significant increase from 40 to 59 per cent of countries offering the same set of services in 2016.

Figure 5.15 Number of countries offering tools related to e-procurement out of 193 countries, 2016 and 2018



Similarly, by announcing government vacancies online and sharing information about employment opportunities with the public sector, governments are increasing transparency in recruitment and encouraging greater participation. Increasingly, more countries are now offering such features in government websites compared to 2016, as shown on Figure 5.16 summarizing the findings of 2018 Survey.

Figure 5.16 Government vacancies online, 2016 and 2018

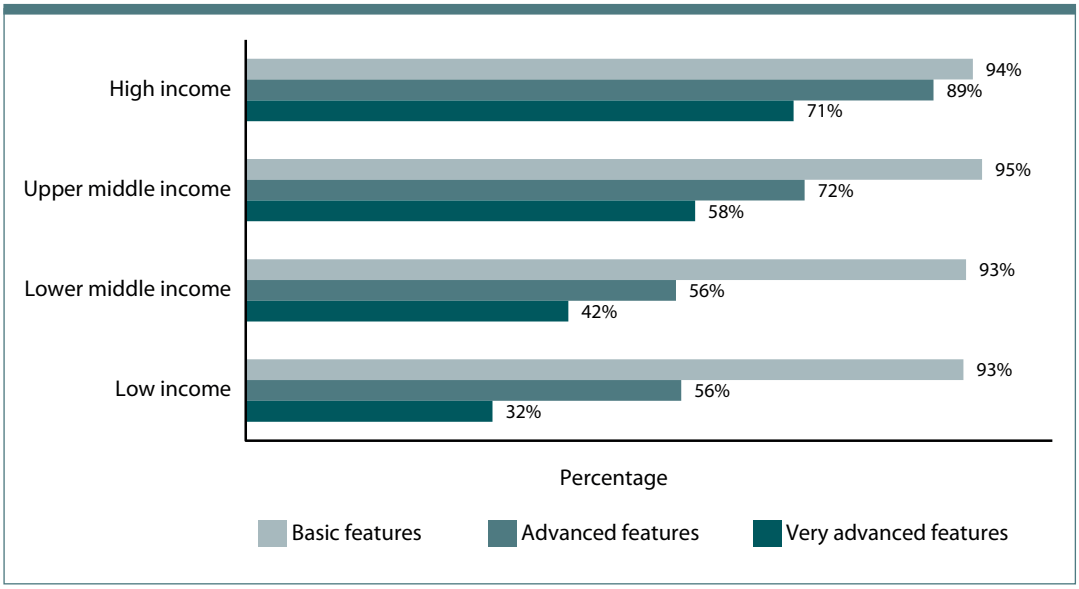


5.3.5 Global disparities in e-government services

ICT-supported and innovative delivery of public services are primarily aiming to ensure the universality of basic services to the poorest and most vulnerable—leaving no one behind. In many parts of the world, especially in developing countries, public service delivery applications are still lacking. While some countries and governments are now fully exploiting ICTs, large disparities remain among regions and countries on how ICTs are being harnessed to deliver public services, innovate service delivery for targeted populations or designing different types of services. Many low-income countries are still utilizing more basic levels of ICTs, resulting in lack of reach and quality of public services, lack of efficiency and effectiveness in service provision.

Figure 5.17 compares the deployment of basic, advanced and very advanced features in national e-government portals by country income. Most government portals are now adopting the basic features covering ease of finding the portal, availability of basic searches, site map and contact us features— all of which are being regularly updated. However, lower and low-income countries lag considerably behind in offering more advanced features such as help, frequently asked questions or FAQs, feedback options, links to one-stop-shop options, social media, and automatic web adaption to any device, as well as very advanced features for searching, availability of tutorials, help-desk, facility to report unethical or corrupt behavior, and ability to propose new open datasets.

Figure 5.17 Availability of basic, advanced and very advanced services on national e-government portals by country income

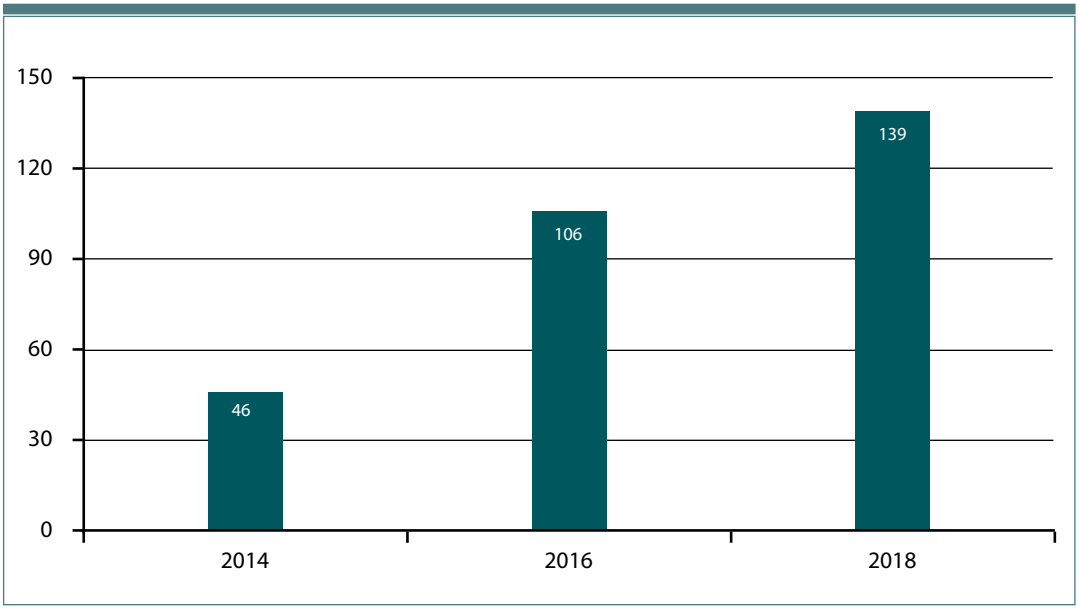


5.4 Trends in Open Government Data

Open government data (OGD) contributes to the achievement of the 2030 Agenda for Sustainable Development in more ways than one. Apart from generating better data for tracking sustainable development progress, it is supporting the attainment of Goal 16 — to build effective, accountable and inclusive institutions at all levels. Open government data is significantly increasing transparency leading to increased accountability and trust in governments and public institutions. Publicly available and reusable open data is fueling participation and collaboration among actors in the public, private and civil society sectors. It is also helping to improve service delivery in many sectors crucial to sustainable development such as education, health, environment, social protection and welfare and finance. Many countries have dedicated portals sharing data in open formats, often referred to as "Open Government Data portals". Many others have OGD catalogues listing all available datasets usually organized by theme, for example, environment, spending, health, among others, and/or by ministry. OGD are typically available in the national portal or the OGD portal.

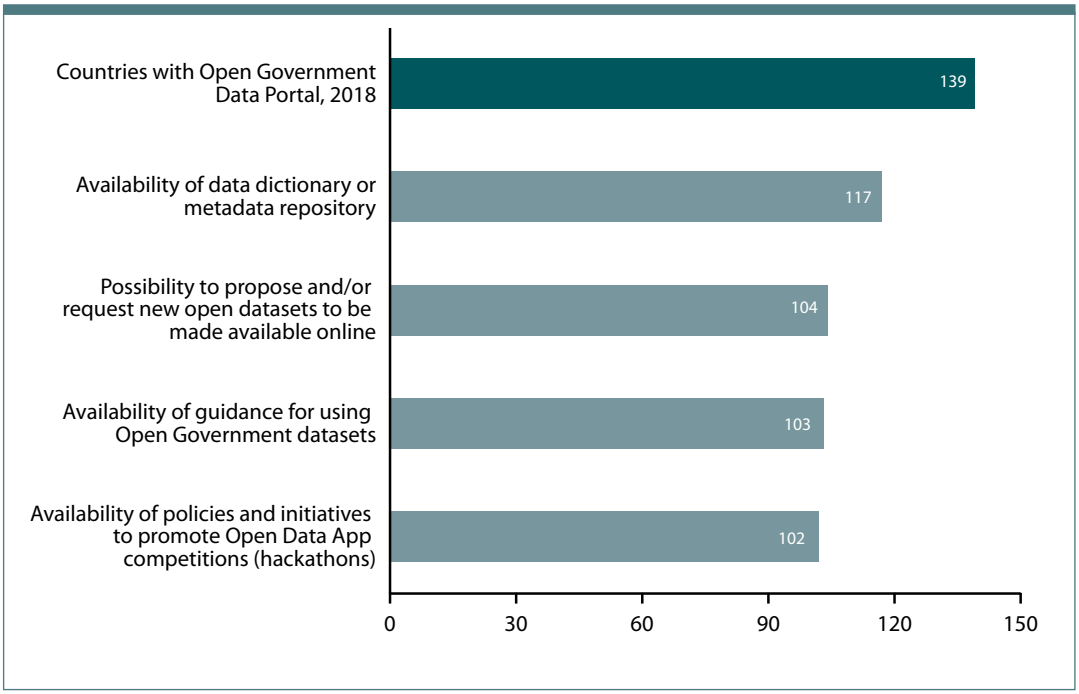
The 2018 Survey tracks the progress of making OGD available to the public through government websites, dedicated portals, and OGD catalogues. As highlighted in Figure 5.18, the number of countries with OGD portals has reached 139, comprising 72 per cent of the United Nations Member States, a significant improvement compared to only 46 countries in 2014 and 106 in 2016. By and large, 84 per cent of these portals also have a directory or metadata repositories describing the data underlying concepts, methodology and structure.

Figure 5.18 Countries with Open Government Data Portal and/or Catalogues in 2014, 2016 and 2018



The functionality of OGD portals is also improving. About 74 per cent of countries that have OGD portals and websites are also providing guidance on using and navigating the complex datasets, encouraging users to request new datasets, initiating hackathons and promoting use of public open data in creating online Apps. This trend is significant and encouraging, given that in 2016 only 24 to 50 per cent of countries did the same.

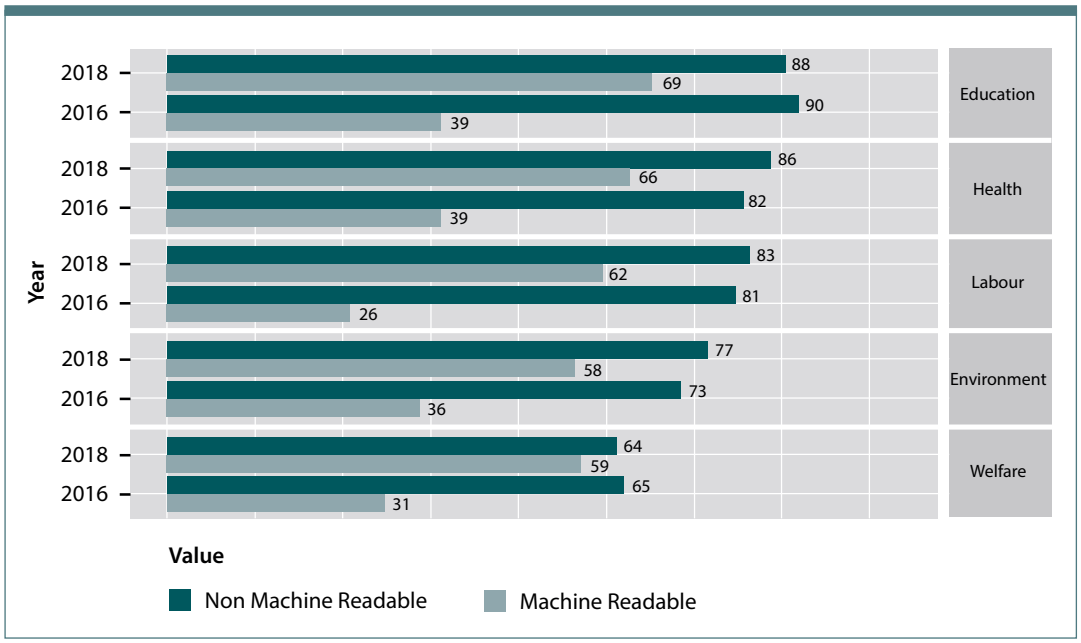
Figure 5.19 Functionalities of Open Government Data Portals, 2018



Open data can be considered as such when information is released in a machine-readable format, there are no legal barriers to access, the information is free of charge and is available in widespread type or open standard files. Making data both human- and machine-readable is an important step towards greater utilization of open government data.

Figure 5.20 below presents the number of countries providing data in machine readable and non-readable formats about the education, health, social welfare, labor and environment sectors. Compared to 2016, it is increasingly common to find sector-specific information in dedicated government websites. However, data are often in non-machine-readable formats, for example, in PDF. While the data being provided in non-machine-readable formats has doubled in the past two years across various sectors, machine-readable datasets are increasing incrementally.

Figure 5.20 Trends in open government data, by sector, 2016 and 2018

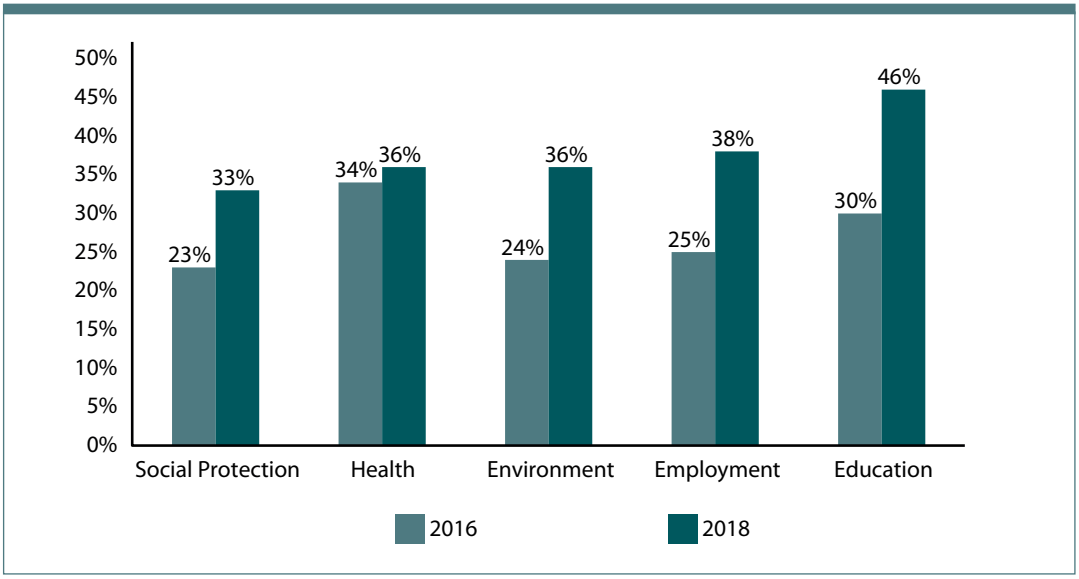


5.5 Trends in mobile service delivery

With the continuous increase in mobile broadband coverage, mobile data traffic, and the rising number of smartphone subscriptions worldwide, accounting for all mobile phone subscriptions[21], governments around the world are actively adapting e-government services to mobile platforms to enable delivery of public services anytime and anywhere.

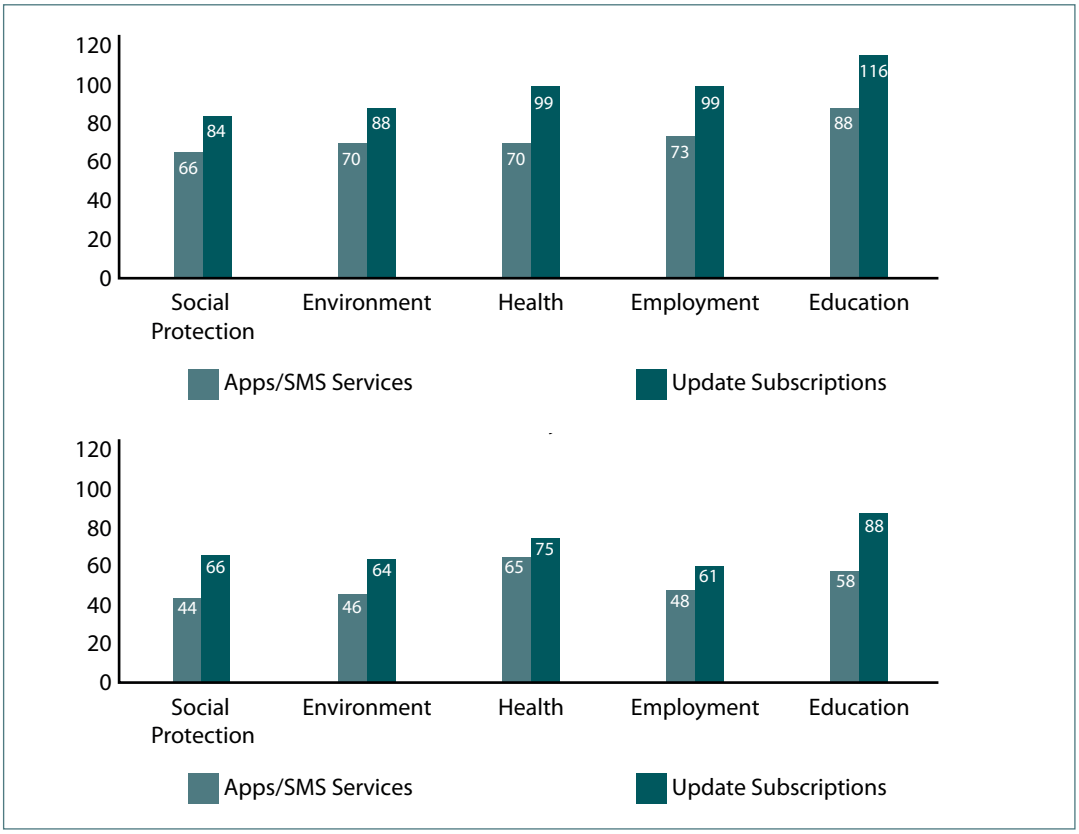
In 2018, the percentage of countries among the 193 Member States providing updates via email, or rich site summary (RSS) feeds has increased in all sectors compared to 2016. The highest number of countries are offering mobile services or applications (Apps) in education at 46 per cent, followed by 38 per cent in employment, 36 per cent in health and environment, and 33 per cent in social protection sectors.

Figure 5.21 Trends in Mobile Apps and SMS Services usage by sectors in 2016 and 2018



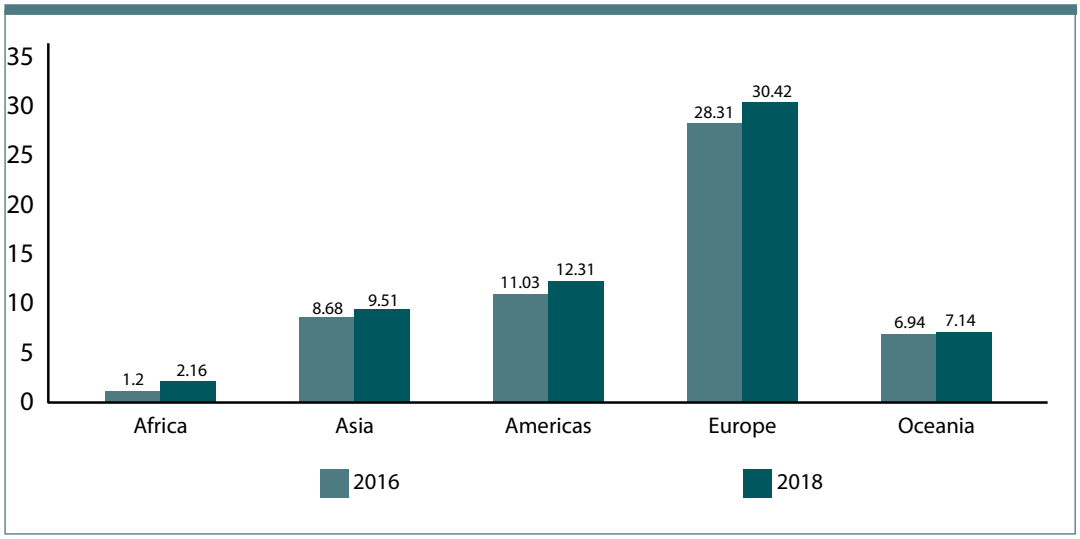
The increasing use of email and RSS, as well as mobile Apps and short messaging system (SMS) services by governments signify the commitment to utilize technology to benefit the people. Updates subscriptions are expanding faster, but the availability of mobile Apps and SMS services is also growing significantly, especially in the education sector with 88 countries offering such services compared to 58 in 2016.

Figure 5.22 Mobile Services Delivery by Sector



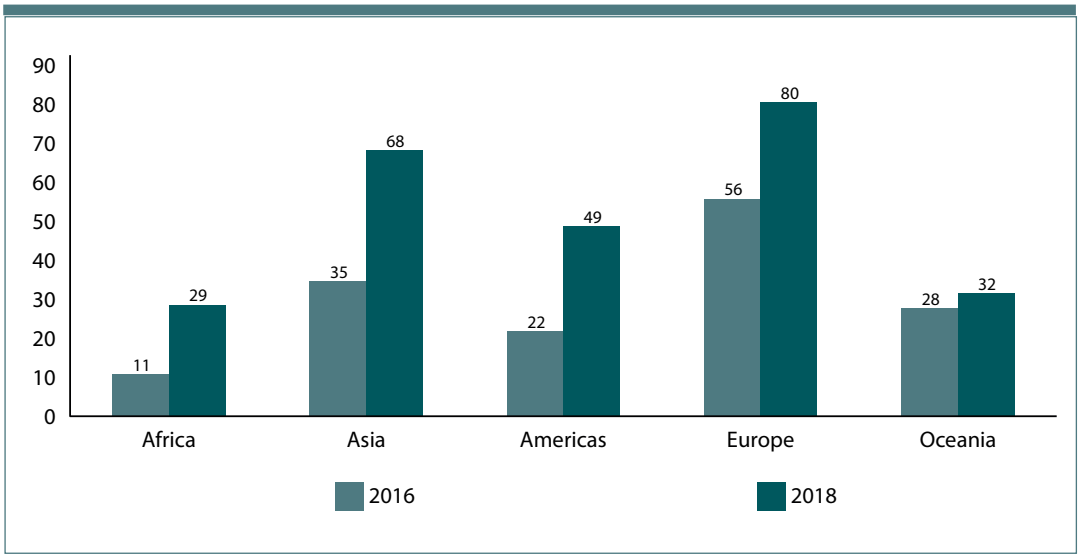
The expansion of mobile services is linked to the increased subscription of mobile phones and fixed broadband across all regions. As shown in Figure 5.23, the accessibility and subscription of fixed broadband has grown by an average of 1-2 per cent in all regions. For every 100 persons, usage grew in Africa from 1.2 users to 2.16 users; in Asia, from 8.68 users to 9.51 users; in the Americas, from 11.03 users to 12.31 users; in Europe, from 28.31 to 30.42; and in Oceania, from 6.94 to 7.14.

Figure 5.23 Trends in fixed broadband subscriptions in 2016 and 2018



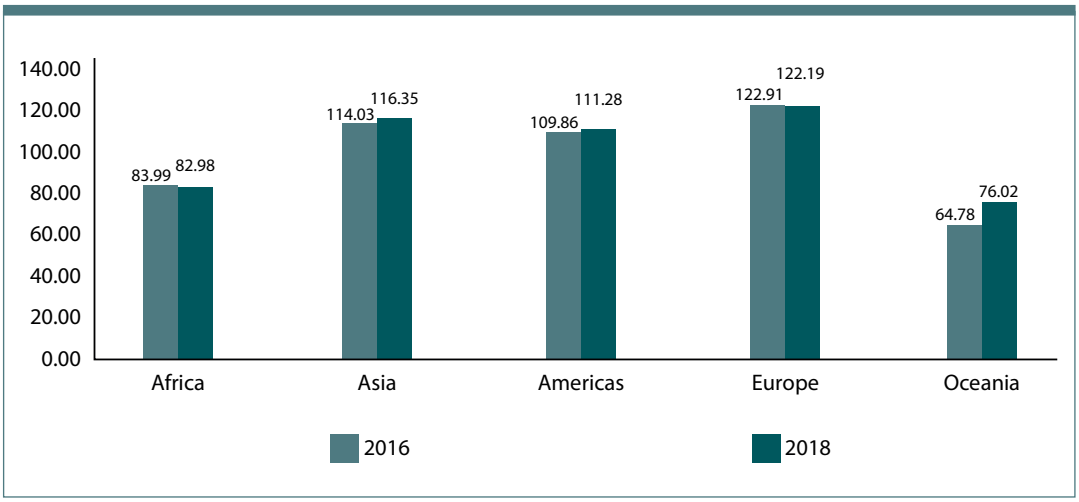
Wireless-broadband subscriptions across the regions has been increasing briskly in the last two years. The number of subscriptions per 100 persons in Africa jumped from 10.75 in 2016 to 28.62 in 2018 even as the region remains in the lower end. Asia and Americas experienced more than a two-fold increase in wireless broadband subscriptions reaching 68.15 and 48.74 subscriptions per 100 inhabitants in 2018 respectively. The Oceania had a modest increase from 27.74 in 2016 to 31.56 in 2018. Europe with an overall subscription rate of 80.45 in 2018 is at the most advanced level globally.

Figure 5.24 Trends in active wireless-broadband subscriptions in 2016 and 2018



The trend of mobile phone subscription per 100 inhabitants for the last two years, according to ITU data as shown in Figure 5.25 below, is increasing in Asia, Americas and Oceania, but is slightly decreasing in Africa and Europe.

Figure 5.25 Trends in mobile phone subscriptions in 2016 and 2018



5.6 E-participation: public engagement for innovative public e-services delivery

5.6.1 E-participation concepts and features

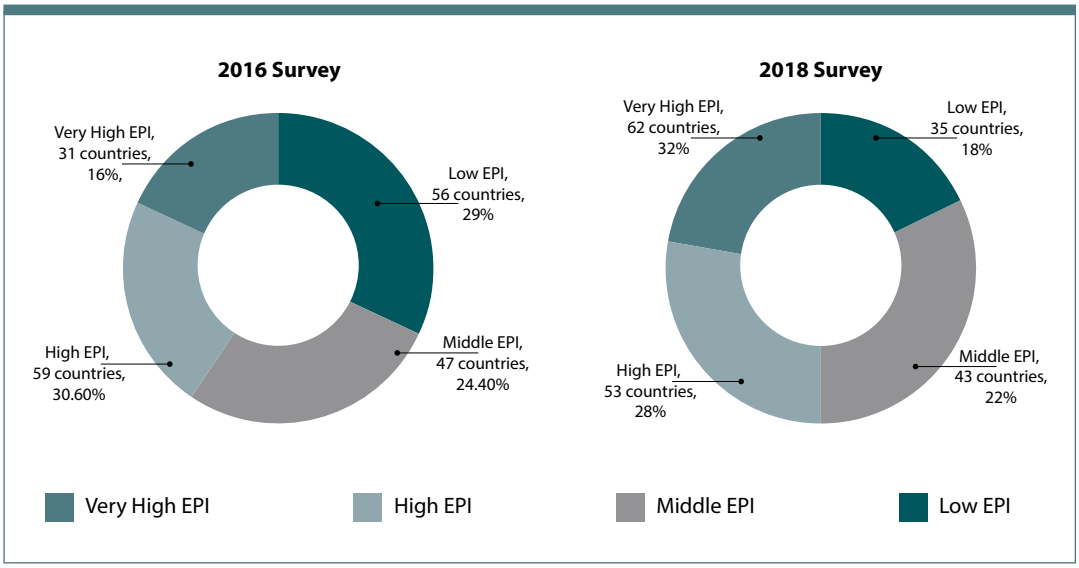
E-participation is defined "as the process of engaging citizens through ICTs in policy, decision-making, and service design and delivery so as to make it participatory, inclusive, and deliberative" (United Nations, 2013). As in previous Surveys, the 2018 Survey measures e-participation through the E-Participation Index (EPI) based on: (i) e-information – availability of online information; (ii) e-consultation – online public consultations, and (iii) e-decision-making – directly involving citizens in decision processes. The Survey assesses the availability of e-participation tools on national government portals for each of the above criteria. It is noted in the 2018 Survey that more and more governments are encouraging citizens and businesses to collaborate by contributing ideas and providing feedback.

The 2030 Agenda[22] calls for equitable, tolerant, open and socially inclusive world in which the needs of the most vulnerable are met. In line with this, new questions were introduced in 2018 assessing the participation of vulnerable groups through provision of targeted information, including in open formats, as well as the support being provided to these groups in terms of policies, budget, and legislation. Table 5.6 below summarizes the main e-participation features assessed in the 2018 Survey.

Table 5.6 Summary of assessed e-participation features

• Availability of sources of archived information (policies, budget, legal documents, budgets, etc.); use of digital channels (including mobile devices/platforms) and open data technologies in the areas of education, health, finance, social welfare, labour, environment.
• Availability of online information on citizens' rights to access government information (such as Freedom of Information Act or Access to Information Act)
• Evidence about government partnership/collaboration with third parties (civil society, private sector) in providing services
• Evidence about free access to government online services through the main portal, kiosks, community centers, post offices, libraries, public spaces or free WiFi
• Availability of open datasets (in machine-readable non-proprietary formats), related policies/ guidance
• Evidence about collaborative co-production, crowdfunding
• Evidence about engaging citizens in consultation/communication to improve online/mobile services and raise citizens' satisfaction
• Evidence about engaging citizens in consultation/communication on education, health, finance, social welfare, labor, environment
• Availability of "personal data protection" legislation online
• Evidence about opportunities for the public to propose new open datasets to be available online
• Availability of e-participation policies/mission statements
• Availability of public procurement notifications and tender results online
• Availability of online tools (on the national portal) to seek public opinion and other input in raw (non-deliberative) form policy formation
• Evidence on decisions made that included results from online consultation with citizens in the education, health, finance, social welfare, labor, and environment sectors
• Evidence about governments' publishing outcomes of policy consultations online

Figure 5.26 Number of countries grouped by EPI levels in 2016 and 2018



Comparing the results from 2016 and 2018 Surveys, the number of countries with Very-High EPI level has doubled from 31 to 62. The number of countries with High-, Middle- and Low-EPI levels decreased slightly because many of them had transitioned to higher EPI level groups. Total number of countries with low EPI decreased from 56 to 35. This positive trend along with improvements in other digital indexes showcases countries' commitments in implementing further tools for engaging citizens.

5.6.2 Global and regional rankings

According to the 2018 Survey, Denmark, Finland, Republic of Korea are ranked as global leaders on e-participation while Netherlands, Australia, Japan, New Zealand, United Kingdom, United States and Spain are following closely behind (see Table 5.7 below).

Table 5.7 Top 10 Performers in 2018

Rank	Country Name	EPI score
1	Denmark	1
1	Finland	1
1	Republic of Korea	1
4	Netherlands	0.9888
5	Australia	0.9831
5	Japan	0.9831
5	New Zealand	0.9831
5	Spain	0.9831
5	United Kingdom of Great Britain and Northern Ireland	0.9831
5	United States of America	0.9831

The countries that are leading in e-participation are implementing different initiatives. For example, in Denmark, e-participation is part of the country's Digital Strategy for 2016-2020[23]. In Australia, all agencies designing new or redeveloping public-facing services must meet the Australian Digital Service Standard, including criteria "9" which ensures the proposed service is accessible to all users, regardless of their ability and environment[24]. Japan has the "Digital Government Idea Box 2017" as a venue to widely discuss e-governance issues with its citizens and realize higher quality e-services.

Table 5.8 Countries grouped by E-participation Index levels

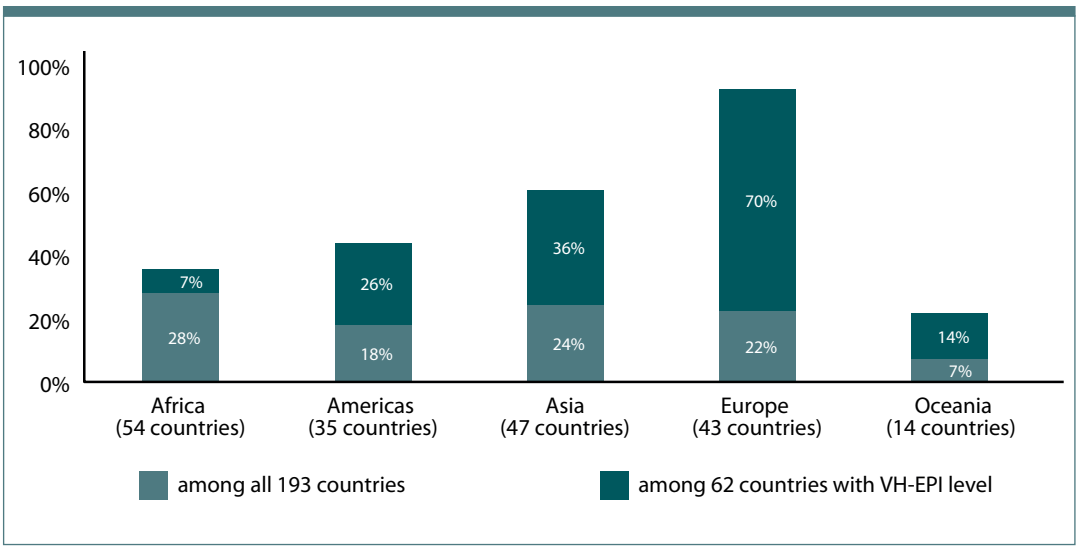
Very High EPI (Greater than 0.75)	High EPI (Between 0.50 and 0.75)	Middle EPI (Between 0.25 and 0.50)	Low EPI (Less than 0.25)
Albania	Andorra	Afghanistan	Algeria
Australia	Argentina	Angola	Botswana (-)
Austria	Armenia	Antigua and Barbuda (+)	Cambodia
Bahrain (+)	Azerbaijan	Belize	Chad
Bangladesh (+)	Bahamas	Benin (+)	Comoros
Belarus (+)	Barbados (+)	Bosnia and Herzegovina	Congo
Belgium (+)	Bhutan (+)	Burundi (+)	Côte d'Ivoire

Very High EPI (Greater than 0.75)	High EPI (Between 0.50 and 0.75)	Middle EPI (Between 0.25 and 0.50)	Low EPI (Less than 0.25)
Brazil (+)	Bolivia	Cabo Verde	Democratic People's Republic of Korea
Bulgaria (+)	Brunei Darussalam	Cameroon (+)	Democratic Republic of the Congo
Canada	Burkina Faso	Central African Republic (+)	Equatorial Guinea
Chile (+)	Czech Republic	Cuba	Eritrea
China	Dominica (+)	Djibouti (+)	Gabon
Colombia	Dominican Republic	Eswatini	Guinea-Bissau
Costa Rica (+)	Ecuador	Fiji	Lao People's Democratic Republic (-)
Croatia	Egypt	Gambia (+)	Lesotho
Cyprus (+)	El Salvador	Grenada	Libya
Denmark	Ethiopia	Guinea (+)	Malawi (-)
Estonia	Georgia	Guyana	Mali
Finland	Ghana	Haiti (+)	Marshall Islands
France	Guatemala	Iraq	Mauritania
Germany	Honduras	Jamaica	Micronesia (Federated States of)
Greece (+)	Hungary	Jordan	Myanmar
India	Iceland	Kiribati	Nauru
Ireland (+)	Indonesia	Lebanon	Niger
Israel	Iran (Islamic Republic of)	Liberia	Papua New Guinea
Italy	Kenya	Madagascar (+)	Saint Lucia
Japan	Kuwait	Maldives (+)	Sao Tome and Principe
Kazakhstan (+)	Kyrgyzstan	Mozambique (+)	Solomon Islands
Lithuania	Latvia	Namibia (+)	Somalia
Luxembourg (+)	Liechtenstein	Nicaragua	South Sudan
Malaysia (+)	Mauritius	Nigeria	Sudan (-)
Malta	Monaco	Palau (+)	Suriname (-)
Mexico	Mongolia	Samoa	Turkmenistan
Morocco	Montenegro (-)	San Marino (+)	Tuvalu
Nepal (+)	Pakistan	Sierra Leone (+)	Yemen
Netherlands	Panama (+)	Syrian Arab Republic	Algeria
New Zealand	Paraguay	Tajikistan (+)	Botswana (-)
Norway	Qatar	Timor-Leste	Cambodia
Oman (+)	Romania (+)	Tonga	Chad
Peru (+)	Saint Kitts and Nevis	Vanuatu (+)	Comoros
Philippines (+)	Saint Vincent and the Grenadines	Venezuela	Congo
Poland	Saudi Arabia	Zambia	Côte d'Ivoire
Portugal (+)	Senegal	Zimbabwe	Democratic People's Republic of Korea
Republic of Korea	Seychelles		Democratic Republic of the Congo

Very High EPI (Greater than 0.75)	High EPI (Between 0.50 and 0.75)	Middle EPI (Between 0.25 and 0.50)	Low EPI (Less than 0.25)
Republic of Moldova (+)	Sri Lanka		Equatorial Guinea
Russian Federation (+)	Thailand		Eritrea
Rwanda (+)	The former Yugoslav Republic of Macedonia		
Serbia	Togo		
Singapore	Trinidad and Tobago		
Slovakia (+)	Uganda		
Slovenia (+)	Ukraine		
South Africa (+)	United Republic of Tanzania		
Spain	Viet Nam		
Sweden			
Switzerland (+)			
Tunisia (+)			
Turkey (+)			
United Arab Emirates (+)			
United Kingdom of Great Britain and Northern Ireland			
United States of America			
Uruguay (+)			
Uzbekistan (+)			

Note: Countries with superscript (+) have advanced from a lower EPI group to a higher EPI group (e.g., from low-EPI to middle-EPI); countries with superscript (-) have dropped from a higher EPI group to a lower EPI group (e.g. from high-EPI to middle-EPI).

Figure 5.27 Distribution of 62 countries with Very-High EPI level by region, 2018 (compared with the regions' percentage in total 193 countries)



As seen in Figure 5.27, only 22 per cent of the countries in the world are in Europe, while European countries contribute 70 per cent in the group of 62 countries with Very-High EPI levels. Asia follows with the largest proportion of 36 per cent in the same Very High-EPI level group while comprising 24 per cent of the 193 Member States. Americas' share in the group is 26 per cent, Oceania's share is 14 per cent, and Africa's share is 7 per cent.

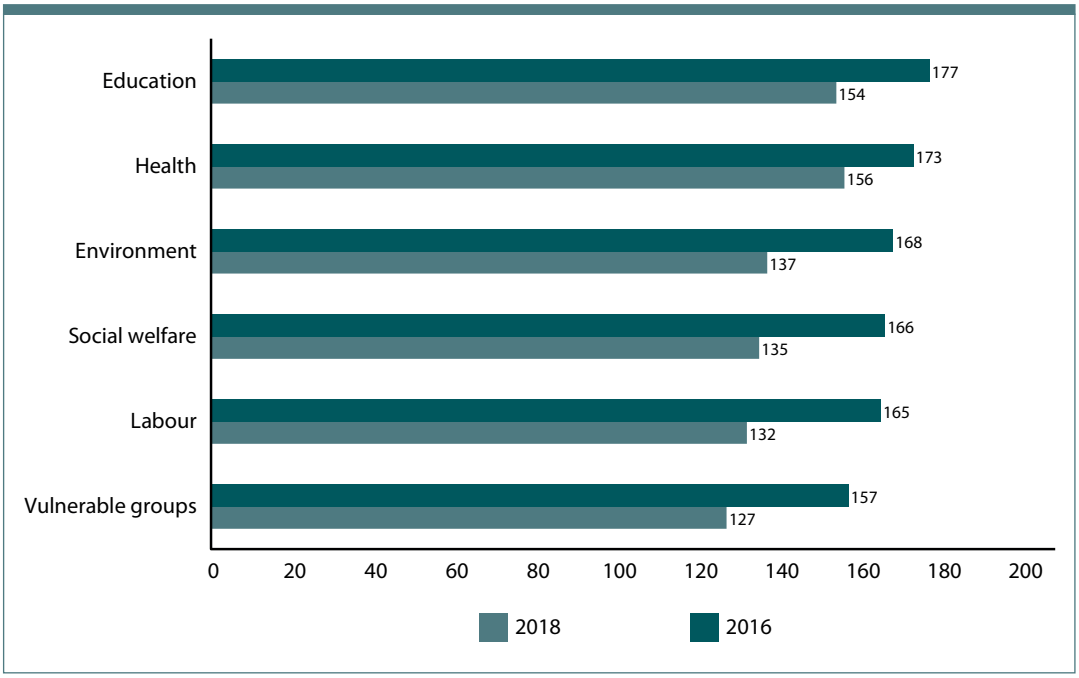
Table 5.9 Countries that have advanced more than 30 positions in the 2018 EPI ranking

Country	Change in rank	2016 EPI	2018 EPI
Burkina Faso	+56	143	87
Dominica	+50	156	106
Philippines	+48	67	19
Panama	+48	114	66
Haiti	+47	164	117
Peru	+46	82	36
Belarus	+43	76	33
Central African Republic	+40	191	151
Cyprus	+38	84	46
Iran (Islamic Republic of)	+38	149	111
Sierra Leone	+38	167	129
Djibouti	+38	191	153
South Africa	+37	76	39
Antigua and Barbuda	+36	157	121
Saint Kitts and Nevis	+35	133	98
Guinea	+35	173	138
Nepal	+34	89	55
Oman	+33	76	43
Bangladesh	+33	84	51
Slovakia	+32	82	50
Rwanda	+32	91	59
Greece	+31	65	34
Switzerland	+31	72	41
Bahamas	+30	122	92
Tuvalu	+30	191	161

5.6.3 E-information

The first level of e-participation is e-information. Governments are providing people with information through ICT channels to help them make more informed choices at the next stage of consultation. E-information is critical because without access to publicly held information, participation cannot be evidence-based, fully relevant, or significant. As seen in Figure 5.28 below, Member States are sharing an increasing amount of information with their citizens mostly in the education and health sectors followed closely by other sectors.

Figure 5.28 Number of countries offering archived information in 2016 and 2018, by sector



Box 5.4 E-participation activities in Finland

Openness and democratic principles are key values and principles in Finland that are being applied in the digital era through the Openness of Government Act which was revised in 1999. Openness and citizen participation have been actively developed during the last decades. Good examples of these development work are the Government's Project Register (HARE), established in 1999; and the otakantaa.fi website, established in 2000 to promote public discussion on government proposals; Hear Citizens project (2000-2005); Government's Policy Programme on Citizen Participation (2003-2007) and the on-going Democracy Network established in 2007.

The government portal, www.demokratia.fi, available in Finnish and Swedish languages only, allows any citizen to suggest initiatives or make comments to the national as well as local government. One of the key services is the Citizen's Initiative for a legislative proposal launched in fall of 2012. Initiatives that collect over 50,000 signatures at a given time are referred to the parliament to be assessed for legislative reform.

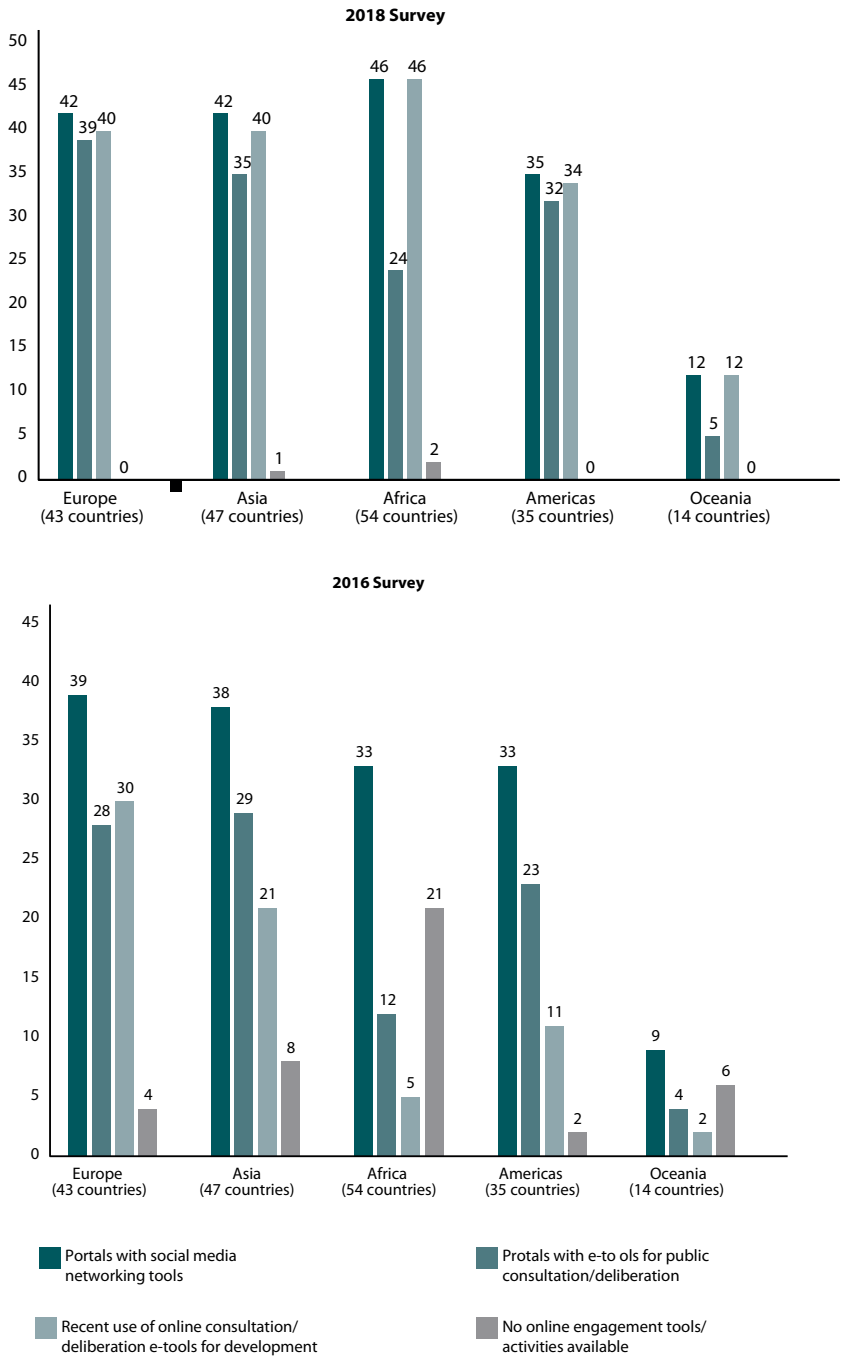
In 2015, the Government initiated a program helping those who are unable or are not accustomed to using digital services. The Ministry of Finance set up "HELP-project" to draft a proposal on ensuring availability of sufficient assistance for those who need help in using digital services. It also set up an Advisory Board, "Digitalization of everyday life", consisting of representatives from over 20 civil society organizations and the academe, to ensure the diverse needs of service users are considered in the implementation of the goal to digitize public services.

Source: UNDESA Member States Questionnaire 2018

5.6.4 E-consultation

The second level of the e-participation model is e-consultation. It means consulting the people is part of the process of crafting new policies, designing new services or projects. Consultation however, need not mean that the government is obligated to use the inputs received. Rather, it has the ability to leverage the information obtained to better respond to public sentiments on a particular subject.

Figure 5.29 Number of countries with online engagement tools on national portals and their usage



Source: UN/DESA

Box 5.5 E-participation activities in Brazil

The third axis of the Digital Governance Strategy of Brazil is about social participation, and its objectives are: (1) Endorse the collaboration in the public policies cycle; (2) Amplify and drive social participation in the creation and improvement of digital public services; and (3) Improve the direct interaction between the government and society. Moreover, in 2014, the President signed Decree 8.243 establishing the National Social Participation Policy and creating the National System of Social Participation managed by the Secretary of Government of the Presidency of the Republic. Through its social participation platform, Participa.br, the initiative is engaging in the development of free software and in body communication tools, discussion forums, chat rooms, videos, maps, participation trails and other means of online social consultation. Since its creation, Participa.br (www.participa.br) has been hosting over 200 participatory processes and more than 30 public government consultations.

The Brazilian open data policy, instituted by Decree No. 8.777 / 2016, has as its fundamental objectives: the promotion of transparency and social participation, the development of new and better government services, the increase of public integrity, and the promotion of entrepreneurship. The Federal Executive Branch of the Ministry of Planning coordinates this policy. To better promote social participation, Knowledge Networks were established through Ordinance No. 290 of 2016, inviting citizens, institutions and communities to become involved in thematic discussion groups, in the E-Government Portal. Also relevant are the network collaboration between government and society through the Ombudsman System, or e-Ouv, which receives information through a variety of channels; and the Consumer Portal, a site allowing consumers to evaluate services provided by companies. (https://www.governoeletronico.gov.br/egd)

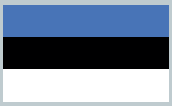
Source: UNDESA Member States Questionnaire 2018

All regions made progress in deploying e-consultation tools in 2018 compared to 2016. For example, in Europe, all countries have online engagement tools or activities, 42 countries have social media networking tools; 39 countries have e-tools for public consultation or deliberation, and 40 countries made recent use of online consultation or deliberation. Among the regions, Africa made the largest progress in 2018. While in 2016, it was recorded that 21 national portals from Africa did not have any online engagement tools available. In 2018, only two countries remain without any kind of online tools for citizen engagement.

5.6.5 E-decision-making

E-decision-making, the third level of the e-participation model, remains a serious challenge. It refers to a process in which people provide their own inputs into decision-making processes. Two examples are: (i) direct e-voting via secure systems and (ii) identifying preferred (popular) options and proposals by rating them through social media's "Like/Dislike" or "plus/minus" functions. While policy-making is the logical outcome of these type of public engagement activities, information gathering and consultations are equally valuable participation forms in their own right. Recently, policy discourse has been gaining special attention as new software tools are creating more complex and sophisticated systems of deliberation online.

Box 5.6 Internet Voting in Estonia



Internet voting (I-voting or online voting) is one of the options for elections in addition to other voting methods in Estonia. I-voting in this context means voting through the Internet, not voting by using a special voting device.

In 2012, an Electronic Voting Committee was established responsible for conducting Internet voting even as the National Electoral Committee retains a supervisory role. Internet voting was first introduced in the local elections of 2005, when more than 9 thousand voters cast their ballot via the Internet corresponding to about 2 per cent of all registered voters. Today, I-voting with binding results has been carried out eight times in Estonia:

- in the local elections in October 2005, October 2009 and October 2013;
- in the parliamentary elections in March 2007, March 2011 and March 2015; and
- in the European Parliament elections in June 2009 and May 2014..

Source: UNDESA Member States Questionnaire 2018

Box 5.7 Digital Malta Strategy 2014-2020

On 24 March 2014, the Government of Malta presented Digital Malta – the National Digital Strategy for 2014-2020. The seven-year strategy was launched by Prime Minister Joseph Muscat along with the Parliamentary Secretary for Competitiveness and Economic Growth.

E-Democracy is addressed in the Strategy whereby the "Government is committed to using ICTs to encourage citizens to take part in democratic decision-making. Initiatives will be implemented to enhance the visibility, transparency and accountability of government."

The Government encourages the general public, civil society organizations, trade unions, business organizations, political parties, governmental institutions and other actors, to participate in online public consultation. The portal http://meae.gov.mt/en/Public_Consultations/ Pages/Home.aspx lists all public consultations and their respective outcomes. Citizens can also subscribe for notification about consultations in their specific areas of interest.

Given the delicate responsibilities that fall under the Planning Authority's remit, the Authority is conscious that informing and involving the public and all interested parties in policy making and decision taking are crucial to the holistic improvement of Malta's island-environment.

As a matter of policy, the Government involves end-user communities in the development of online services as stated in Circular No. 17/2015 from the Office of the Prime Minister entitled "Online Public Services For Citizens and Businesses".

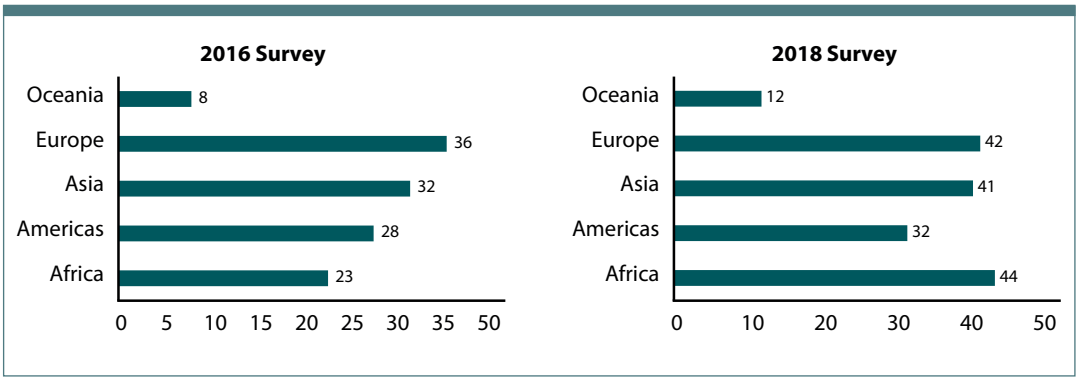
Source: UNDESA Member States Questionnaire 2018

5.6.6 Innovative partnerships, crowdsourcing, and crowdfunding

Innovative public-private partnerships (PPPs) have emerged as models for the provision of public services and social entitlements in areas such as education, health and environmental sustainability. As the 2030 Agenda states— in support of implementing its Goals and targets, there is a need to mobilize all available resources for intensive global engagement, to bring together Governments, the United Nations system, the private sector, civil society, and other stakeholders and actors. In this regard, the Survey checks the online services provided in partnership with civil society and/or the private sector. Figure 5.30 below shows the number of countries providing such services by region for 2016 and 2018. There is progress in all regions, particularly in Africa. The partnership usually

includes financial transactions such as payment of passport application fees in partnership with banks as in the case of Ghana and Cabo Verde.

Figure 5.30 Number of countries providing online services in partnership with civil society or private sector, by region, 2016 and 2018



5.7 Conclusions:

The key conclusions from this chapter are as follows:

- Countries are advancing towards higher levels of e-government signified by an upward movement of 46 countries from Low- to Middle- to High- and Very High-EGDI levels. The world average EGDI has been increasing from 0.47 in 2014 to 0.55 in 2018 due to the continuous improvement of its sub-indices in the last 4 years.

- The percentage of countries with High- and Very-High levels of e-government development is reaching 58 per cent or close to two-thirds of all United Nations Member States. The share of countries with Low-EGDI level, has dropped by a significant 50 percent, that is, 16 countries in 2018 compared to 32 in 2016.

- The regional distribution of e-government development in 2018 mirror those of previous Surveys. In 2018, Europe with 0.77 continues to lead with the highest regional EGDI, followed by the Americas with 0.59, Asia with 0.58, Oceania with 0.46 and Africa with 0.34.

- The overall progress of e-government development in the Americas and Asia is noteworthy. While in 2016 most countries in Latin America and the Caribbean had Middle-EGDI values, eight countries transitioned to High-EGDI level in 2018. Moreover, two-thirds of the countries in Asia, or 31 out of 47, and almost half of countries in Americas, that is, 15 out of 32, have averages above the world average EGDI scores.

- Despite some development gains and investments in technology in several countries, e-government divide and digital divide continue to persist. Fourteen countries with Low-EGDI values are African and belong to the least developed countries. Within these countries, there is high risk that the divide deepens between people who have access to the Internet and online services and those who do not.

- The improvement of the average score of the Online Service Index (OSI) was the fastest —from 0.39 to 0.57 or by an average of 40 per cent—suggesting that globally, there was a steady progress in improving e-government and public services provision online. It is important to note that for the first time, in 2018, the main contributor of EGDI score improvement in all income groups is OSI.

- Although not all countries provide transactional online services, the coverage and availability of services in countries that do provide has increased between 18 per cent to 47 per cent across all service categories. The three most commonly used online services are paying for utilities, available in 140 countries; submitting income taxes, available in 139 countries; and registering new businesses, which can be done in 126 countries.

- Improvement in providing online services has been steady over the last four years in all OSI level groups. Even among the 31 countries in the Low-OSI group in 2018, 23 countries, or 74 per cent, provide at least one kind of online service.

- The number of countries providing online services using emails, SMS/RSS feed updates, mobile Apps and downloadable forms has been increasing in all sectors. For instance, between 156 to 176 countries provide archived information online compared to 137 to 154 in 2016. Similarly, sector-specific mobile Apps and SMS services are now being offered in 70 to 88 countries compared to 46 to 65 countries in 2016.

- Provision of services through mobile Apps is growing fastest in the education, employment, environment sectors, increasing by 52 per cent. Email updates has increased the most, in the employment sector by 62 per cent, followed by the environment sector by 38 per cent.

- One positive trend recorded in 2018 Survey is that increasingly, more countries provide online services targeted to the most vulnerable groups. From the regional perspective, Europe continues to lead in online service delivery for all vulnerable groups reaching almost universal coverage across the region or 81-89 per cent of all European countries. The percentage of countries offering services to vulnerable groups ranges from 69 to 86 per cent in the Americas, from 70 to 79 per cent in Asia, from 33 to 57 per cent in Africa, and from 4 to 15 per cent in Oceania.

- The number of countries with Open Government Data (OGD) portals has reached 139, comprising 72 per cent of all United Nations Member States. Most of these portals, that is, 84 per cent, also have a directory or metadata repositories describing the data underlying concepts, methodology and structure. About 74 per cent of countries that have OGD portals and websites also provide guidance on using and navigating the complex datasets, encourage users to request new datasets, initiate hackathons and use public open data for creating online Apps. This trend is significant and encouraging, given that in 2016 only 24 to 50 per cent of the Member States offered these.

- In all sectors, the share of data provided in non-machine-readable formats has doubled, whereas the increase in machine-readable datasets is incremental.

- The percentage of countries among the 193 Member States providing updates via email, or RSS in 2018 continue to increase compared to 2016 in all sectors. The highest percentage of countries offering mobile services by sector was in education by 46 per cent, followed by 38 per cent in employment, by 36 per cent in health and environment, and by 33 per cent in social protection.

- There was progress in e-participation development in all regions. Comparing the results from 2016 and 2018, the number of countries with very-high EPI level doubled from 31 to 62.

- While all regions made progress in deploying e-consultation tools in 2018 compared to 2016, e-decision-making – the third level of the e-participation model – remains a serious challenge.

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Regional development and country groupings performance

6.1. Introduction

The swift evolution and subsequent diffusion of technology are bringing about significant changes in the way people interact with each other and their immediate environments. Governments around the world are using the advancement in infrastructure and information and communication technologies (ICTs) to promote innovation of and sustainable development in their economies. This chapter presents an overview of e-government development initiatives at regional levels. It features important trends and analyses of regional e-government development performance, including by specific country groups such as the small island developing States (SIDS), least developed countries (LDCs) and least developed landlocked countries (LLDCs).

6.2. Regional rankings

Figure 6.1. below highlights the breakdown of the EGDI and its sub-indices per region. As was the case in previous editions, Europe continues to lead e-government development as indicated by the highest EGDI (0.7730) it enjoys, followed by Americas (0.5900), Asia (0.5780), Oceania (0.4610), and Africa (0.3420) respectively. The Human Capital Index (HCI) is the highest contributing sub-index in all regions while the Telecommunication Infrastructure Index (TII) is the lowest. This implies that the major impediments to the further growth of e-government development worldwide are still the lack of infrastructure and the digital divide. Africa has the lowest HCI and Online Service Index (OSI), but its OSI at 0.3630 is relatively close to Oceania's OSI, at 0.3930. While Asia's OSI at 0.6220 is better than the Americas' at 0.6100, it still ranks behind the Americas in terms of EGDI due to Asia's lower HCI and TII rating.

Photo credit: pixabay.com

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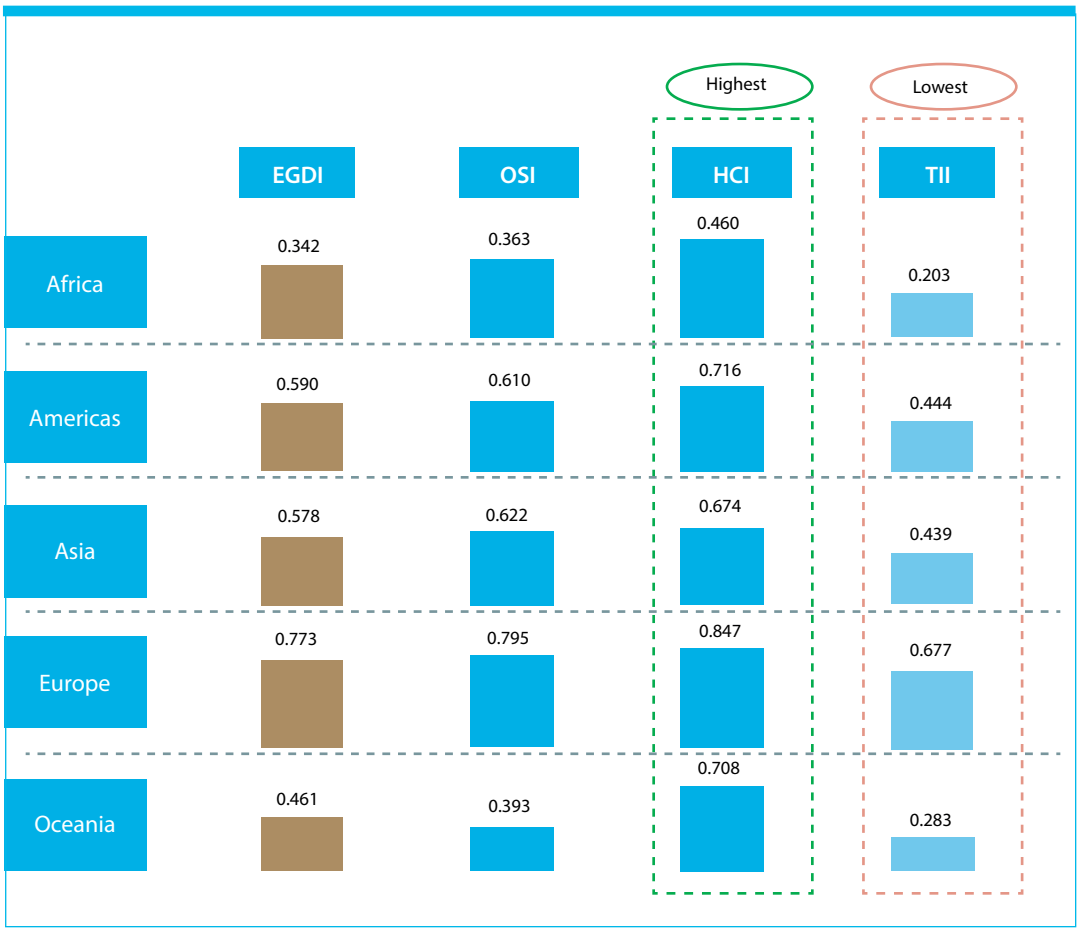
Figure 6.1. Breakdown of E-Government Development Index (EGDI) per geographical region



As Figure 6.1 indicates, Africa has the least developed technical infrastructure and is less connected to the Internet than other regions. According to a recent report by the Economic Commission for Africa, while there is an impressive growth in mobile broadband access across much of the continent, there remains very limited access to fixed broadband. In many African countries, fixed broadband does not even exist.

Figure 6.2 highlights an overall improvement in worldwide EGDI ratings since 2014. The box on the right explains the contribution of each of the three sub-indices indicating that the largest component of the rise in EGDI comes from improvements in OSI. This shows that investment in OSI is the fastest means of improving a country's EGDI rankings. However, the graph also shows the importance of investing in infrastructure and human capital in the long term. While improvements in both infrastructure and human capital have been slower, they are equally important for a healthy and functioning e-government system.

Figure 6.2 Contributors to the EGDI improvements

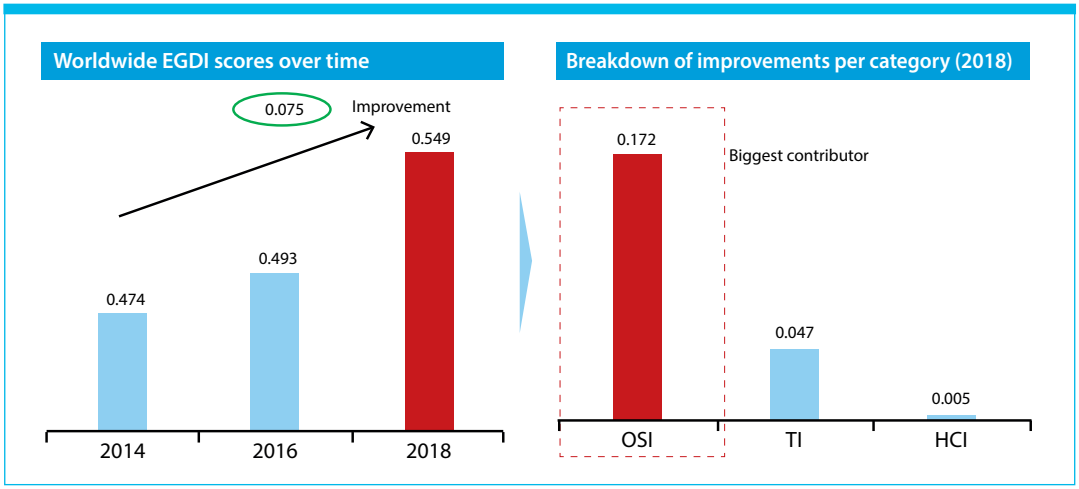
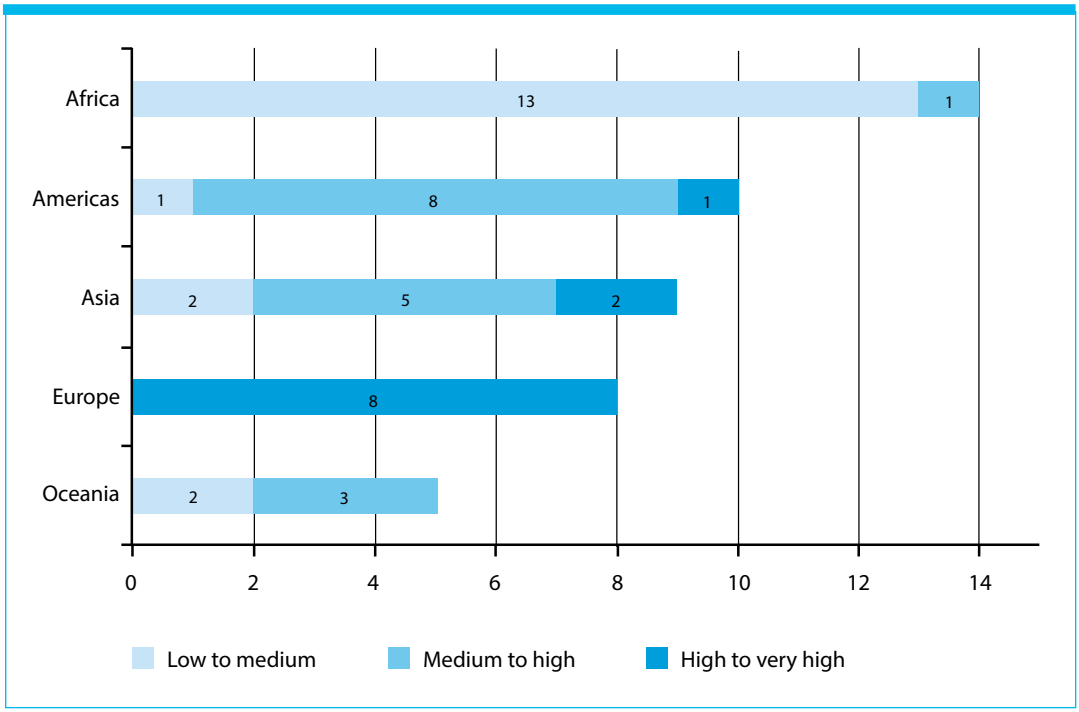


Figure 6.3 shows the comparison of the standard deviation for each region indicating intra-regional gaps in development. Europe, due to the relative homogeneity in the level of development across countries, has the lowest dispersion in EGDI and its sub-indices. On the other hand, Asia has the highest levels of asymmetry in OSI and TII rankings because the region comprises both highly advanced countries such as Japan, Singapore and Republic of Korea as well as developing countries like Afghanistan, Bangladesh, Myanmar and others. Similarly, Oceania has the highest level of dispersion in its EGDI and the second highest level of dispersion across the other three sub-indices due to the inclusion of Australia and New Zealand which boosted the indices of Oceania, a region composed mostly of small island developing States. Among the EGDI sub-components, OSI has the highest level of dispersion across all regions, which confirms that availability and accessibility to online government services are uneven throughout all the regions.

Figure 6.3 Comparison of the standard deviation of EGDI, OSI, HCI and TII

Figure 6.4 highlights the absolute improvements in EGDI levels for each region. The largest gains come from 18 countries[1] across the regions improving from Low-EGDI level to Medium-EGDI level. This is followed by 17 countries[2] that moved from Medium-EGDI level to High-EGDI level and 11[3] moving from High-EGDI level to Very-High-EGDI level. Africa has the largest improvement with 14 countries increasing their EGDI levels between 2016 and 2018 followed by the Americas (10), Asia (9) Europe (8) and Oceania (5). Thirteen African countries moved from Low-EGDI to Medium-EGDI level and one country moved from Medium-EGDI level to High-EGDI level. In the Americas, either countries moved from Medium-EGDI level to High-EGDI level, followed by Asia (5) and Oceania (3). At the same time, eight European countries improved from High-EGDI level to Very-High-EGDI level followed by Asia (2) and the Americas (1).

Figure 6.4 Breakdown of change in countries' EGDI categories per geographical region from 2016 to 2018



Each region contains differing percentages of EGDI levels in their respective countries. Figure 6.5 highlights asymmetries and distributional impacts of e-government development within these regions. Only two regions currently have Low-EGDI level countries; Africa with 26 per cent and Asia with 4 per cent of their respective countries. Africa has no countries represented within the Very-High-EGDI level. On the other hand, 63 per cent of European countries have Very-High-EGDI level followed by Asia (17 per cent), Oceania (14 per cent) and the Americas (9 per cent) respectively. Finally, most of the Oceanian (64 per cent) and African (63 per cent) countries are represented within the Medium-EGDI levels, whereas American (63 per cent) and Asian (51 per cent) countries are mostly within the High-EGDI category.

Figure 6.5 Percentage of countries grouped by E-Government Development Index (EGDI) level and geographical regions

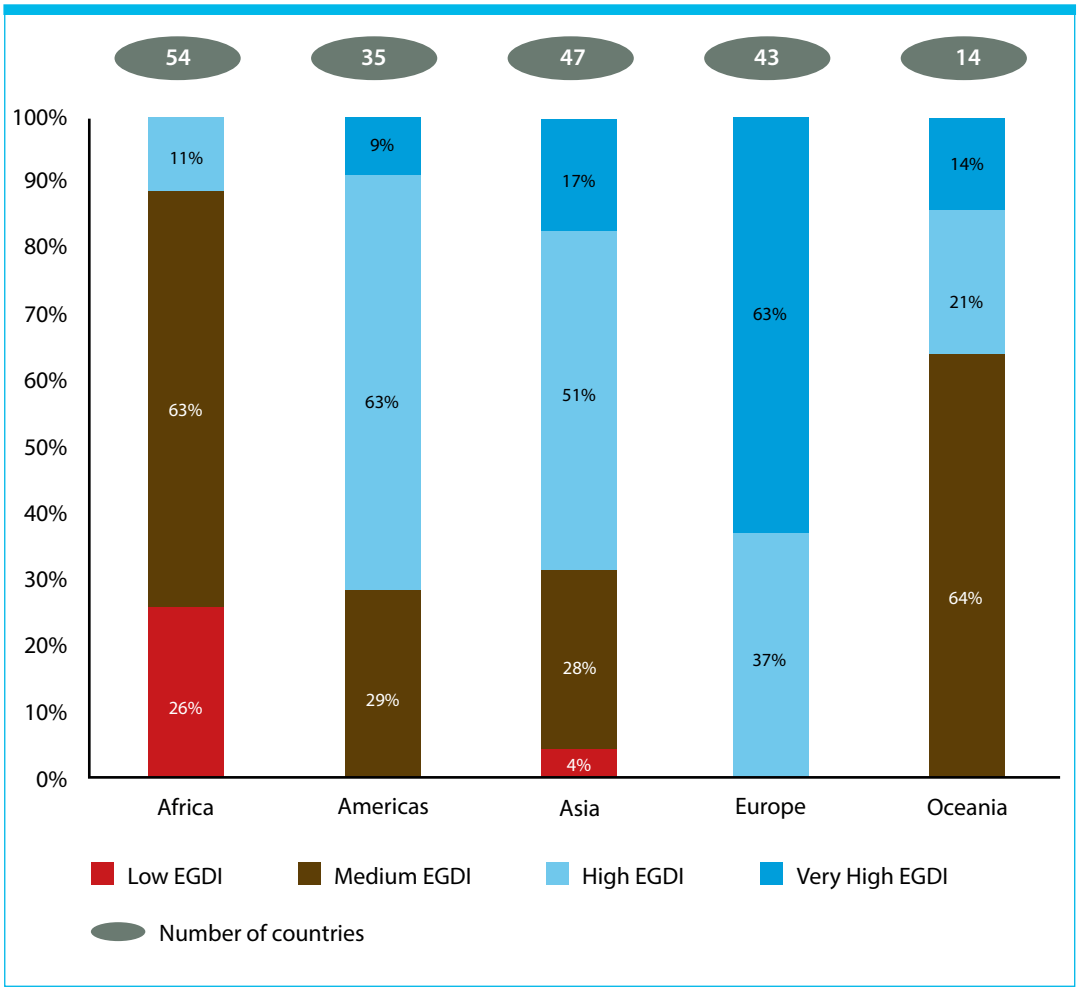
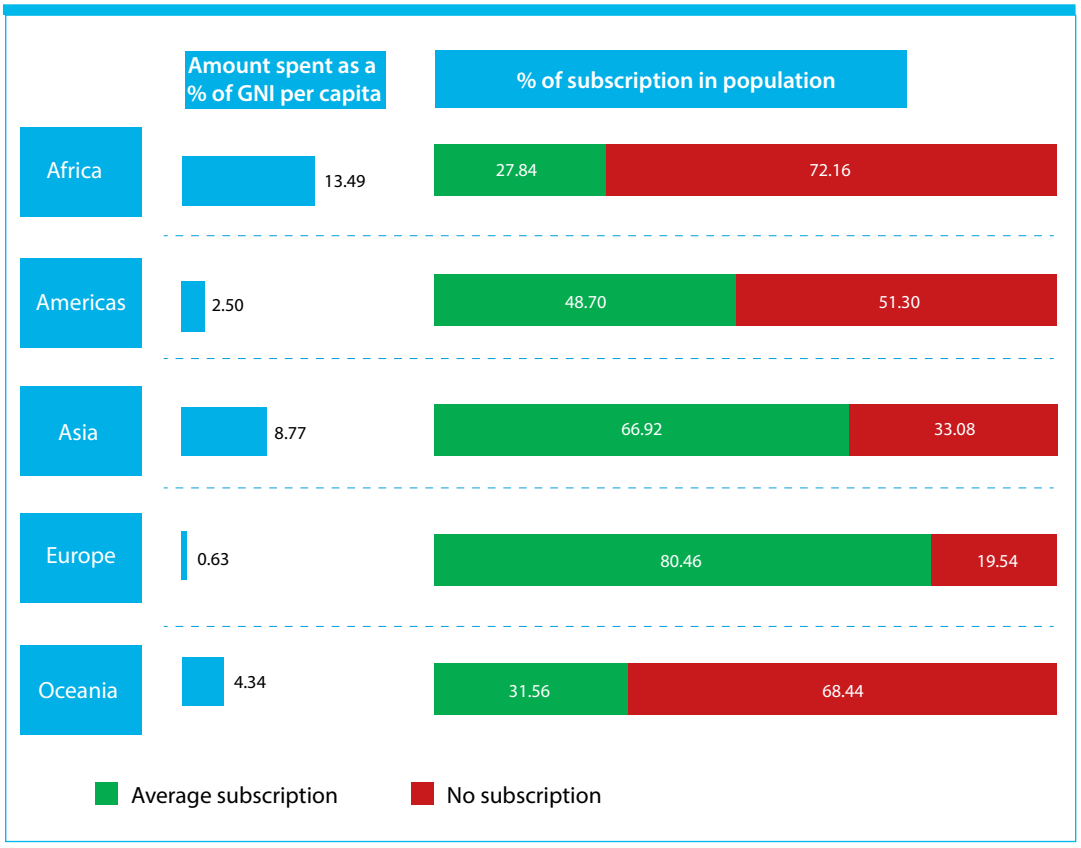


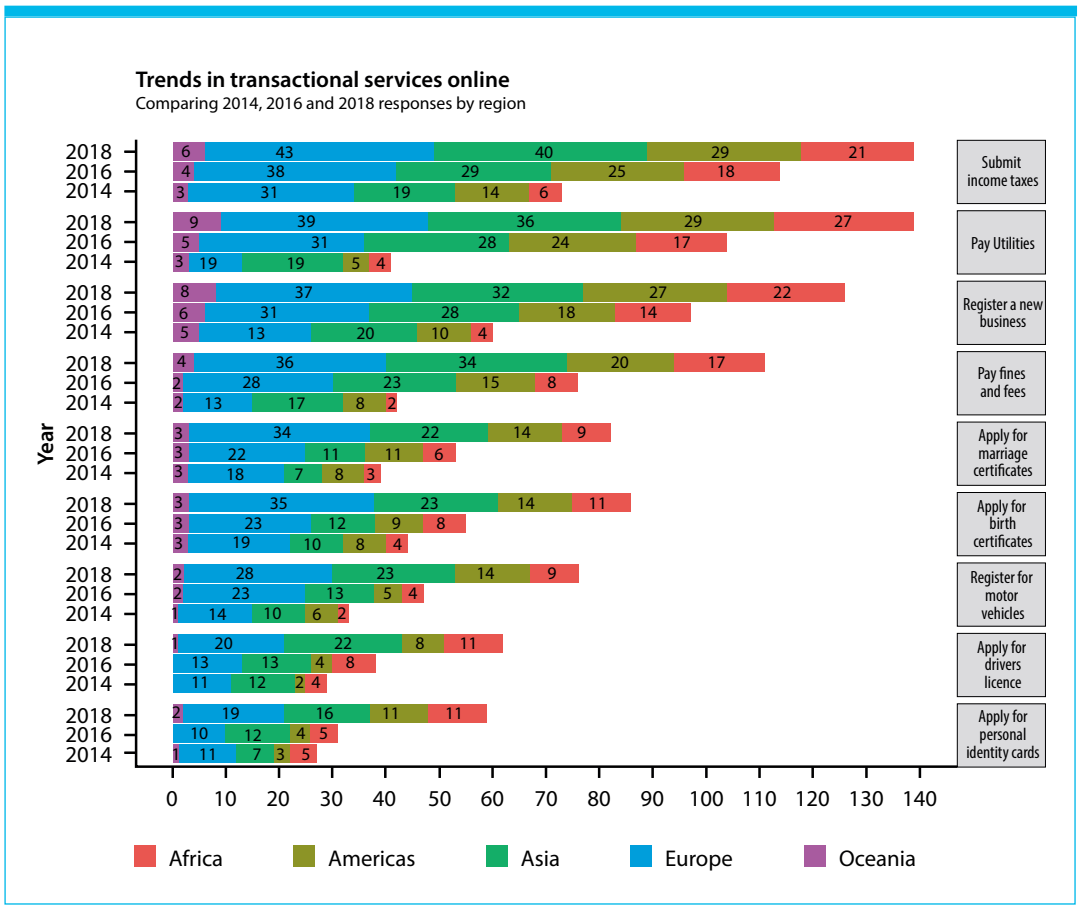
Figure 6.6 shows the percentage of GNI per capita spent by citizens to access broadband, and the percentage of broadband subscriptions for each region. While Europeans spend the least on mobile broadband, at 0.63 percent of their income, they have the largest mobile broadband subscription at 80.46 per cent. In contrast, Africa has the lowest level of mobile broadband subscription with 27.84 per cent, while African citizens need to spend 13.49 per cent of their income on mobile broadband. Clearly, there is a need to lower the cost of access to technology so that it could be utilized to serve a wider segment of the population. According to ITU data in 2018, 156 countries have National Broadband Plan implemented.[4] These countries indicate their intent to improve access and affordability through various measures.[5]

Figure 6.6 Amount spent on mobile broadband as percentage of GNI per capita against the percentage of subscriptions per geographical region



While efficiency gains do not come automatically with e-government, savings are possible both on the government and citizen sides with the implementation of transactional services. As seen in Figure 6.7, all regions made progress in their implementation. "Submitting income taxes" and "paying for utilities" are the most used transactional services across all regions. Africa made significant progress in all transactions between 2014 and 2016. However, there is still room for improvement.

Figure 6.7 Transactional services per geographical region



6.2.1 Africa

Africa has large gaps in infrastructure, including broadband infrastructure and access to broadband services, where it exists, is very expensive. This is evident in the region's low TII score of 0.2030. Progress with respect to the EGDI across the whole region remains positive albeit uneven. The average 2018 EGDI is 0.3420 compared to 0.2880 in 2016, which represents the third highest regional improvement in EGDI largely driven by a 0.1060 increase in the provision of online services.

In an effort to contribute to the advancement of e-government development in Africa, the Economic Commission for Africa (ECA), among others, plays an active role in strengthening the environment for adopting effective ICT policies in the region and developing a greater collaboration between all relevant stakeholders within the Internet community, including African Union Commission, ITU, ICANN, Smart Africa Secretariat, IGF, etc.).

Box 6.1 UN Economic Commission for Africa (ECA) work on selected areas in ICT

United Nations Economic Commission for Africa

In 1996 the Economic Commission for Africa (ECA) had launched The African Information Society Initiative (AISI), and since then assisted the UN Member States in adopting evidence-based ICT, science, technology and innovation policies to transform their economies. With support of the ECA, 48 UN Member States in Africa adopted national e-strategies complementing their development efforts and are harnessing their ICT sectors to play a greater role in achieving the 2030 Agenda for Sustainable Development Goals(SDGs), the African Union 2063 Agenda and other internationally agreed development goals.

Building on its experience from the AISI, rigorous analytical and policy-research work was conducted on many emerging and frontier technologies, including cybersecurity, geo-blocking & future of e-commerce, Internet of Things (IoT) and Smart Cities, financial technology, big data & analytics, transition to IPV6, Internet governance & net neutrality, and analog to digital broadcasting migration, Blockchain technologies, and digital economy.

ECA also undertook various activities to measure the economic, social, political, and security impact of technologies and innovation process. Within the Partnership on Measuring Information and Communications Technology for Development which was launched in 2004 to improve the availability of internationally comparable information and communications technology (ICT) statistics, ECA has been leading the taskforce for e-government indicators and has been instrumental in the development of the core list of e-government indicators and its implementation by developing a manual for using the core list of e-government indicators and producing a training manual for implementers. ECA continues to contribute also to data gathering and dissemination including an annual follow up and review of the implementation of the WSIS outcomes in Africa.

ECA has been working with the African Union Commission to develop the African Union Convention on Cyber security and personal data protection adopted by the 23rd Assembly of Heads of States and Governments of the African Union. UNECA is coordinating along with other UN Agencies effective implementation of the United Nations Group on the Information Society (UNGIS). UNGIS serve as an interagency mechanism to coordinate substantive policy issues facing the UN's system in the implementation of the WSIS outcomes for leveraging ICTs to Build Information and Knowledge Societies for Achieving the Sustainable Development Goals.

Source: UN ECA

Box 6.2 Case study on Mauritius' Vision 2030 Blueprint

The Government of Mauritius has developed "Vision 2030 Blueprint", which aims to provide the country with a high-income, sustainable and innovative economy. In line with the UN 2030 Agenda, the Government, through its Ministry of Technology, Communication and Innovation and Central Informatics Bureau, is developing "Digital Mauritius 2030 Strategy" and "Digital Government Strategy for 2018-2022".[6] These strategies, closely aligned with the "Vision 2030 Blueprint", will address legal, regulatory, security, and institutional frameworks. The digital strategies are intended to address the gap between academia and industry, to ensure that the right skills are developed to meet the increasingly growing digital economy and the IT requirements of the future.[7] The government aims to implement these strategies by strengthening the information, technology and communications sector by focusing on software development and big data analytics.[8]

Source: http://www.govmu.org

In Africa, only four countries (Mauritius, South Africa, Tunisia and Seychelles) are in the top fiftieth percentile along with countries that have EGDIs above the world average of 0.549. Mauritius (66th) and South Africa (68th) the two highest ranking countries from the region closely followed by Tunisia (80) and Seychelles (83) are the only countries in the top 100. The average rank of countries in the African region is 150th. It is worth mentioning that Algeria and Burkina Faso have made great strides in e-government development, climbing 20 places from 2016 to 2018. Algeria rose from 150th to 130th, while Burkina Faso climbed from 185th to 165th. Cameroon rose by 19 places from 155th to 136th and Ghana from 120th to 101st. These movements, even if they originate from very low levels, highlight regional efforts to keep pace with worldwide technological development trends. Upward movements in EGDI across the region were driven by significant improvements in OSI (0.106 increase) and TII (0.031 increase). This is an encouraging trend given that 13 African countries have low EGDI and require major leaps to improve their EGDI levels.

Table 6.1 Top 10 countries for e-government in Africa

Country	Sub-region	OSI	HCI	TII	EGDI	EGDI Level	2018 Rank
Mauritius	Eastern Africa	0.7292	0.7308	0.5435	0.6678	High	66
South Africa	Southern Africa	0.8333	0.7291	0.4231	0.6618	High	68
Tunisia	Northern Africa	0.8056	0.6640	0.4066	0.6254	High	80
Seychelles	Eastern Africa	0.6181	0.7299	0.5008	0.6163	High	83
Ghana	Western Africa	0.6944	0.5669	0.3558	0.5390	High	101
Morocco	Northern Africa	0.6667	0.5278	0.3697	0.5214	High	110
Cabo Verde	Western Africa	0.4861	0.6152	0.3926	0.4980	Medium	112
Egypt	Northern Africa	0.5347	0.6072	0.3222	0.4880	Medium	114
Rwanda	Eastern Africa	0.7222	0.4815	0.1733	0.4590	Medium	120
Namibia	Southern Africa	0.4514	0.5850	0.3299	0.4554	Medium	121

6.2.2 Americas

The Americas is continuing its improvement in e-government development into 2018. The region is no longer represented in the low-EGDI and low-OSI levels. Uruguay has moved from a High-EGDI to a Very-High-EGDI level country in 2018, followed closely by Chile and Argentina just below the Very-High-EGDI threshold. Since 2016, eight countries (Panama, Antigua and Barbuda, Dominica, Dominican Republic, El Salvador, Bolivia, Saint Vincent and the Grenadines and Paraguay) have improved their EGDI level from Medium- to High-range. Fifty-seven per cent of the region comprising 20 countries are in the top 50th percentile. These positive developments have allowed the Americas to maintain its position as the second most developed region in e-government development, worldwide.

The average regional EGDI in the Americas has risen from 0.5250 in 2016 to 0.5900 in 2018, an improvement of 0.0650 representing the largest regional improvement in 2018. The top performing country in the Americas region remains the United States, one of the world leaders in e-government

(11th), followed by Canada (23rd) and Uruguay (34th), both among the countries with Very-High-EGDI.

Box 6.3 Case Study on Agenda Uruguay Digital 2020

Source: http://uruguaydigital.gub.uy

In addition to developing "Digital Government Plan 2020", the Government of Uruguay has created "Agenda Uruguay Digital 2020", a plan built on four key pillars: i) social policy and inclusion, ii) sustainable economic development, iii) government management, and iv) governance for the information society. Objective VI of the Agenda, on "Proximity government", aims to improve transparency, accountability, citizen participation and services through increased focus on citizens' interaction with the Government. Specific goals include the establishment of "Citizen Response Centres" and portals, which will allow citizens to complete all transactions related to select services online.[9]

Table 6.2 Top 10 countries in e-government in the Americas

Country	Sub-region	OSI	HCI	TII	EGDI	EGDI Level	2018 Rank
United States of America	Northern America	0.9861	0.8883	0.7564	0.8769	Very High	11
Canada	Northern America	0.9306	0.8744	0.6724	0.8258	Very High	23
Uruguay	South America	0.8889	0.7719	0.6967	0.7858	Very High	34
Chile	South America	0.8333	0.8339	0.5377	0.7350	High	42
Argentina	South America	0.7500	0.8579	0.5927	0.7335	High	43
Brazil	South America	0.9236	0.7525	0.5220	0.7327	High	44
Barbados	Caribbean	0.6667	0.8301	0.6719	0.7229	High	46
Costa Rica	Central America	0.6736	0.7933	0.6343	0.7004	High	56
Colombia	South America	0.8819	0.7382	0.4412	0.6871	High	61
Mexico	Central America	0.9236	0.7044	0.4173	0.6818	High	64

Saint Kitts and Nevis leapt by 23 places from 94th to 71st, the most improved ranking in the region, followed closely by the Bahamas and Dominica, whose rankings increased by 21 and 16 respectively. Haiti has improved its ranking from 178th to 163rd, but remains the lowest ranking country in the region, owing mostly to difficulties that it has been experiencing such as natural disasters, which hinder its e-government development, particularly, the development of its telecommunications infrastructure.

Box 6.4 Economic Commission for Latin America and the Caribbean (ECLAC)

In line with Goal 16 of the 2030 Agenda for Sustainable Development, ECLAC and The Latin American and Caribbean Institute for Economic and Social Planning (ILPES) continue to work with countries in the region to democratize public management, accountability, access to information and participation in order to respond to the expectations of citizens who demand accessible and higher quality public services through the formulation of open government policies. For instance, in Costa Rica, ECLAC, through ILPES, collaborated in the design of a Policy on Open Justice. The Costa Rican government generated this policy as an innovative form of administration of justice and its subsidiary bodies.

The Judicial Power is aware that the implementation of the Open Justice Policy demands a change of paradigm that includes a citizen-centered cultural change. It includes changes in the processes seeking efficiency and effectiveness in the delivery of justice, employing information technology for simplification, traceability and predictability. It also includes organisational changes, giving priority to coordination and team work under a results-based network model.

In addition to this technical assistance, since 2011, more than 1,000 professionals from 19 countries in Latin America and the Caribbean have been trained in open government and digital government. Participants come mainly from government agencies at the national, regional, state and local levels, as well as from universities and other academic and research institutions.

Source: ECLAC

6.2.3 Asia

Asia is not only the most populous region, but it is also the largest continent in terms of land mass. The e-government development trend is highly diverse across the countries in the region. The Republic of Korea (third), Singapore (seventh) and Japan (tenth) are ranked among the top 10 in the world, while in the low-EGDI spectrum are the Democratic People's Republic of Korea (185th) and Yemen (186th). Such vast differences in the availability of e-government services were highlighted in Figure 6.4 depicting high levels of dispersion across the region. Despite this, Asia's strong performance in e-government development from 2016 to 2018 is a continuing challenge to the America's position as the second best performing region. The average regional EGDI has risen from 0.5130 in 2016 to 0.5780 in 2018, an improvement of 0.0650 representing the second highest leap across all of the regions. Moreover, the average ranking for the region is 90th, while the Americas' average is 87th.

Box 6.5 Case Study on the Republic of Korea's e-Government Master Plan 2020

The Republic of Korea indicated in its MSQ response that it has developed the "e-Government Master Plan 2020" to address the challenges that come from a constantly evolving e-government environment. The plan consists of five strategies that include: developing all-digital government service, reforming public administration based on intelligent information, creating more digital friendly industries, building a e-government platform and solidifying a position in the global e-government as a major e-government exporter. The Government develops a master plan every five years to ensure that the e-government services it offers incorporate the latest available technologies and take into consideration the evolving needs of its citizenry.

Source: http://www.mois.go.kr

Compared to 2016, the region has made significant improvements to its OSI (0.1100) and TII (0.0660), This is evident when analyzing Cyprus, which has made the biggest improvement in this year's Survey. In 2018, the country's ranking rose to 36th from 64th in 2016 representing an improvement of 28 spots, the highest in the region. Similarly, the Maldives (97th), Timor-Leste (142nd) and Brunei (59th) have improved their rankings by 20 or more places.

United Arab Emirates has the highest EGDI among Gulf Cooperation Council (GCC) countries followed by Bahrain, Kuwait and Qatar. GCC countries managed to achieve a series of substantial accomplishments related to improving e-government systems and making it easier for citizens to access government portals of other GCC Member States. During the Fifth GCC eGovernment Ministerial Committee, which took place in Bahrain, the proposal of a virtual academy for e-Government training was discussed. Such an institution would contribute towards the development of e-government by providing qualified specialists for GCC comprehensive e-government strategy.

Box 6.6 The World Government Summit

TThe World Government Summit is hosted in United Arab Emirates on an annual basis since 2013. This event allows government leaders to take part in the global dialogue and outline strategies regarding the usage of technology and innovation. It also functions as a platform and networking hub for policymakers, business and civil society in human development.[10] This event also gives opportunities to showcase innovative solutions in e-government and analyze best practices in 150 participating countries with the aim of addressing future challenges using and improve already existing e-government policies.

Source: http://www.worldgovernmentsummit.org

Table 6.3 Top 10 countries for e-government in Asia

Country	Sub-region	OSI	HCI	TII	EGDI	EGDI Level	2018 Rank
Republic of Korea	Eastern Asia	0.9792	0.8743	0.8496	0.9010	Very High	3
Singapore	South-Eastern Asia	0.9861	0.8557	0.8019	0.8812	Very High	7
Japan	Eastern Asia	0.9514	0.8428	0.8406	0.8783	Very High	10
United Arab Emirates	Western Asia	0.9444	0.6877	0.8564	0.8295	Very High	21
Bahrain	Western Asia	0.7986	0.7897	0.8466	0.8116	Very High	26
Israel	Western Asia	0.8264	0.8635	0.7095	0.7998	Very High	31
Cyprus	Western Asia	0.7847	0.8083	0.7279	0.7736	Very High	36
Kazakhstan	Central Asia	0.8681	0.8388	0.5723	0.7597	Very High	39
Kuwait	Western Asia	0.7917	0.6852	0.7394	0.7388	High	41
Malaysia	South-Eastern Asia	0.8889	0.6987	0.5647	0.7174	High	48

Table 6.4 Level of e-government development in Gulf Cooperation Council member states

Country	Level of Income	EGDI	2018 Rank	2016 Rank	Change in Rank*
United Arab Emirates	High income	Very High EGDI	21	29	+8
Bahrain	High income	Very High EGDI	26	24	-2
Kuwait	High income	High EGDI	41	40	-1
Qatar	High income	High EGDI	51	48	-3
Saudi Arabia	High income	High EGDI	52	44	-8
Oman	High income	High EGDI	63	66	+3

* A plus sign (+) implies rank improvement, while minus (-) sign implies rank drop.

Box 6.7 UN-ESCWA and E-Government in the Arab Region

e-Government is one of the most important Action Lines of the World Summit on Information Society (WSIS) Tunis Agenda. ESCWA conducted several activities related to the WSIS and SDGs one of which was Arab High-level Forum on WSIS and 2030 Agenda for Sustainable Development[11] (AHLF 2017), which was the first, to link the WSIS action lines and targets with the 17 SDGs at the Arab region's level.

During 2017, ESCWA conducted a report on Smart Digital Transformation in Government[12] provided conceptual frameworks of transition from government applications to government services; and highlighted the role of technology and the smart paradigm in the transformation from e-government to smart government. It proposed linkages of the SDGs with smart government and highlighted the top 10 technologies for smart government. The study considered that smart governments are those which score high on the e-Government Development Index (EGDI). Committed to continue working on the WSIS and SDG processes and linkages, ESCWA conducted a study (also in 2017) entitled "Arab Horizon 2030: Digital Technologies for Development[13]" which provided a preliminary vision on how the Arab region can achieve an appropriate status in seven major policy areas by 2030, that include Bridging Divide, Digital Strategies, Infrastructure, Cybersecurity, ICT Sector, e-Government and e-Applications.

As a continuation of this effort ESCWA is currently in the process of conducting a new study "Arab Digital Technologies for Development Report(2019): Towards Empowering People and Ensuring Inclusiveness", which is considered to be a continuation to 2017th study giving more emphasis to the assessment of the current status of the Arab Region in the different policy areas, and linking the role of ICTs to sustainable development in its three dimensions to the theme of empowering people and ensuring inclusiveness of societies; and thus leaving no one behind in sustainable development, derived from the theme of the High Level Political Forum (HLPF) of the year 2019.

Furthermore, ESCWA led an initiative to develop a Government Electronic and Mobile Services (GEMS) maturity index that can be applicable across countries, while taking into consideration regional specificities. GEMS index is an assessment tool for policy makers to measure the level of digitization and sophistication in delivering Government services to the public. GEMS index enables multi-dimensional benchmarking. On the national level, it allows for comparing government entities, and comparing them to their peers in the Arab region. In addition, it allows for services comparison on the regional level, and thus it supports identifying the need for developing common services among Arab countries, therefore allowing for joining regional efforts to enhance these services. The GEMS index is currently dedicated to serve the whole Arab region in the first stage and then probably the World in a later stage.

ESCWA has given high priority to innovation due to its importance for sustainable social, and economic development in the Arab region. In innovation efforts are focused on improved national innovation policies and systems for economic growth, industrial optimization, social welfare and environmental protection.

In 2017, ESCWA published a study entitled "Innovation Policy for Inclusive the Sustainable Development in the Arab region[14]". It provides a framework for the development of national innovation policies as well as its adaptation to specific sectors, including youth employment and climate change to help Arab countries in their efforts to achieve inclusive sustainable development.

With the aim of supporting Arab countries in building stronger public institutions, ESCWA launched a project in 2016 entitled "Institutional development for better service delivery towards the achievement of the sustainable development goals in Western Asia". One of the components of this project focus on the employment of emerging technologies and embracing the concept of openness, specifically open government.[15]

Source: ESCWA

6.2.4 Europe

Since the first edition of the UN E-Government Survey in 2003, Europe has always had the highest EGDI among the regions. In 2018, this dominance continues at both country and regional levels. Five of the top 10 countries come from Europe. Fourteen of the top 20 ranked countries are in this region and no European country ranks below the high-level EGDI category.

Table 6.5 Level of e-government development in European Union member states

Country	Level of Income	EGDI	2018 Rank	2016 Rank	Change in Rank
Denmark	High income	0.9150	1	9	+8
United Kingdom	High income	0.8999	4	1	-3
Sweden	High income	0.8882	5	6	+1
Finland	High income	0.8815	6	5	-1
France	High income	0.8790	9	10	+1
Germany	High income	0.8765	12	15	+3
Netherlands	High income	0.8757	13	7	-6
Switzerland	High income	0.8520	15	28	+13
Estonia	High income	0.8486	16	13	-3
Spain	High income	0.8415	17	17	0
Luxembourg	High income	0.8334	18	25	+7
Austria	High income	0.8301	20	16	-4
Ireland	High income	0.8287	22	26	+4
Italy	High income	0.8209	24	22	-2
Belgium	High income	0.8080	27	19	-8
Portugal	High income	0.8031	29	38	+9
Malta	High income	0.8011	30	30	0
Poland	High income	0.7926	33	36	+3
Greece	High income	0.7833	35	43	+8
Slovenia	High income	0.7714	37	21	-16
Lithuania	High income	0.7534	40	23	-17
Hungary	High income	0.7265	45	46	+1
Bulgaria	Upper middle income	0.7177	47	52	+5
Slovakia	Upper middle income	0.7155	49	67	+18
Czech Republic	High income	0.7084	54	50	-4
Croatia	Upper middle income	0.7018	55	37	-18
Latvia	High income	0.6996	57	45	-12
Romania	Upper middle income	0.6671	67	75	+8

* A plus sign (+) implies rank improvement, while minus (-) sign implies rank drop.

Challenges brought about by an aging workforce, subdued growth and high levels of youth unemployment have stimulated the region to seek innovative e-government solutions to improve competitiveness. This has resulted in the region improving its EGDI from 0.7240 in 2016 to 0.7730 in 2018. Slovakia (49th) showed the best improvement in the region with an increase of 18 rankings, followed by Switzerland (15th) and Portugal (29th) whose rankings rose 13 and 9 spots respectively. Forty-two countries, or 97 per cent of the region, are in the top 50th percentile for EGDI.

Box 6.8 Case Study of Denmark's Digital Strategy 2016-2020

Through the Digital Strategy 2016-2020, Denmark is further evolving towards digital public administration, communication and e-services. Specific focus areas of the Strategy are: a user-friendly and simple digital public sector; better use of data and quicker case processing; more cohesive welfare services; a better framework for the business community; having public-sector data as a growth driver; having an efficient utilities sector; public sector data protection; robust digital infrastructure and digitization for everyone. Initiatives such as mandatory Digital Post and mandatory online self-service for individuals and businesses; telemedicine solutions for people with chronic disorders, digital learning tools and availability of public-sector data online, free of charge for individuals, businesses and authorities alike were recently introduced. The Strategy emphasizes the need for the public sector to work closely with the business community, stakeholder organisations, and others, in establishing the foundation for a "flexible and adaptive society, ready for an ever more digitised world".[16]

Source: https://en.digst.dk

Europe's commitment to enhancing e-government within the region is evidenced by the *European eGovernment Action Plan 2016-2020*, a result of the successes and lessons learned from monitoring and evaluating previous action plans. The *eGovernment Action Plan 2016-2020* aims to accelerate the digital transformation of Governments, a key factor to ensure the success of the EU Single Market by removing existing digital barriers and preventing fragmentation caused by modernization of the public sector. Priority policies under the action plan include modernizing public administrations using Key Digital Enablers; enabling mobility of citizens and businesses by cross-border interoperability; facilitating digital interaction between Governments and citizens/businesses. Early indicators of the successful implementation of the Action Plan is evident when analyzing the region's improvement in OSI levels (0.2250) from 2014 to 2018, which shows the largest improvement in OSI score worldwide.

Box 6.9 European Union Digital Single Market

The Digital Single Market strategy, created among European Union Member States, aims to open up digital opportunities for people and business, and enhance Europe's position as a world leader in the digital economy.[17] Thanks to this strategy, individuals, businesses, researchers and public authorities are exposed to online activities that accelerate various processes by means of digital interactions. There are three main pillars on which Digital Single Market strategy is grounded. The first one addresses the issue of access to digital products and services. The second pillar calls for the creation of appropriate conditions for online services to develop across the EU. The third promotes maximization of digital economy growth.

Source: https://ec.europa.eu

6.2.5 Oceania

Oceania consists of two developed countries, Australia and New Zealand, juxtaposed within the region, with island-States having smaller populations, economies and, by extension, fewer resources. Table 6.6, which shows Australia and New Zealand in the top 10 countries with very high levels of EGDI, presents this stark contrast vividly. Fiji and Tonga, the 3rd and 4th ranking countries within the region, are outside of the top 100 ranked countries, despite having relatively high EGDI scores. Nonetheless, Oceania improved its average EGDI from 0.415 in 2016 to 0.461 in 2018.

Table 6.6 Top 10 countries for e-government in Oceania

Country	Sub-region	OSI	HCI	TII	EGDI	EGDI Level	2018 Rank
Australia	Australia and New Zealand	0.9722	1.0000	0.7436	0.9053	Very High	2
New Zealand	Australia and New Zealand	0.9514	0.9450	0.7455	0.8806	Very High	8
Fiji	Melanesia	0.4583	0.7899	0.3562	0.5348	High	102
Tonga	Polynesia	0.4722	0.8039	0.2951	0.5237	High	109
Palau	Micronesia	0.3264	0.8462	0.3346	0.5024	Medium	111
Samoa	Polynesia	0.3403	0.7241	0.2064	0.4236	Medium	128
Vanuatu	Melanesia	0.4375	0.5675	0.1920	0.3990	Medium	137
Tuvalu	Polynesia	0.2222	0.6422	0.2693	0.3779	Medium	144
Marshall Islands	Micronesia	0.2292	0.7301	0.1037	0.3543	Medium	149
Kiribati	Micronesia	0.2986	0.6591	0.0773	0.3450	Medium	153

Nte: Table 6.6 shows that Oceania does not have any country in the low-EGDI level, with the majority of its countries in the medium-EGDI level. Vanuatu leapt by 12 rankings to 137th, worldwide. Papua New Guinea (171st) and Tuvalu (144th) have improved by 8 and 7 spots respectively.

6.3 The situation in the Least Developed Countries (LDCs)

Least Developed Countries (LDCs) are low-income countries with low levels of human capital development and are highly vulnerable to economic structural shocks. The United Nations classifies 47 countries as LDCs. The African region (33) is the most represented nation in the LDC category, followed by Asia (9), Oceania (4) and the Americas (1).

Table 6.7 shows the top 10 LDCs ranked by 2018 EGDI scores.

Table 6.7 Top 10 countries for e-government - Least Developed Countries (LDC)

Country	Region	Sub-Region	OSI	HCI	TII	EGDI	EGDI Level	2018 Rank
Bangladesh	Asia	Southern Asia	0.7847	0.4763	0.1976	0.4862	Medium	115
Nepal	Asia	Southern Asia	0.6875	0.4957	0.2413	0.4748	Medium	117
Rwanda	Africa	Eastern Africa	0.7222	0.4815	0.1733	0.4590	Medium	120
Bhutan	Asia	Southern Asia	0.5000	0.4743	0.3080	0.4274	Medium	126
Zambia	Africa	Eastern Africa	0.4792	0.5689	0.1853	0.4111	Medium	133
Uganda	Africa	Eastern Africa	0.5694	0.4906	0.1566	0.4055	Medium	135
Vanuatu	Oceania	Melanesia	0.4375	0.5675	0.1920	0.3990	Medium	137
Togo	Africa	Western Africa	0.5556	0.5058	0.1353	0.3989	Medium	138
United Republic of Tanzania	Africa	Eastern Africa	0.5625	0.4759	0.1403	0.3929	Medium	139
Timor-Leste	Asia	South-Eastern Asia	0.3125	0.5387	0.2937	0.3816	Medium	142

Among LDCs, Bangladesh ranks top in e-government development. In launching the "Digital Bangladesh Initiative", also known as "Digital Bangladesh by 2021",[18] Bangladesh aims to emphasize the importance of ICTs in improving efficiency and productivity in all industries. The country is expanding e-government in all possible sectors, including health, agriculture, transportation, education and poverty reduction, to make public services more transparent as stated in its MSQ submission. It is also enhancing accessibility to mobile and online services to better implement a more digitized society.

6.4 Landlocked Developing Countries (LLDCs)

Seventeen LDCs are also categorized as Landlocked Developing Countries (LLDCs).[19] LLDCs have the additional impediment of facing significant geographical challenges as countries with no or limited access to the sea. Thus, their access to the international market depends on their neighbouring countries, and they rely on bordering countries for access to important telecommunication infrastructures. This geographical handicap also increases the cost of trading. The United Nations has identified 32 countries that are landlocked developing countries. The African region is, again, the most represented with 16, followed by Asia with 12 and the Americas with 2 and Europe with 2.

Table 6.8 shows the top 10 LLDCs ranked by 2018 EGDI levels.

Table 6.8 Top 10 countries for e-government - Landlocked Developing Countries

Country	Region	Sub-Region	OSI	HCI	TII	EGDI	EGDI Level	2018 Rank
Kazakhstan	Asia	Central Asia	0.8681	0.8388	0.5723	0.7597	Very High	39
Republic of Moldova	Europe	Eastern Europe	0.7708	0.7274	0.4787	0.6590	High	69
Azerbaijan	Asia	Western Asia	0.7292	0.7369	0.5062	0.6574	High	70
The former Yugoslav Republic of Macedonia	Europe	Southern Europe	0.7153	0.6924	0.4859	0.6312	High	79
Uzbekistan	Asia	Central Asia	0.7917	0.7396	0.3307	0.6207	High	81
Armenia	Asia	Western Asia	0.5625	0.7547	0.4660	0.5944	High	87
Kyrgyzstan	Asia	Central Asia	0.6458	0.7628	0.3418	0.5835	High	91
Mongolia	Asia	Eastern Asia	0.5972	0.7899	0.3602	0.5824	High	92
Bolivia (Plurinational State of)	Americas	South America	0.5625	0.7148	0.3148	0.5307	High	103
Paraguay	Americas	South America	0.5556	0.6701	0.3507	0.5255	High	108

Kazakhstan has the top EGDI score among the LLDC group, with a very-high-EGDI score of 0.760. In 2013, the country adopted "Information Kazakhstan - 2020", which aims to create conditions for its transition to an information society. The programme seeks to ensure and optimize the effectiveness of public administration through information technology. It has identified four key areas of focus: ensuring the effectiveness of the government administration system, guaranteeing information availability, forming an information environment for socio-economic and cultural development of the society and developing a national information space. Kazakhstan is creating a more 'mobile government' by utilizing ICTs in these areas. The programme also provides ICT awareness opportunities through e-learning to its citizens.[20] It will be supported further through the use of information technologies at all levels of State bodies and through the implementation of ICT projects at the national level.[21]

6.5 The situation in Small Island Developing States (SIDS)

Small Island Developing States (SIDS) face similar development struggles as LLDCs, particularly a geographical impediment. SIDS have small economies and limited resources that are geographically dispersed. They are heavily vulnerable to environmental changes and external economic shocks. For example, countries such as the Federated States of Micronesia and Seychelles are small groups of islands that rely heavily on the international system. This implies that these countries are not only susceptible to internal and external shocks, such as natural disasters, but also face the omnipresent challenge of increased costs with respect to the government's provision of infrastructure and services. There are 37 Small Island Developing States found in the Americas (16), Oceania (12), Africa (6), and Asia (3).

Table 6.9 Top 10 countries for e-government - Small Island Developing States

Country	Region	Sub-Region	OSI	HCI	TII	EGDI	EGDI Level	2018 Rank
Singapore	Asia	South-Eastern Asia	0.9861	0.8557	0.8019	0.8812	Very High	7
Barbados	Americas	Caribbean	0.6667	0.8301	0.6719	0.7229	High	46
Mauritius	Africa	Eastern Africa	0.7292	0.7308	0.5435	0.6678	High	66
Saint Kitts and Nevis	Americas	Caribbean	0.5347	0.7491	0.6825	0.6554	High	71
Bahamas	Americas	Caribbean	0.7014	0.7249	0.5393	0.6552	High	72
Trinidad and Tobago	Americas	Caribbean	0.6389	0.7195	0.5735	0.6440	High	78
Seychelles	Africa	Eastern Africa	0.6181	0.7299	0.5008	0.6163	High	83
Grenada	Americas	Caribbean	0.4931	0.8202	0.4658	0.5930	High	89
Antigua and Barbuda	Americas	Caribbean	0.4583	0.7518	0.5617	0.5906	High	90
Dominica	Americas	Caribbean	0.6111	0.6497	0.4775	0.5794	High	93

Among SIDS countries, Singapore has historically had a very-high-EGDI score since the first publication of the United Nations E-Government Survey. According to its MSQ submission, since 1980, long before the Survey, the country was designing and implementing policies to provide its citizenry with an ever-advancing level of e-governance. From 1980-1999, it aimed to have a computer on every desk; in 2000-2006, online services delivery; in 2006-2015, integration of data, processes and systems aimed at creating a collaborative "Gov-with-You" rather than a "Gov-to-You". Finally, since 2016, Singapore has been providing a digital government to a "smart nation" improving lifestyles, creating more opportunities, and stronger communities by harnessing technology. The country's strong foundation in its approach to e-governance and ICT development continues to allow Singapore to be among the world leaders in these fields.

Box 6.10 Small Island Developing States (SIDS) Symposium, Nassau, Commonwealth of the Bahamas (26-27 February 2017)

Small Island Developing States (SIDS) face geopolitical realities and socio-economic dependencies, along with prevalent development challenges, such as the scarcity of resources, spatial segregation and barriers to major markets. The SIDS Accelerated Modalities of Action [S.A.M.O.A.] Pathway, adopted by the General Assembly in 2014, recognized the enabling role of information communication technologies (ICTs) to sustain high levels of economic and social growth in SIDS. It also highlighted the importance of increasing connectivity and enhancing the use of ICTs through improved infrastructure, training and national legislation, as well as through partnership with the private sector and other stakeholders.

The important role of ICTs was echoed at the Small Island Developing States (SIDS) Symposium, hosted by the Government of the Bahamas and attended by ministers and high-level officials from more than 40 SIDS and other countries from 21 to 23 February 2017[1]. An informal communiqué containing key messages from the Symposium was presented by the Bahamas at the 16th Session of the UN Committee of Experts of Public Administration and at the 2017 Session of the UN High Level Political Forum [2].

The communiqué indicated that ICTs, including e-government, can be a very important tool for delivering public services and supporting progress towards the SDGs. Further efforts, however, are needed to put them at the service of the SDGs in SIDS. The communique also expressed great concern by the persistent digital divide in SIDS and called on the international community to support the building of ICT infrastructure in SIDS. It also stressed the importance of promoting innovation through education, raising public awareness and stimulating debate about key digital public policy choices. A similar request was made to the private sector and all other actors to develop innovations to ensure that SIDS can benefit from ICTs and Internet access.

[1] Refer to Symposium website: https://publicadministration.un.org/bahamas_symposium
[2] Available at: http://workspace.unpan.org/sites/Internet/Documents/UNPAN97155.pdf

6.5.1 Comparing EGDI Levels of LDCs, LLDCs, and SIDS

Bangladesh is the highest ranked LDC at 115th. The average EGDI for this group is 0.2980 which is significantly lower than the world average of 0.5490, as seen in Figure 6.8 below. It is important to note that the LDC bloc has seen a significant improvement in e-government development since 2014. LLDCs, however, perform slightly better in their 2018 rankings with the average for the group at 133rd. This is, however, 29 positions better than the LDC average. In 2018, the LLDC countries have an average EGDI of 0.4130, significantly higher than the LDCs' 0.2980 average. Overall, EGDI levels across all three groups have been improving since 2014, but remain behind the world average.

Figure 6.8 World Average v. Average EGDI levels for LDCs, LLDCs, SIDS for 2014-2018

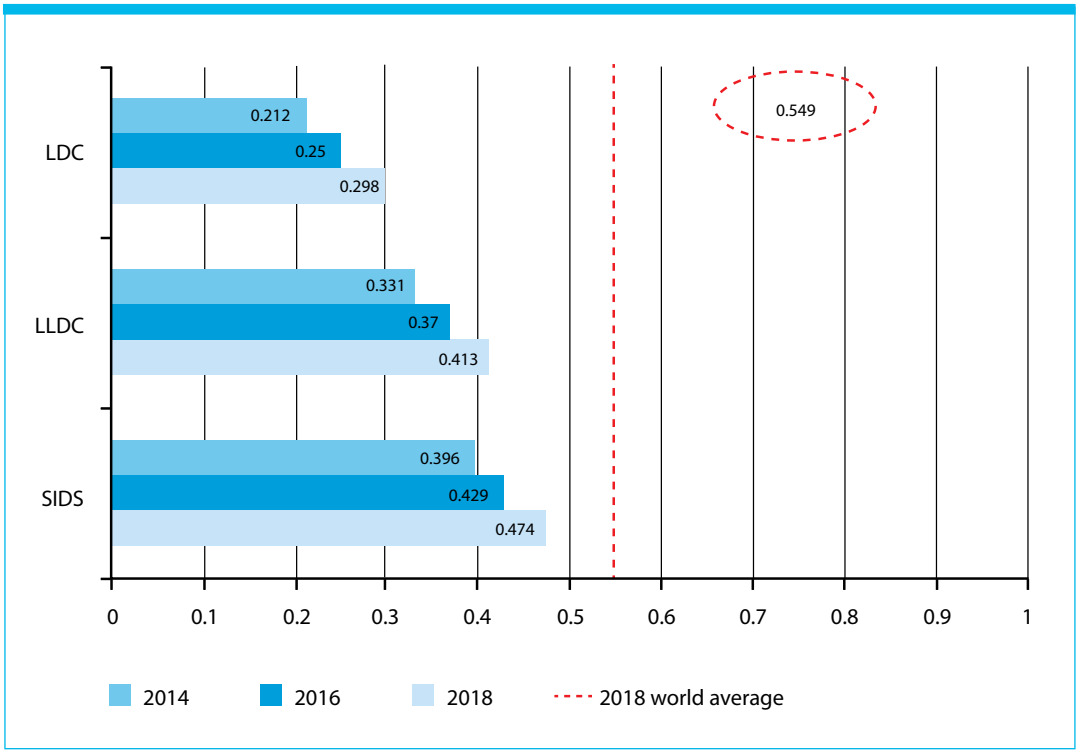
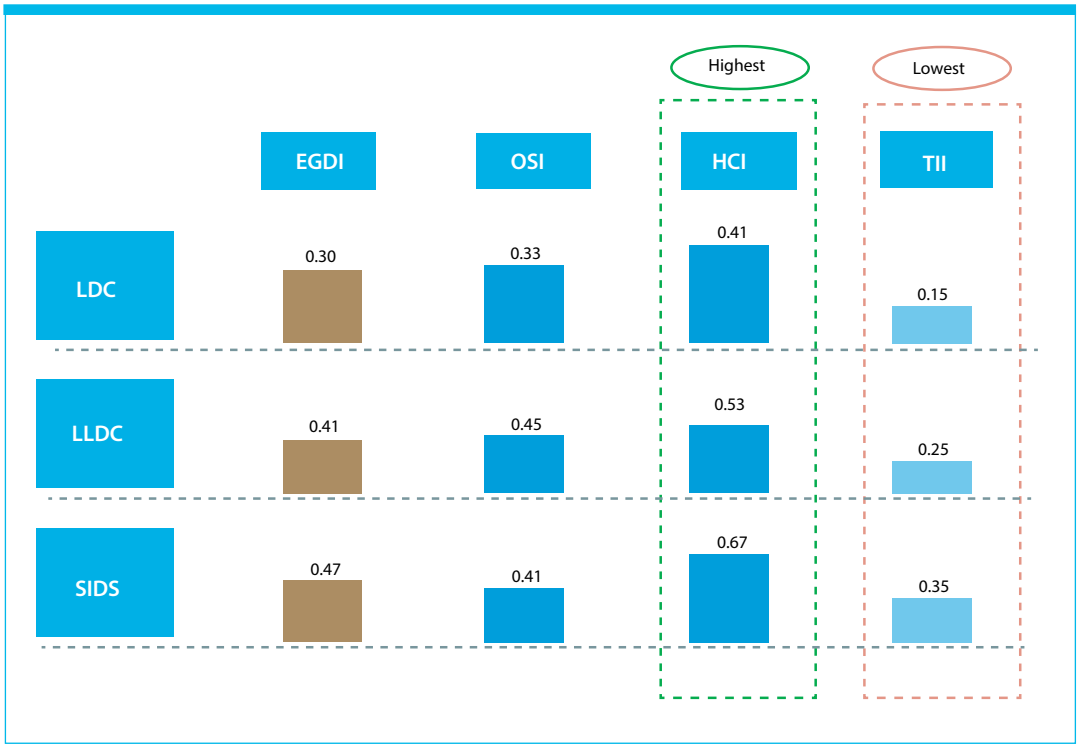


Figure 6.9 below shows the 2018 breakdown and comparison of the EGDI, OSI, HCI and TII levels across least developed countries, landlocked developing countries and small island developing states. Similar to the findings found in Figure 6.1, the Human Capital Index (HCI) is the highest contributing sub-index for each group. In contrast, the TII sub-index has the lowest contribution to e-government development, which highlights the urgent need for major investment in technology infrastructure in these countries.

Figure 6.9. Granular breakdown of 2018 e-Government Development Index (EGDI) and its components per grouping

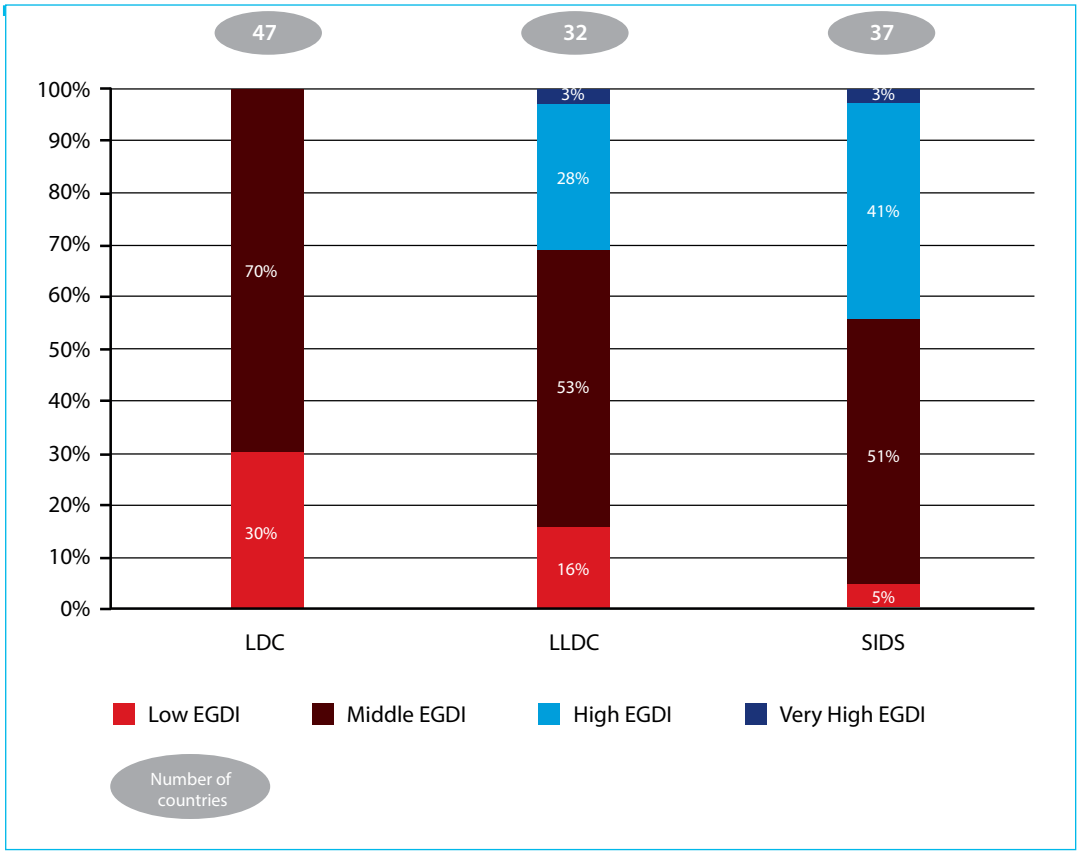


The LDC and LLDC countries generally perform poorly in all three sub-indices of the EGDI when compared to the world average. However, there have been improvements since 2016. E-government allows these countries to utilize technology in providing more efficient and innovative public services such as improving access to the most vulnerable, accelerating Government's ability to handle economic and environmental shocks and improving accountability and transparency. E-government has the potential to improve the allocation of scarce resources and enable long-term sustainable development. It can provide the impetus to boost resilience to the underlying conditions within LDC and LLDC countries. However, good infrastructure is an essential component of e-government, and insufficient spending on infrastructure coupled with lack of planning negate potential benefits. Investing in improving mobile and online services should be done in tandem with forging partnerships among stakeholders, including in the private sector.

Figure 6.10 depicts the dispersion of EGDI levels across LDCs, LLDCs and SIDS which complements the previous analysis on EGDI levels. LDCs have a higher percentage of low-EGDI and middle-EGDI levels compared to LLDCs and SIDS. And while LLDCs and SIDS have the same percentage in very-high-EGDI levels, there are more SIDS among high-EGDI level countries and the lowest among middle- and low-EGDI level countries.

E-government development is strongest in SIDS and weakest in the LDC group, possibly owing to the fact that the majority of the LDCs are African countries, where most have very low levels of e-government development. On the other hand, Singapore, along with many high-EGDI level countries from the Americas and Oceania, are part of the SIDS group.

Figure 6.10. Percentage of Countries Represented per bloc based on E-Government Development Index (EGDI) levels



6.6 Conclusion

The lessons learned from this chapter are as follows:

There has been an overall increase in e-government development across the regions, driven largely by improvements in OSI. Improvements in HCI and TII increased relatively less between 2014 and 2018, which require more strategic investments given the far-reaching outcomes.

The regional rankings have not changed since 2003. Europe remains the highest performing region in e-government, owing to its leveraging of its existing high levels of TII and HCI and using that advantage to drive its policies towards significant improvements in OSI.

The biggest EGDI improvement from 2016 to 2018 has been in the Americas, followed closely by Asia and Africa.

The majority of African countries and LDCs are still in low-EGDI levels due to their poor performance in HCI and TII. Many people in these countries are unable to benefit from ICTs because of poor connectivity, high costs of access and lack of necessary skills. These disadvantages are likely to affect further development of e-government as the pace of innovation in technology intensifies. In order to build a well-functioning e-government, countries need to intensify investments in their human capital and telecommunication infrastructure.

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2 Note: Antigua and Barbuda, Bolivia, Dominica, Dominican Republic, El Salvador, Fiji, Ghana, India, Indonesia, Iran (Islamic Republic of), Kyrgyzstan, Maldives, Palau, Panama, Paraguay, Saint Vincent and the Grenadines, Tonga

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Improve cities resilience and sustainability through e-government assessment

Photo credit: pixabay.com

7.1. Introduction

7.1.1 Urbanisation and Sustainability

Cities are important hubs of human activity that are gaining in population and increased importance in the global economy. In 2016, close to 4 billion people — 54 per cent of the world's population — lived in cities. According to the World Bank[1], in the last 50 years the proportion of population living in cities has increased by 50 per cent, and it is estimated that, by 2050, 6 billion people will be living in cities (66 per cent of the world's population). In 2014, high levels of urbanisation, at or above 80 per cent, characterised Latin America and the Caribbean and Northern America. Europe, with 73 per cent of its population living in cities, is expected to be over 80 per cent urban by 2050. Africa and Asia, in contrast, remain mostly rural, with 40 per cent and 48 per cent of their respective populations living in urban areas. Over the coming decades, the level of urbanisation is expected to increase in all regions, with Africa and Asia urbanising faster than the rest[2].

The role of local administration in the achievement of the United Nations Sustainable Development Goals (SDGs) is critical, since those goals recognise the transformative power of urbanisation for development and the significance of city leaders in driving global change from the bottom up. Most of the SDGs have targets that are directly or indirectly related to the daily operation of local and regional governments. Local governments are policy makers and catalysts of change. They are also the level of government best-placed to bind the goals with local communities[3]. Improvement of local e-Government functions encompasses local public institutions, their operations and civil society organisations alignment with UN SDGs 11 and 17 for sustainable cities and communities and goal 16 for peace, justice and strong institutions. In practice, institutions are strengthened by free, fair and equal citizen participation. Furthermore, local governments that possess decentralised authority can better set local priorities to assure the rights and needs of vulnerable groups and provide transparent and accountable institutions.

7.1.2 Public service delivery at a local level

Municipality administration constitutes the lowest level of governance in each country (Lanvin and Lewin, 2006). E-Government at the local level has its own flavour, since cities and municipalities are developing specific functions and components that cannot be found at other levels of government. On the one hand, local government serves the

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administrative purpose of maintaining the essential infrastructures and providing services, and on the other hand, it offers their citizens the possibility of active participation in decision-making.

Local governments are key players in public life, since what they do has a daily and direct impact on citizens. People interact more often with local administration than with the central one, because the first delivers the vast majority of services that concerns them[4] and determines the sustainable development of their close living environment. In Europe, 50 to 80 per cent of the interaction between citizens and government takes place at the local levels[5].

Municipal public administration organisations assure the sustainability and resilience of the city and they are responsible for a huge number of operations covering a wide range of areas. They provide to citizens with a wide spectrum of services like educational services (e.g. day nurseries, adult training programs), health and social care services (health advice services, health care centres, programmes for vulnerable groups), environmental and urban management services (e.g. disaster management, traffic planning, public transport, pollution, cleaning, waste collection, flood control), security and infrastructure services (water, sewage, power, public lighting, crime contention) and cultural and sport services. At the same time, they significantly interact with enterprises through different types of services such as enterprise registration, local taxation, business occupancy permit, networking events, financing programs, professional authorisations and licenses.

Citizen interaction and engagement in local communities is a main responsibility of local authorities. Facilitation of citizens' participation is vital because it allows individuals to express their needs and to provide feedback about their local governments' policies. Citizen inclusion in decision-making and proximity to public administration are achieved by applying a wide spectrum of processes and tools. Virtual face-to-face meetings, such as online discussion forums, e-Bulletin boards, social media applications, real-time discussions, e-Petitions and e-Meetings, are some of the local e-Government systems that encourage citizens' participation and enable a wide scope of formal and informal government-citizen interaction and engagement[6].

This chapter illustrates the necessity of local e-Government assessment and highlights the specific characteristics of local government. It also offers an overview of existing e-Government assessment models and practices, based on which new assessment method for local e-government is proposed. The results of a pilot local e-Government assessment study, carried out in 40 municipalities worldwide, are presented, and options to advance SDG implementation through e-Government application are discussed. Finally, lessons learned are presented.

7.2. Local Level e-Government

7.2.1 Supporting e-Government implementation at local level

A significant number of cities worldwide have adopted local initiatives in response to the growing recognition of the need to improve their sustainability and resilience. Municipalities, aligning with Sustainable Development Goals, have taken action on policies related to eradicating poverty; providing equal opportunities for all, including vulnerable groups; land development and land-use planning; economic development; smart growth; transport optimisation including in connection with inner-city public transit; pollution prevention, energy, water and resource conservation; eco-projects and alternative energy development policies[7]. The need for enhancing the sustainability and resilience of cities has prompted many politicians, policy-makers and public officials to define new policies and activities.

In order to integrate those policies into local planning and development efforts, public administration processes are continuously reengineered and increasingly underpinned by emerging technologies and innovations. Public administration authorities' portals provide the opportunity to local governments, not only to digitize services but, at the same time, to "localise" their resilience and sustainability. This underlines the need for web-based local government systems to enhance access to services and prompt greater engagement among constituents. It should be ensured that policies are tailored to the socioeconomic characteristics of each city.

7.2.2. e-Government assessment on local level

Therefore, the analysis of public administration portals is essential and a way for e-Government development assessment[8]. Such assessment assists public sector organisations to determine their web strategy, achieve resilient and sustainable policies and operations, and inform policy-makers and agencies about how e-Government has performed[9] from a citizen's point of view[10]. Since local government has the greatest direct contact with citizens, it is critical to collect and exploit regional and local-level data, as the more resources that are allocated at the subnational level, the more value its citizens obtain[11].

As is the case at the national level, successful existing practices and initiatives worldwide could set the benchmark for local e-Government development. Politicians, policy-makers and local public administration officers could use e-Government assessment and successful paradigms in megacities, as a guide to making informed decisions[12]. They could monitor the results of current e-Government investments and determine if the applied e-Government strategy is well-balanced, fruitful and aligned with the designated resilience and sustainability programme. Decision-makers then could set new targets regarding specific areas of e-Government service provision and improve the local government agenda.

Assessment and comparison of various practices are key instruments for depicting the existing e-Government status, ascertaining which objectives have been achieved, confirming the efficiency of applied policies, identifying strengths and weaknesses, suggesting new measures and looking for improved operational patterns in large cities around the world.

7.2.3. Relative assessment efforts

Apart from United Nations e-Government Development Index (EGDI), several other assessment efforts are also commissioned, at national levels, by different stakeholders. The European Commission, in 2017, found that individual countries, private consulting companies, individual researchers, and the Commission itself apply various assessment processes. In each case, policy-makers, government officials, researchers, and others seek to learn lessons from other governments' e-Government policies, to measure their relative progress, discover best practices and global trends and explore underlying e-Government concepts to identify points of leverage[13]. There are some efforts, mainly in the research realm, to evaluate municipal portals (Box 7.1). Some of them consider ICT readiness for the municipality, while others assess the local administration portal.

Box 7.1 Local e-Government Assessment Efforts

The **Digital Governance in Municipalities Worldwide** assesses the practice of digital governance in large municipalities around the world. It evaluates the official municipality portals of 100 cities of the top 100 most wired nations (based on International Telecommunication Union data), in terms of public service provision and residents' participation in governance and ranks the portals. The evaluation categories they apply are: services provision, privacy/security, usability, content, and citizen participation. Regarding provided services, it checks 20 specific ones, assessed in terms of maturity with a reference framework of three stages[14].

The **e-Government Municipal Assessment Project** (MeGAP) for benchmarking of local e-Government is proposed by Kaylor et al.[15]. This bottom-up approach assesses 68 services that are performed by local administrations in the US and is grouped in four distinct categories (information dissemination, interactive functions, eCommerce functions and e-Democracy). Each service is evaluated using a four-level services sophistication assessment framework. Finally, a summary statistic is defined to encapsulate all the results and is the base for a score used to rank cities. MeGAP has been also applied to the 30 municipalities in southern Norway.

The Evaluation of the Portuguese Municipalities' Online Presence is a Portuguese robust and well-established study developed and evolved since 1999. This method introduces a procedure and an assessment evaluation grid. Municipalities' portals are evaluated according to 32 groups of indicators allocated in four criteria: content, accessibility, online services and participation.

Source:
United Nations University

The United Nations Department of Economic and Social Affairs considers that the different role cities play in different countries makes comparison difficult (i.e. a public function that is highly centralised in one country may be highly decentralised in another).[16] In addition, the variety of services and operations make it even more complex for information collection and comparison. Collecting internationally comparable data at the local level – even where it exists – is especially difficult, due to differences in political and economic systems.[17] It is thus challenging to design a municipality e-Government assessment process that avoids misleading results.[18]

7.2.4. Towards Local e-Government Assessment

Consequently, a need to move the focus of assessment of e-Government development to different levels of public administration emerges. It is expected that local level e-Government assessment will improve public services, citizen engagement and authorities' transparency and accountability. Local e-government could also be used as a tool to propel resiliency and sustainability goals and align local government operation with national digital strategy plans. Assessment results could produce useful benchmarks, which can lead to further improvement and application of best practices.

The actions needed to improve local public governance and achieve the UN SDGs need more sub-national, policy-orientated, and capacity-building indices. That requires comprehensive government indicators, which reflect universal aspects of local governance to enable global comparisons across cities. The indicators should, for instance, evaluate specific municipality services, community participation, support to vulnerable groups, access to information, and anti-corruption measures.

7.3 Current Status of Local Online Services: a Pilot Study

This section reports on a pilot study of local e-Government development, which sampled 40 diverse cities across the globe. It starts by describing the instrument used to assess the municipalities' online services, as well as its application to the 40 cities. The study's main findings, including some best practices, are presented in the second part of this section.

7.3.1 Study Methodology

Local Online Service Index

Municipalities worldwide are constantly improving their official websites, as those are the primary interfaces with citizens in the e-Government paradigm.[19] The focus of the proposed assessment instrument is the municipality's official website, where information about administration and online services are provided by the local government authorities. Specifically, a municipal website should include information about available city services, along with information related to the city council, mayor and executive branch, as well as other departments and services. These websites should use the appropriate technologies to effectively provide government services and engage citizens in decision-making. Local government portals are also the main gateways to promote and apply cities' resiliency and sustainability programmes.

There are many parameters for assessing local government websites, as different perceptions of evaluation lead to diverse criteria. Therefore, local e-Government metrics cannot be regarded as one-size fits-all. Existing research indicates that they differ, to some extent, by municipality needs, operation and provided services. To define an appropriate set of metrics, the study expands upon previous empirical research to understand and to measure the degree of web presence in municipality portals.

The proposed instrument, applied in this pilot to assess local e-Government progress around the world, is based on a set of specific indicators that yield some sort of score and, furthermore, allow city e-Government status comparison. The suggested instrument enables the comparison of individual indicators identified on municipalities' portals by clustering them into certain criteria groups using website provided information.[20]. Apart from the indicators, an email response test is conducted which identifies different aspects regarding how municipality portals respond to citizen email requests for information[21].

Simply stated, the Local Online Service Index (LOSI) comprises four criteria groups which cover the whole spectrum of the identified assessment indicators depicted in Table 7.1, derived from the analysis of literature and practice efforts. The first one is the *Technology* criterion, where some basic features of the website are assessed; next is the *Content Provision criterion*, where the existence of essential information is examined; the third criterion is *Services Provision*, where the delivery of fundamental electronic services is assessed; and the final criterion is *Participation and Engagement* which assesses the existence of relevant participation and engagement mechanisms and initiatives.

LOSI is a multi-criteria index, composed of 60 indicators (Table 7.1). The indicators enable progress towards the achievement of each criterion's key objectives to be measured. That, in turn, permits the ongoing evaluation of success in implementing the municipality's website aimed strategy. Each of the 60 indicators is ascribed a "value 1" if it is found in a municipality website, "value 0" if it is absent and nothing if it is not applicable. The LOSI value of a municipality is the sum of the values of all the 60 indicators for that municipality.

Table 7.1 LOSI – Criteria and Indicators

Technology	Content Provision
Browser compatibility	Contact details
Ease of portal finding	Organization structure
Portal loading speed	Names and contacts about heads of departments
Mobile device accessibility	Municipality information
Navigability	Budget related information
Internal search mechanism	Information about procurement announcements
Internal advanced search mechanism	Information about procurement results
Alignment with markup validation standards	Information about provided services
Alignment with display standards	Information about municipality partnership with third parties
Alignment with accessibility standards	Facilitation of free internet access
Customization of display features	Health information
Foreign language support	Environmental information
	Education information
	Social welfare information
	Sport and culture information
	Privacy policy
	Open data policy
	Open data provision
	OGD metadata
	Smart cities initiatives
	Use of emergent technologies
	Online user support
	Guiding information on online services use
	Links for government agencies
	Statistical data and studies provision
	Evidence of portal content update
Service Provision	**Participation and engagement**
Portal authentication	Real time communication
Personal data accessibility	Feedback/complaint submission
Personal data updating	Online deliberation processes
Municipality responsiveness t emails	Social networking features
Delay of email response	Reporting of occurrences in public spaces
Quality of email response	Participatory budgeting
e-Procurement service	Participatory land use plan
Police online declaration	Announcement of upcoming e-participation activities
Address change notification	Feedback about consultation processes
Online residentship	
Online building permit	
Online vacancies	
e-Payment	

Assessment Procedure

The 40 cities in the pilot assessment were selected on the basis of geographical coverage and population size. All geopolitical regional groups of United Nations Member States were covered. More specifically the number of countries per region that are included is based on the percentage of that region's total population in the context of the global population: Africa – 7; Americas – 6; Asia – 13; Europe – 12; Oceania – 2. Wherever possible, all sub regions in the region are covered. Within regions, the cities with the largest population were selected, wherever possible. Where this was not possible, other criteria such as gross domestic product (GDP) and e-Government ranking were considered. Within countries, the city with the largest population was selected. Cities' population were obtained from The United Nations Statistics Division (UNSD) website[22]. In 31 cases, the largest city is also the capital city. Table 7.2 systematises the final list of cities considered. After selection, a search was conducted to identify the relative municipality website link for each.

The link for each municipality's website and the 60 indicators to be evaluated were sent to an assessor, who was a native speaker of the official language of the city. Instructions and guidance regarding the assessment process and about the email messages to be sent to the municipality to assess municipalities' responsiveness to email contacts, were also sent to the assessors. In order to have external validation of the information collected by the assessors, an expert review was conducted. To do so, the assessors were asked to introduce comments to the indicators and, departing from that, a researcher from the team re-checked the information provided.

Table 7.2 Pilot Cities Profile

City	Country	Region	Sub-region	Population
Luanda	Angola	Africa	Middle Africa	2107648
Buenos Aires	Argentina	Americas	South America	2965403
Sydney	Australia	Oceania	Australia and New Zealand	4451841
Toronto	Canada	Americas	Northern America	2808503
Shanghai	China	Asia	Eastern Asia	14348535
Bogotá	Colombia	Americas	South America	6763325
Abidjan	Cote d'Ivoire	Africa	Western Africa	4395243
Prague	Czech Republic (the)	Europe	Eastern Europe	1259079
Santo Domingo	Dominican Republic (the)	Americas	Caribbean	965040
Cairo	Egypt	Africa	Northern Africa	7771617
Tallinn	Estonia	Europe	Northern Europe	413782
Addis Ababa	Ethiopia	Africa	Eastern Africa	2739551
Helsinki	Finland	Europe	Northern Europe	616690
Paris	France	Europe	Western Europe	2243833
Berlin	Germany	Europe	Western Europe	3469849
Accra	Ghana	Africa	Western Africa	1594419
Athens	Greece	Europe	Southern Europe	664046
Mumbai	India	Asia	Southern Asia	11978450
Jakarta	Indonesia	Asia	South-Eastern Asia	9607787
Rome	Italy	Europe	Southern Europe	2867672
Tokyo	Japan	Asia	Eastern Asia	9272740
Almaty	Kazakhstan	Asia	Central Asia	1507509

City	Country	Region	Sub-region	Population
Nairobi	Kenya	Africa	Eastern Africa	3133518
Kuala Lumpur	Malaysia	Asia	South-Eastern Asia	1588750
México City	Mexico	Americas	Central America	8851080
Amsterdam	Netherlands	Europe	Western Europe	821752
Karachi	Pakistan	Asia	Southern Asia	9339023
Port Moresby	Papua New Guinea	Oceania	Melanesia	254158
Warsaw	Poland	Europe	Eastern Europe	1735391
Seoul	Republic of Korea	Asia	Eastern Asia	9860372
Moscow	Russian Federation (the)	Europe	Eastern Europe	11918057
Riyadh	Saudi Arabia	Asia	Western Asia	5188286
Cape Town	South Africa	Africa	Southern Africa	433688
Madrid	Spain	Europe	Southern Europe	3186241
Colombo (commercial)	Sri Lanka	Asia	Southern Asia	647100
Bangkok	Thailand	Asia	South-Eastern Asia	6355144
Istanbul	Turkey	Asia	Western Asia	14100000
London	UK	Europe	Northern Europe	8135667
Dubai	United Arab Emirates	Asia	Western Asia	2983248
New York City	United States of America	Americas	Northern America	8550405

7.3.2 Study Findings

The aim of this study was twofold: to demonstrate the feasibility of the methodology used to assess local e-Government development and to present a set of findings that illustrate the value of this kind of information for policy- and decision-makers, and managers involved in promoting e-Government locally. Its goal is to contribute to the sustained and sustainable development of cities and societies.

As mentioned, each city was analysed against the 60 LOSI indicators, covering technical and content aspects of the municipality website, as well as electronic services provision and e-Participation initiatives available through the portal.

Table 7.3 presents the final ranking of cities. The table also clusters the cities according to the total number of indicators in which they scored. Four clusters are considered: *very high* cluster, grouping cities that met at least 46 indicators of the 60 analysed (more than 75 per cent of the indicators); *high* cluster, grouping cities that achieved between 31 and 45 indicators (between 50 and 75 per cent); *medium* cluster, grouping cities that satisfied between 16 and 30 indicators (between 25 and 50 per cent) and, finally, *low* cluster, grouping cities that met fewer than 16 indicators (less than 25 per cent). This cluster is not presented in the table since none of the cities scored in fewer than 16 indicators.

Table 7.3 Ranking of cities

Rank	City	Total indicators	Technology indicators	Content provision indicators	Service provision indicators	Participation and engagement indicators	Cluster
1	Moscow	55	10	26	11	9	Very high (more than 75% indicators)
2	Cape Town	53	10	26	11	7	
2	Tallinn	53	11	26	12	5	
4	London	51	10	25	11	6	
4	Paris	51	11	24	8	9	
6	Sydney	50	11	21	12	7	
7	Amsterdam	49	9	25	10	6	
7	Seoul	49	11	25	6	8	
9	Rome	48	11	25	8	5	
9	Warsaw	48	11	25	7	6	
11	Helsinki	47	10	24	7	7	
11	Istanbul	47	6	24	12	6	
11	Shanghai	47	10	24	5	9	
14	Madrid	46	10	22	8	7	
14	New York City	46	10	21	10	6	
16	Dubai	44	10	21	10	4	High (50% to 75% indicators)
17	Prague	43	10	23	4	7	
18	Addis Ababa	42	12	21	4	6	
19	Tokyo	41	12	24	3	3	
19	Toronto	41	9	22	8	3	
21	Buenos Aires	40	8	22	5	6	
22	Berlin	39	11	21	2	6	
23	Jakarta	37	9	17	5	7	
24	Mumbai	36	12	19	5	1	
25	Almaty	35	11	19	3	3	
25	Kuala Lumpur	35	11	19	4	2	
27	Athens	33	8	18	7	1	
27	Cairo	33	10	18	5	1	
27	Nairobi	33	5	15	10	4	
30	Riyadh	31	9	15	3	5	
31	Bogotá	30	7	17	3	4	
32	México City	29	7	20	1	2	Medium (25% to 50% indicators)
33	Colombo (commercial)	28	8	13	5	3	
34	Bangkok	24	5	11	5	4	
34	Port Moresby	24	9	12	0	4	
36	Accra	23	10	12	0	2	
37	Abidjan	19	10	9	0	1	
38	Luanda	17	8	9	0	1	
38	Santo Domingo	17	5	11	0	2	
40	Karachi	16	5	11	0	1	

When considering the whole set of indicators, the study found that municipalities tend to be performing quite reasonably. As shown in Figure 7.1, 75 per cent of the cities were classified in *very high* or *high clusters*, meaning that 30 of the 40 cities scored in more than half of the 60 indicators assessed.

Figure 7.1 Percentage of cities in each cluster

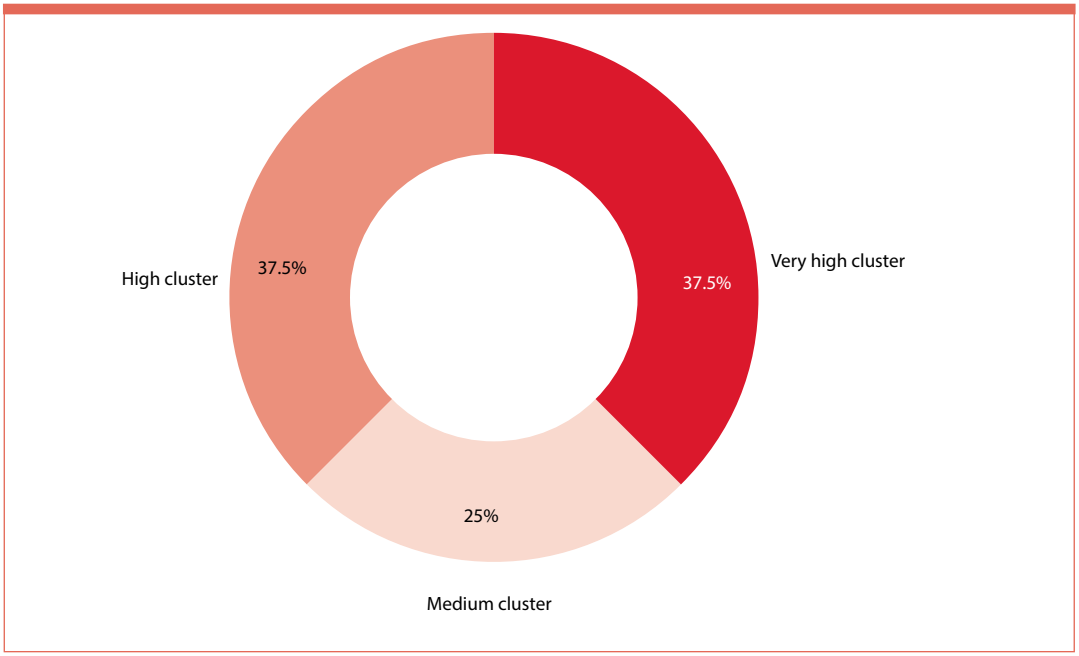


Figure 7.2 illustrates the relationship between the level of assessment obtained by a city and the level of e-Government development of the country to which the city belongs. It does so by comparing the classification obtained by the city in this pilot (LOSI) with the 2018 UN OSI (Online Service Index) value and classification (*very high* (countries with OSI >= 0.75), *high* (countries with OSI between 0.5 and 0.75), *medium* (countries with OSI between 0.25 and 0.5) and *low* (countries with OSI <= 0.25)). The 2018 UN OSI values and classifications were presented and discussed in chapter 5 of this report.

As shown, 55 per cent of the cities got a cluster position in LOSI similar to the one that their countries got in UN 2018 OSI (37.5 per cent *very high–very high*; 12.5 per cent high-high; 5 per cent *medium-medium*). There were, however, 42.5 per cent of the cities that got a LOSI classification lower than that of the country in which they resided, as per the UN 2018 OSI (25 per cent *high-very high*; 12.5 per cent *medium-high*; 5 per cent *medium-very high*). Two municipalities received a classification (5 per cent) that differs two levels from that of its country as per OSI (the municipality got a *medium* position in LOSI while its country got a *very high* position in OSI). Only in one case, for Abidjan, did a municipality reach a LOSI level higher than that of its country in OSI (the municipality got a *medium* position in LOSI while its country got a *low* position in OSI).

These figures tend to suggest that there is not a very strong correlation between the level of assessment obtained by a local municipality and the level of e-Government development of the country to which the city belongs. This fact reinforces the need to conduct assessments of e-Government development at the local level, to complement the national level assessment.

The discrepancy that may exist in national and local-level e-Government development may be even greater than the one shown by these figures, considering the fact that the cities included in this

pilot study are the biggest cities, in terms of population, in their countries. Being big cities, it is highly probable that they present higher levels of e-government development than smaller ones, meaning that, when conducting a wider local e-government analysis, the difference found between performance at a national and local level may be more marked.

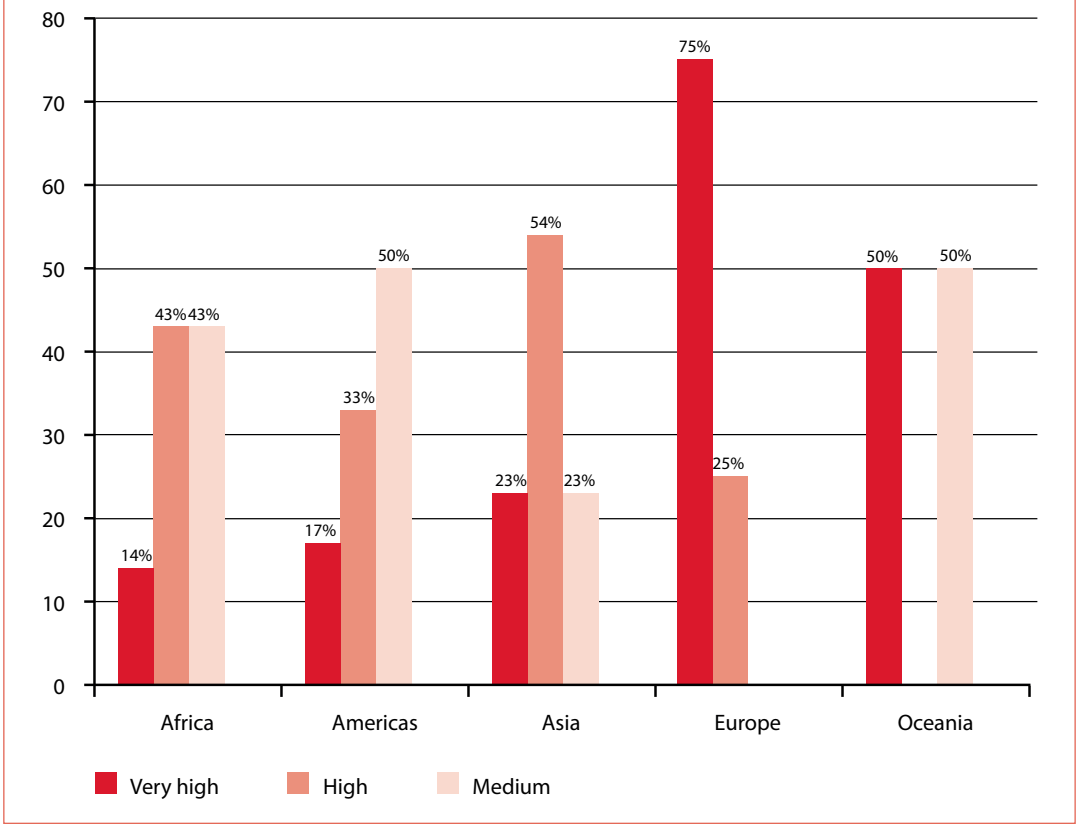
Figure 7.2 City–Country Online Services Index cross classification in 2018

City/Municipality classification in the LOSI 2018

Country classification in UN OSI ranking 2018	Low	Medium	High	Very high
		5%	**25%**	**37.5%**
Very high		Bogotá Mexico City	Almaty Athens Berlin Buenos Aires Dubai Kuala Lumpur Mumbai Riyadh Tokyo Toronto	Amsterdam Cape Town Helsinki Istanbul London Madrid Moscow New York City Paris Rome Seoul Shanghai Sidney Tallinn Warsaw
High		**12.5%** Accra Bangkok Colombo (commercial) Karachi Santo Domingo	**12.5%** Addis Ababa Cairo Jakarta Nairobi Prague	
Medium		**5%** Luanda Port Moresby		
Low		**2.5%** Abidjan		

The analysis by region shows that cities in Europe scored higher. As depicted in Figure 7.3, all European cities analysed are included in *very high* and *high* clusters. Most of the African, Americas and Asian cities, respectively, 86 per cent, 83 per cent and 77 per cent, fell into the *medium* and *high* clusters.

Figure 7.3 Performance of cities per region



Despite the reasonable global scores achieved by the cities, when looking individually to the different criteria and indicators assessed, it becomes evident that municipalities do not perform uniformly in all of them.

As can be seen (Table 7.4), 85 per cent of the 13 *Technology* indicators (i.e. indicators which cover basic features related to accessibility, navigability, and ease of use of the website, such as browser compatibility, portal finding, portal loading speed, mobile device accessibility, internal search mechanism, customisation of display features, and foreign language support), were positively assessed in more than 50 per cent of the cities, meaning that these issues are regarded and implemented in most of municipalities' websites. Similarly, 96 per cent of the *Content Provision* indicators, such as those related to the availability of essential information, were also found in more than 50 per cent of the cities analysed, with half of them being satisfied by more than 75 per cent of the cities.

Table 7.4 Percentage of indicators per criteria that scored by percentage of cities.

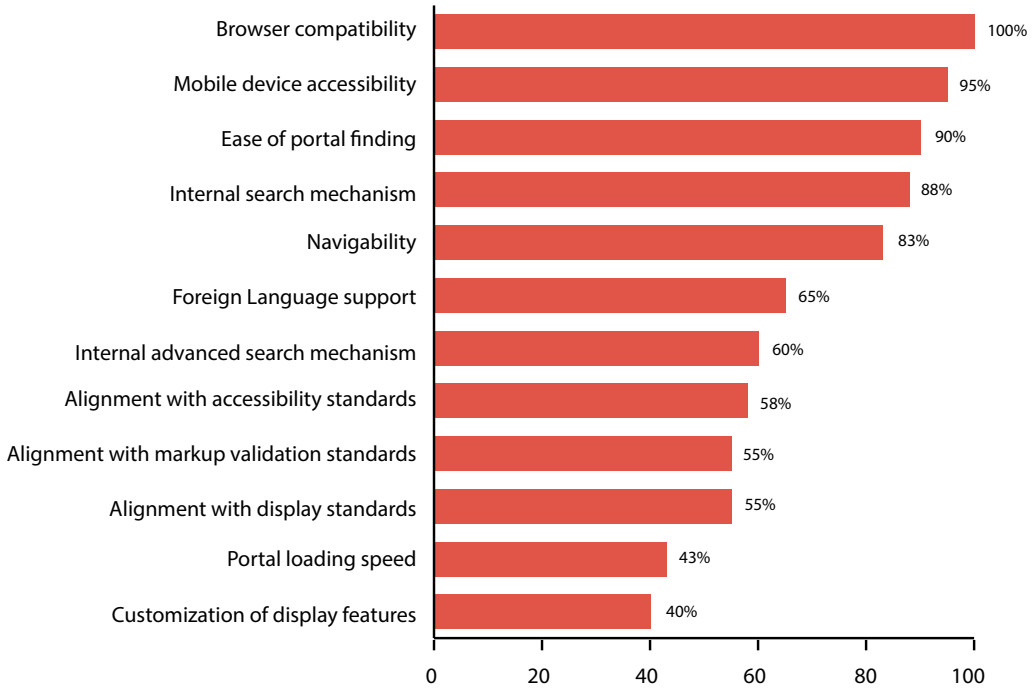
Indicators		Percentage of cities			
Criterion	Total Number	0%-25%	25%-50%	50%-75%	75%-100%
Technology	13	0	15%	39%	46%
Content Provision	26	0	4%	46%	50%
Service Provision	13	15%	54%	31%	0
Participation and Engagement	9	12%	44%	22%	22%

A different situation emerges with the other two criteria. As shown by the numbers, 56 per cent of the *Participation and Engagement* indicators, or those covering the availability of citizen engagement and participation initiatives through the website, were implemented by less than 50 per cent of the municipalities. The *Service Provision* criterion scored the lowest, with 69 per cent of its indicators being implemented only by less than half the municipalities ranked.

These results tend to show that, despite some very good cases, many municipalities continue to focus their attention more on providing websites with adequate content and satisfactory usability, and less on making life easier for citizens insofar as such things as service request and execution and promoting citizen participation.

As shown in Figure 7.4, *Technology* indicators addressed most by municipality websites are related to accessibility, ease of use, and navigability. Most of the websites are compliant with the Web Content Accessibility Guidelines (WCAG1.0), as well as with the technical standard recommendations by World Wide Web Consortium (W3C) referring the mark-up validity and Cascade Style Sheets (CSS) standards.

Figure 7.4 Implementation of Technology indicators in municipalities' websites



Only 65 per cent of the municipalities provide their website content in more than one language. Considering that the sample used in the pilot includes the biggest city in the countries, and that most are capital cities that attract a huge number of visitors for business and tourism purposes, it would be reasonable to expect that their websites would be fully or partially available in an oft-used language, such as English. There is also an expectation that multilingual website content would be used in multiracial and multi-language cities, to ensure that language, ethnic and indigenous minorities can access public services and information easily.

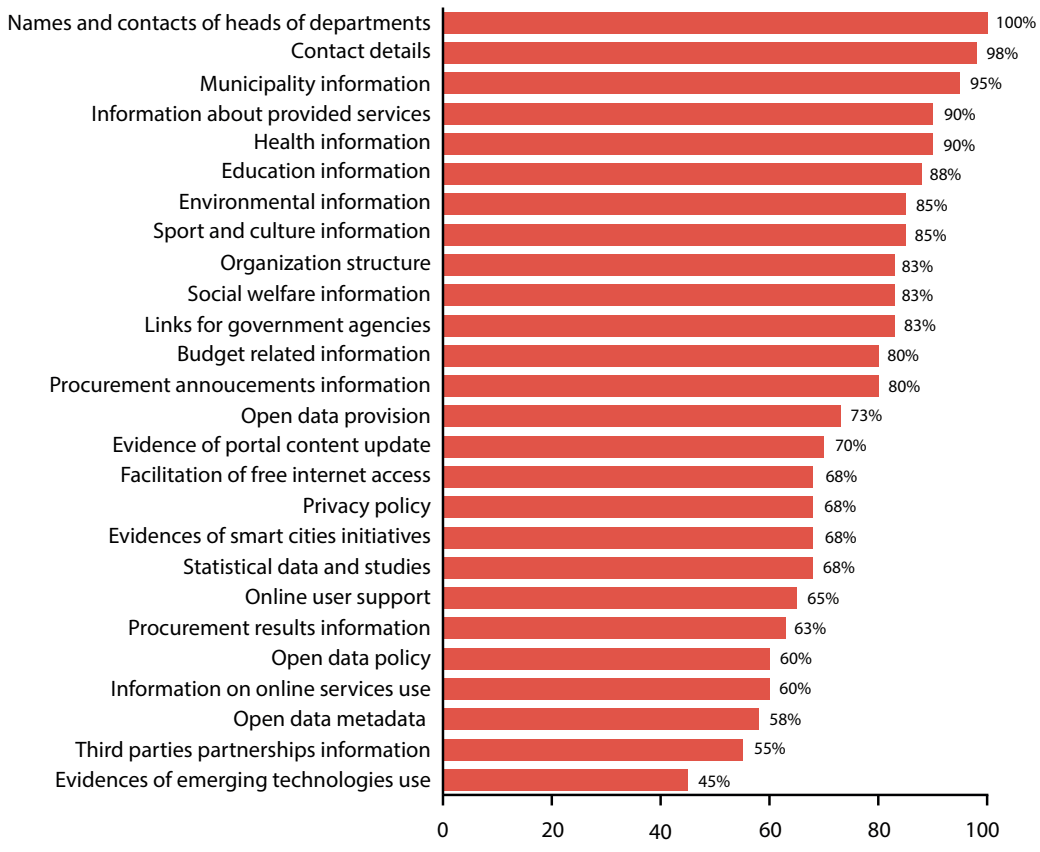
Most municipalities, or 95 per cent, already provide websites that are accessible through mobile platforms. This is particularly relevant considering the high penetration of mobile devices and the growing trend of "access on moving".

Only 40 per cent of the municipalities studied have websites that make it possible to customise website display options, such as font type, size and colour.

Concerning *Content Provision*, which covers indicators related to the availability of information, namely institutional information, sectorial information, services information and information about policies of privacy and open data, most of the municipalities performed quite well. As previously mentioned, 96 per cent of the *Content Provision* indicators were verified in more than half the cities analysed, with 50 per cent of indicators being satisfied by more than 75 per cent of the cities.

As presented in Figure 7.5, information about the municipalities' organisation, operations and management, such as a municipality chart, the names and titles of heads of departments and their functions, working hours, contracts, municipality budget and budget-related policies, as well as information about services provided is available on the website of more than 75 per cent of the cities.

Figure 7.5 Implementation of Content Provision indicators in municipalities' websites



The majority of municipalities' websites also provide a rich and wide range of information covering sectorial areas such as education, health, environment, social welfare, leisure, culture and sports.

Announcements of forthcoming municipality procurement/bidding processes were found in 80 per cent of the websites, although only 63 per cent of them provide the results of the procurement/bidding processes.

Notably, 68 per cent of the municipalities have a privacy policy or statement available on the website, which denotes respect for citizens' privacy and awareness of transparency and accountability principles.

The websites were also analysed to determine whether the municipality is using, starting to use, or intends to use information and communication technologies (ICTs) in more innovative ways. For that purpose, three aspects were analysed, relating to the existence of any Open Government Data (OGD) initiatives, smart city initiatives, and the adoption and use of emerging technologies, such as Internet of Things (IoT), artificial intelligence (AI), blockchain, virtual reality (VR), or augmented reality (AR).

Open Government Data initiatives were noted in 73 per cent of the cities, which is a sign of municipalities' willingness to become more transparent and economical. However, only 60 per cent of those cities provide an OGD policy, establishing the rules and recommendations for publishing and using open datasets. In most cases, the municipality website provides a link to a specific OGD portal, be it a municipal or national OGD portal. One interesting example of OGD was found in Helsinki (Box 7.2).

Box 7.2 Helsinki: Helsinki Region Infoshare

Helsinki Region Infoshare (HRI) service aims to make regional information quickly and easily accessible to all. Essentially, HRI is a web service for fast and easy access to open data sources between the cities of Helsinki, Espoo, Vantaa and Kauniainen. The data published is mainly statistical, giving a comprehensive and diverse outlook on different urban phenomena, such as living conditions, economics and well-being, employment and transport. A good proportion of the data material offered by the service is GIS based. The main operational activity is to support the producers of information in opening their data and to increase its utilisation by multi-channel communication.

The data can be used in research and development activities, decision-making, visualisation, data journalism and in the development of apps. The data may be used by citizens, businesses, universities, academies, research facilities or municipal administration. The data on offer is ready to be used freely at no cost. There are no limitations on users; anyone interested in open data can participate.

Currently 628 datasets are offered organised in various categories. The data can be downloaded as files and is also available as raw data in different formats (XLS, PC-AXIS, CSV, KML, GML, JSON and XML) via various network services or technical interfaces.

Source: http://www.hri.fi/en/

Smart cities initiatives are emerging around the globe. Prompted by environmental, economic, or social reasons, cities are taking advantage of technology advancements in many domains to become smarter. The pilot study tends to support this evidence, with some smart city initiatives found in 68 per cent of the cities analysed, such as in Amsterdam (Box 7.3).

Comparing with Open Government Data and smart cities initiatives, the results obtained for emerging technologies were somewhat lower. The use, or intention to use, of emerging technologies was found in only 45 per cent of the municipalities. This percentage, however, is a positive sign, since there is still a significant general lack of understanding about the use of emerging technologies. These require new technical competencies, which, at the municipal level, may not be readily available. One interesting case of emerging technologies use was found in Seoul (Box 7.4).

Box 7.3 Amsterdam: Solar Cycle Path

In Amsterdam, they have designed and installed the world's first solar cycle path. Solar path is exactly what it sounds like—solar panels that pull double duty as road surface and electricity generator. The path, which was developed by the Netherlands' TNO Research Institute, runs between the suburbs of Krommenie and Wormerveer. The busy 70-meter stretch serves some 2,000 cyclists per day. Underneath all that glass, the solar panels are hooked up to the electric grid. 70 meters might not sound like much, but it's a proof-of-concept pilot project to test feasibility and practicality, and it makes sense to test the waters on roads that are occupied with lightweight bicycles rather than hefty vehicles. Eventually, it could make the sense to use this solar road electricity for traffic signals and street lights. After a six months' operation, the path attracted more than 150,000 riders, and more importantly, generated more than 3,000 kilowatt-hours of energy. That's enough to power a home for a year.

The solar path was made using prefabricated slabs consisting of concrete blocks topped with a translucent layer of tempered glass. Beneath the protective glass lie crystalline silicon solar cells which are hooked up to the grid. The glass has been given a special coating to make it skid-resistant, and it's strong enough to withstand steel balls dropped onto it. The path has been installed on a slight tilt which is designed to help rain wash off dirt and hence keep it as clean as possible, which will help maximise the amount of sunlight that can reach the solar cells. As it is still in its early days, production costs are unfortunately rather hefty. The pilot cycle path came with a $3.75 million (€3 million) price tag, which was mostly put up by the local authority. However, as the technology develops and production gets scaled-up, the price should drop.

Source: http://www.solaroad.nl/

The favourable scores achieved by municipalities in the *Technology* and *Content Provision* criteria change considerably when looking at the *Participation and Engagement* indicators. As shown in Table 7.4, there were 56 per cent of *Participation* and *Engagement* indicators that were only found in less than half of the municipalities' websites studied.

According to Figure 7.6, one of the *Participation* and engagement indicators that received a more positive assessment relates to a social network presence in municipalities, with 34, or 85 per cent of municipalities polled having a presence in some social network, such as Facebook, Twitter, YouTube, and Flickr.

Box 7.4 Seoul: smart bins for waste management improvement

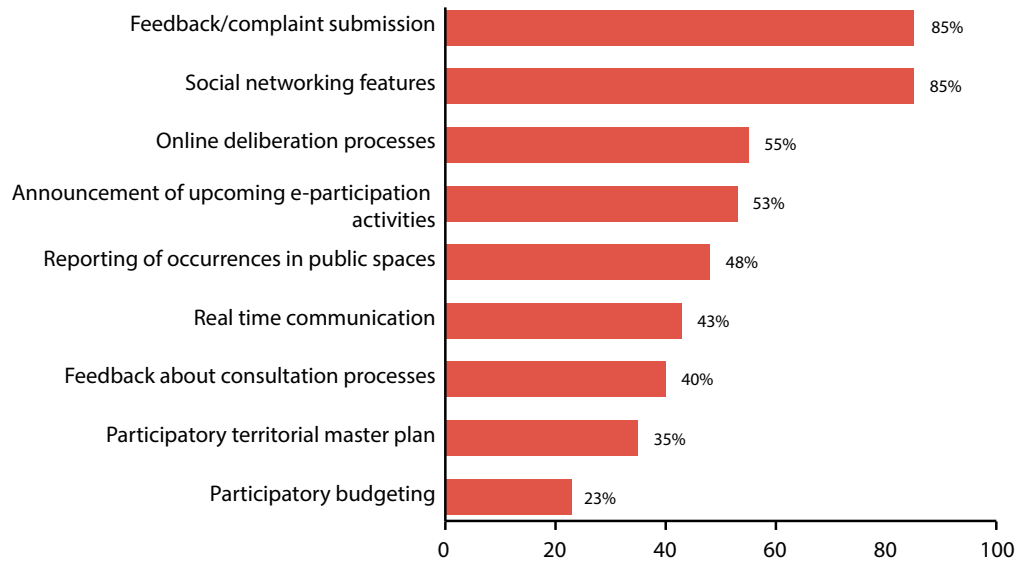
Seoul had problems of frequent waste collection and waste overflow. With an inadequate number of public waste bins and with four to five daily waste collections proving to be insufficient, they had a serious problem on their hands. Furthermore, because the waste collection planners did not know how full or how quickly the bins became full, Seoul's waste collection staff had to deal with plastic bottles and paper cups that continuously piled up on top of recycling bins.

With the main goal of improving the cityscape by making streets cleaner and reducing waste collection costs, Seoul municipality decided to install 85 solar power trash compactor waste bins which can hold up to 8 times more waste compared to non-compacting bins. Those wheelie bins provide easy and safe trash removal, and they also communicate information they collect in real time through wireless transmission, to monitor the status and fill-level of waste bins and observe the collection efficiency throughout Seoul.

Since installing those waste bins, waste overflow was eliminated, waste collection cost has been reduced by 83%, recycling diversion rate has been increased to 46%, route optimisation for waste collections has been achieved (66% reduction in collection frequency) and there was a significant reduction of litter on the streets. This waste management solution, using emergent technologies, is contributing to making the city cleaner and more pleasant for both residents and tourists.

Source: http://gov.seoul.go.kr/

Figure 7.6 Implementation of Participation indicators in municipalities' websites



Regarding the possibility for a citizen to send a complaint or opinion to their municipality – present in in 85 per cent of the municipalities - different approaches are used. In some cases, general inquiry options are available, whereas other websites provide specific areas for that feedback. One kind of information or feedback provided by citizens to their municipalities is related with the reporting of occurrences/ problems found in public spaces, such as holes in the street, broken public lamps, damages in sports facilities or playgrounds. This possibility was found, however, in only 19, or 48 per cent, of the websites. One interesting system for reporting occurrences was found in Bogota (Box 7.5).

Box 7.5 Bogota: Geographic Information Services

Bogotá DC has created effective mechanisms to permit timely availability of quality geospatial information to support the range of sectoral, local and regional projects that are deployed in and from the national capital district. The Infrastructure of Spatial Data for the Capital District (or IDECA) is responsible for promoting collaborative strategies to manage geographic information based on official policies and standards, using technological tools that enable information management and facilitate the development of institutional strategies for best practices related to the data lifecycle.

Tu Bogotá is an application that can identify, through an interactive map, variables to make decisions about housing or investment in the capital within a search radius of 0.5 to 2 km. It can also be shared on social networks. The application gives the per-sq-km value of a land, and other useful information, such as the options available in the property's environment related with education options, health providers, parks, and other. The tool allows users to report the real estate offers and civic needs for different sectors of the city (health, education, culture, trade, tourism, social security, risk, mobility, environment, public space). In addition, users can upload a related image, a description of the need and a contact email. This way, users can get in touch with the different public entities that provide information for the app and contribute for portraying a certain area of the city, thus allowing interactive and information wise navigation in the app's map.

Source: http://www.bogota.gov.co/

Too few websites offer mechanisms, such as online forums, social media, online polls, online voting tools, chats, blogs and online petition tools, to gather public opinion so as to inform policy deliberations. Only about half of the cities studied, or 55 per cent, provide tools on their website to engage citizens in deliberative and decision processes. Sydney, Australia has spearheaded a noteworthy community consultation initiative (Box 7.6).

Box 7.6 Sydney: Community Consultation

The City offers a range of opportunities for residents, workers, community groups, business, government and industry stakeholders to share ideas, insight and feedback on our projects and policies to help inform Council decisions. They can take part at workshops and community meetings, stakeholder meetings and roundtables, online consultations, community reference groups, advisory panels, drop-in sessions, surveys, school workshops etc. Consultation and engagement outcomes are collated, analysed and considered along with other input and technical, financial or legislative requirements as a key part of Council's decision-making process.

The following principles guide the city's approach to engaging the community in decision-making:

- Integrity: Engagement should be clear in scope and purpose.
- Inclusiveness: Engagement should be accessible and capture a full range of values and perspectives.
- Dialogue: Engagement should promote dialogue and open up genuine discussion.
- Influence: The community should be able to see and understand the impact of their involvement in consultations that the city conducts.

Source: http://www.cityofsydney.nsw.gov.au

Despite such initiatives, only 16 of the municipalities in the study, or 40 per cent, could point to some indication of online public consultation that resulted in a policy decision, regulation, or service. Likewise, only in 21 of such websites or 53 per cent of those polled, were there calendar announcements or postings of upcoming online consultation, such as voting forums, surveys, or polls.

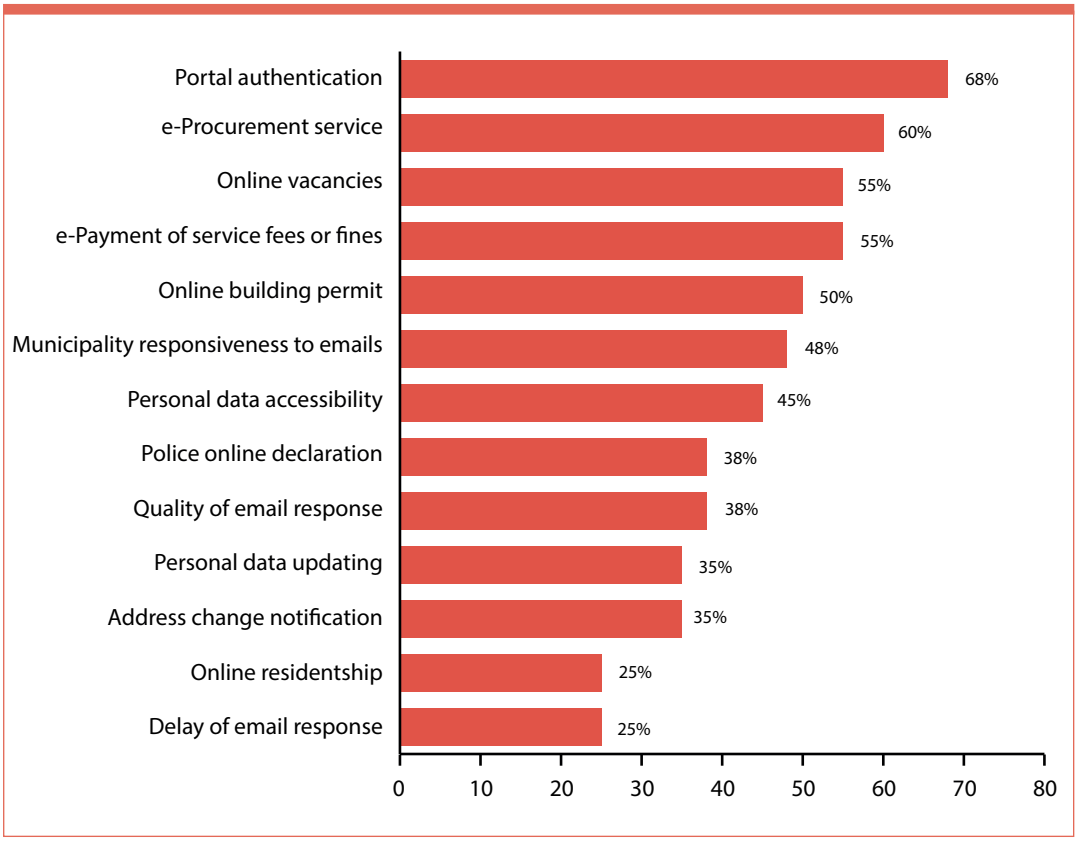
"Participatory budget" and "participatory municipality's land-use plan" are two specific kinds of initiatives used by municipalities to engage with their citizens. Nevertheless, at this level, the figures in our study are still low. The participatory budget initiative was found in only 9 cities studied, or 23 per cent. Similarly, only 14 cities, 35 per cent in the study, provided evidence of specific initiatives to allow citizens' participation in the municipality's land-use planning process. These lower numbers may, however, be due to the seasonality of such initiatives and may not have been available at the time of the pilot project.

It was observed that some cities, 17 of those studied, or 43 per cent, offer "live support" features with municipality employees in real time (such as VIPE, WhatsApp, call centres) through their portal. This kind of interaction creates a closer relationship among stakeholders.

Regarding the fourth set of indicators, online *Service Provision*, only six cities, or 15 per cent, did not score in any of the 13 *Service Provision* indicators, while 26 cities, or 65 per cent, scored in less than half the indicators.

As depicted in Figure 7.7, citizen authentication, a basic auxiliary service for the online provision of most of the remaining services, was available on 27 (68 per cent) of municipality websites.

Figure 7.7 Implementation of Services Provision indicators in municipalities' websites



Besides this basic auxiliary service, nine specific services were also analysed: (i) access to personal data; (ii) personal data updates; (iii) resident application; (iv) application for government vacancies; (v) building permits; (vi) notification of change of address; (vii) declaration to the municipality police; (viii) submission of a tender through an e-procurement platform; and (ix) payment of fees for government services or fines.

The submission of tenders through e-Procurement platforms is the service offered by most municipalities, as it was found in 60 per cent of the websites, although different approaches are followed: in some cities, citizens are redirected to specific e-procurement municipality platforms while, in others, they are redirected to national e-procurement platforms.

The online service for applying for residency is the least available: only 10 cities, or 25 per cent, have it, and in two of these cases, the service is not provided directly by the municipality but by other entities, namely the magistrate, to which the citizen is redirected.

As for making a declaration to the police, only 15, or 38 per cent of the municipalities studies provide this option, and, similar to the situation prevailing for residency applications, there are nine municipalities in which the police declaration service is not provided directly by the city but through a link to the municipality police website where the declaration can be made.

Application for government positions is available on the websites of 22, or 55 per cent of the municipalities, and this option is not presented by a city website but through a link to external specific websites.

Payment for municipality services or fines can be made in 55 per cent of the municipalities' websites and the possibility of online application for building permits in half of the municipalities studied.

The possibility of online access and the opportunity to update personal data is available on 18, or 45 per cent of the websites, and 14, or 35 per cent, respectively.

Three final services related to the usage, delay and quality of responses to email messages sent by citizens to municipalities were also analysed. For doing so, an email message containing a simple request, in particular, asking about the official working hours of the office, was sent to each municipality. During this process, it was found that not all the municipalities provide email addresses on their websites. In some of those cases, it was possible to send a message through an embedded web form. Overall, only 19, less than half of the municipalities, replied to the messages sent. And of those, only 10 replied in less than two working days. Also, from the 19 replies received, only 15 responses were considered "useful" since they applied directly to the request made. The 15 useful messages received had very different formats. Some were short, providing a simple and clear response to the request. Others did not provide an immediate answer in the email body. Instead they annexed a file, usually in the pdf format, containing the municipality's internal regulation where the timetable of services is defined, requiring users to sort through lengthy documents written a very formal and legal way, just to find very simple information. Tallinn, Estonia is an interesting example of email interaction, since it keeps the citizens well informed about the time that it will take to receive a full reply to their request (Box 7.7).

Box 7.7 Tallinn: Tallinn City Office Response

In Estonia, Tallinn the municipality responds to an email request with specific time indications regarding the expected answer. The expected time response depends on request type.

"Thank you for sending an email to lvpost@tallinnlv.ee. If your message is a request for information, we will answer within 5 business days. A request for information is a query for a document or documented information. If your message is sent as a memorandum or a request for explanation, we will answer within 30 days. A memorandum is an inquiry that makes a suggestion concerning administration or a forwarding of information. A request for information is an inquiry that requires analysis of existing information or the collection of further information."

Source: : https://tallinn.ee/

The analysis reveals that, despite municipalities' strong performance in the provision of webpage content and in meeting most of the technical indicators embedded in the study's methodology, they are still lagging behind expectations in what refers to the areas of participation and engagement with citizens and services provision. At services provision level, there are already, many cities that provide information about services, as well as forms to be downloaded for their requests, but that still require in-person submission. Likewise, it was found that the responsiveness and quality of email usage by municipalities to interact with citizens are far from the desired levels.

7.4. Using Local e-Government to Advance SDG implementation

Improving the local level of e-Government is inseparable from achieving the UN Sustainable Development Goals. The development of electronic services and the increase in the number of people participating in decision-making will drastically lead to achievement of the development Goals. It will assist in making cities sustainable, improving local communities, making them inclusive safe and resilient.

The 2030 Agenda for Sustainable Development recognises the important role of technological innovation and contains specific references to the need for high quality, timely, reliable and disaggregated data, including on Earth observation and geospatial information. Many of the Agenda's Sustainable Development Goals have targets that are directly or indirectly related to local e-government assessment indicators, what makes improvements in local e-Government assessment operate as a catalyst for the achievement of the SDGs.

Although most municipalities perform relatively well in the Technology criterion, there is room for improvement in portal design, so as to allow user configuration, content display in more than one language and improvement of user guidance in understanding and using online services. In this way, municipalities will satisfy target 1.4, on access to basic services, ensuring that all people have equal rights to access appropriate new technology, and SDG 9, which requires the building of resilient infrastructure, promotes inclusive and sustainable industrialisation and fosters innovation.

Information related to municipality budget and government procurement processes, provided by 75 per cent of the municipalities, satisfies target 1.4 ensuring that all men and women have equal rights to economic resources, as well as access to financial services.

Service provision in partnership with third parties such as civil society and the private sector, provided by half the sample, aligns with SDG 8, on the promotion of sustained, inclusive and sustainable economic growth, and full and productive employment and decent work for all, requests partnership

with the informal sector to improve working conditions and social protections. Also relevant is SDG 17, aimed at strengthening implementation means and revitalising the Global Partnership for Sustainable Development and encouraging partnerships between public bodies, the private sector and civil society in communities.

Improvement of free access to government online services through kiosks, community centres, post offices, libraries, public spaces or free Wi-Fi, provided by less than 75 per cent of the cities sampled, aligns with target 1.4, which seeks to ensure that all people have access to appropriate new technology, as well as target 9.1, on affordable and equitable access for all, development of quality, reliable, sustainable and resilient infrastructure. Similarly, relevant is target 9.C, on access to ICTs and the Internet, generally, as well as increasing universally and affordable access, especially in least developed countries (LDCs).

Provision of information on health issues, in most of the municipalities, contributes to achieving SDG 2, on ending hunger, achieving food security and improving nutrition, and promoting sustainable agriculture by identifying and tackling child malnutrition. Also significant is the municipality's role in connection with SDG 3, on ensuring healthy lives and promoting well-being for people of all ages.

In over 75 per cent of municipalities reviewed, the indicator on the provision of information about environmental issues is interlinked with the most SDGs. For example, the provision of information promotes targets 3.9, on reducing pollution and contamination, 6.3, on reducing pollution and increasing recycling and safe reuse, as well as SDG 7, on access to affordable, reliable, sustainable and modern energy for all; SDG 12, on sustainable consumption and production patterns; SDG 13, on urgent action to combat climate change and mitigate its impacts; SDG 14, on conserving and sustainably using the oceans, seas and marine resources for sustainable development; and SDG 15, on protecting, restoring and promoting the sustainable use of terrestrial ecosystems, the sustainable management of forests, combatting desertification, and halting and reversing land degradation and biodiversity loss.

Provision of information about educational issues, also present in over 75 per cent of the municipalities, advances SDG 4, on ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all. Similarly, 75 per cent of those studied on provision of information on social welfare issues, goes hand-in-hand with target 1.4, ensuring that all men and women, particularly the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership, control over land and other forms of property, inheritance, natural resources, appropriate new technology, and financial services including microfinance.

Support for participation and related issues, such as reporting of occurrences in public areas, participatory budgeting and the revision process of the territorial organisation of the municipality displays some gaps, as that is present in less than half the municipalities polled. Enhancing those indicators could improve SDG 16, on the promoting of peaceful and inclusive societies for sustainable development, provision of access to justice for all and the building of effective, accountable and inclusive institutions at all level, as well as participatory and representative decision-making.

Smart city initiatives and use of emergent technologies by the municipality, evident in about half those reviewed, aligns with SDGs 7 and 8. Personalised responses to citizen contact, available in less than half the municipalities, promotes SDG 16, especially targets 16.6, on effective, accountable and transparent institutions, 16.7, on responsive, inclusive, participatory and representative decision-making, and 16.10, on access to information, all of which are aimed at public access to information and protection of fundamental freedoms through national legislation and international agreements.

Enhancement of online service provision and online payments, available in half the municipalities, stands to improve targets 10.2, on empowering and promoting social, economic and political inclusion, and 10.3, on eliminating discriminatory laws, policies and practices, including by ensuring equal opportunity and reducing inequalities of outcome, through elimination of discriminatory laws, policies and practices and promotion of appropriate legislation, policies and actions.

Another area which needs improvement is e-participation, present in less than half the cities examined. Enhancing e-participation and including e-consultation in policymaking initiatives could contribute to target 10.2, on empowering and promoting the social, economic and political inclusion of all people. At the same time, target 10.3 can be advanced, on ensuring equal opportunity and reducing inequalities of outcome. Target 16.7 is also furthered by ensuring responsive, inclusive, participatory and representative decision making at all levels.

7.5. Conclusion

Local Online Service Index (LOSI) assessment has been applied in 40 municipalities worldwide. The results prove the overall suitability of the assessment approach. The present study reveals the main characteristics for a local e-Government assessment, which could be useful for municipality managers, public officials, researchers and politicians. An efficient comparative assessment of municipality electronic administration should cover the breadth and variety of services and tasks performed by local authorities. It should rely on an updated e-Government model including new trends in service delivery, such as user interactivity, citizens' participation, and proactivity. An assessment also should consider the service provision, not only through the web channel, but also through all the new digital channels currently in use, such as social media, kiosks, and mobile apps. It should also be based on the existence of a corpus of services that are common to municipalities worldwide, thereby setting a baseline for comparative assessment of municipalities, which examines similar services rather than similar organisations.

Based on the pilot study results and analysis, some lessons can be extracted:

- Local governments recognise the importance of e-Government in order to achieve sustainability and resilience;
- Generally, cities in countries with very-high and high e-Government Development Index (EGDI) values perform better than the others;
- 42.5 per cent of the cities got a LOSI classification less than the one assigned to their countries, as per the UN 2018 OSI;
- Despite municipalities' sound performance in webpage content provision to citizens and meeting most of the technical indicators considered in the methodology adopted, they are lagging behind in terms of what could be expected and what could be achieved, with the universal participation and engagement of all citizens and particularly in services provision;
- There are already many cities that provide information about services, as well as downloadable forms for their requests, but that still requires in-person submission and process triggering;
- The responsiveness and quality of email usage by municipalities, when interacting with citizens, are far from anticipated levels;

- E-Government systems can become a useful tool for local administration in line with achievement of the SDGs;

- There are already several best practice e-Government cases that can be used as benchmarks for local governments worldwide.

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Chapter 8. Fast-evolving technologies in e-government: Government Platforms, Artificial Intelligence and People

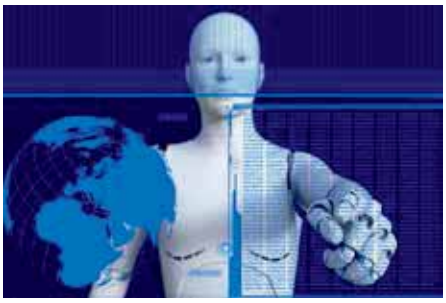

Photo credit: pixabay.com

8.1. Introduction

As public institutions focus on the implementation of Agenda 2030 with the core principles of leaving no one behind and eradicating poverty, frontier technologies are creating both opportunities and risks for future governance.

The fourth industrial revolution and convergence of innovative technologies, such as big data, Internet of Things (IoT), cloud and super-computing, geo-spatial data and broadband, artificial intelligence (AI), and deep machine learning, are promoting a dramatic shift towards more data and machine-driven societies, while development challenges and social inequality continue to increase. So-called disruptive technologies, including predictive analytics, are creating unforeseen opportunities in many government sectors, including health, security, water management, environment, among others. The rapidity with which these new technologies are evolving, combined with the knowledge that governments already possess, present a historic opportunity for sustainable development.

However, the pace and evolution of technological innovation can surpass the speed with which governments can absorb changes and reap their rewards. In the past decade, there have been ground-breaking technological advances, such as the economy app, blockchain, and facial recognition via simple smart phones, to name a few. Apart from the need for governments to catch up is the need to ensure that the new data tools are not concentrated in the hands of a few but are equitably distributed. A sufficient balance which serves the needs of many for the greater good is required. Thus, the process of integrating the new data tools could benefit from constant review and an incremental approach.

The accelerated speed of innovation and the integration of technology into all devices and all sectors are equally disrupting the public sector. Models governing the design and consumption of public services are evolving. Beyond digital transformation, governments themselves are increasingly called upon to evolve as well. Indeed, the degree to which technology is disrupting society on the one hand and supporting it on the other is unknown. The use of these fast-evolving technologies in

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e-government also raises the question whether and to what extent they are being used by members of society to generate the greatest impact. The interface between government and society reinforces the widely held belief that the use of new technologies by governments can support the realization of society's broader goals.

This chapter examines several fast-evolving technologies, the e-government application of which, can be instrumental in promoting good governance principles and achieving the sustainable development goals. It also ponders present and future challenges and hypothesizes that the success of e-governance lay in leveraging and balancing the extraordinary new platforms with society's needs.

8.2. Harnessing fast evolving technologies

There is a case to be made that fast-evolving technologies have already transformed the traditional ways in which governments operate and deliver services. In the context of e-government, this chapter focuses on digital technologies, excluding but not discounting innovations in the fields of energy, biology, health and other domains. Some of the major digital technology trends fuelling innovation and growth in both the private and public sectors are mainly related to digital, analytics, cloud, core modernization, and the changing role of information and communications technologies overall. Social and mobile technologies, open data initiatives, and Internet of Things (IoT) also play an important role in transforming government efforts. Constituent engagement also drives transformation, both in service delivery and operational efficiency.

Several rapidly advancing technologies have great potential, both for the ICTs industry as well as for governments around the world, include:

- Data, intelligent apps and analytics
- Artificial Intelligence and Robotic Process Automation
- Intelligent "things", cyber-physical integration and edge computing
- Virtual and augmented reality
- High Performance- and Quantum Computing
- Blockchain and Distributed Ledger Technologies

A combination of the fruition of long-term research and development are among the forces driving these technologies. Artificial Intelligence, for example, has been around since the 1950s, but its use today by businesses and individuals has increased exponentially. That is due in part to the growing processing power of hardware, increasing data availability, and the needs and expectations of society. Often, the technologies themselves are not new. Rather it is the convergence of developments in hardware, software and data availability that offer new potentials.

8.2.1. Data, intelligent apps and analytics

The public sector has the challenge of processing vast amounts of unstructured data, responding to inquiries, and making knowledge accessible. Through automated capabilities, so-called dark analytics, or the analysis of data that is not in common use, can allocate, store, secure, and retrieve vital data on demand, from such sources as documents, e-mails, tickets, videos, and tweets. Algorithms,

following a form recognition protocol, can read machine print and hand print, and use contextual logic databases for automated validation. This can reveal trends, population movements, user preferences, demographics, transportation details, and more. User trends can then be analyzed to improve customer service. Decision-making in such areas as migration can be made more transparent and targeted, and have profound impacts.

Intelligent apps and platforms are already being used to make correspondence and customer service of public institutions quicker and more effective, as well as less costly. They also support the process of digital payments and help manage information flows and reporting. Moreover, applying analytics frees human resources and reduces costs by speeding up data capture, recognition, and retrieval. This increased capacity allows greater focus on improving the "customer journey".

Data analytics can be the link between public and private institutions. Open public data can be used to fuel private sector innovations, but likewise, private sector data can support new and better public services. Technological developments and information sharing between governments and private stakeholders can benefit such vital areas as national security, health care, social and financial services, transportation, and public safety. Together with artificial intelligence and automated processes, data science are key drivers in technology-induced transformation.

8.2.2. Artificial Intelligence and Robotic Process Automation

Artificial Intelligence constitutes a range of specific technologies through which "intelligent machines are gaining the ability to learn, improve and make calculated decisions in ways that enable them to perform tasks previously thought to rely solely on human experience, creativity, and ingenuity".[1] Artificial Intelligence is the ability of a computer or a computer-enabled robotic system to process information and produce outcomes in a manner similar to the thought process of human beings in learning, decision-making and problem-solving. Artificial Intelligence has been rapidly advancing and will provide benefits through enhancing citizen engagement, automating workloads, and increasing workplace productivity. It will thus significantly impact businesses, societies and the daily lives of their members.

The confluence of significant technological developments in hardware, software and data has fuelled the development of Artificial Intelligence, positioning it to have a major impact on society for the coming decades. The speed of improvements in processing power has continued apace. Graphics processing units, which are specialized hardware that can run specialized algorithms, play a key role in Artificial Intelligence. New software has been developed that can leverage this processing power by leading to faster and better learning. Data – the crucial ingredient for Artificial Intelligence – is also increasingly available, fuelling the learning process of computers. This can significantly benefit the public sector, for example, in automating decision-making of routine tasks, forecasting climate change, answering questions from citizens and managing transport flows. Another change is access to large cloud computing platforms such as AWS, Google, and Microsoft, among others, and the advent of quantum computing, which is a vastly different approach.

8.2.3. Intelligent "things", Cyber-Physical Integration and Edge Computing

Intelligent things are an evolution of the Internet of Things (IoT) whereby physical objects with sensors are connected to a network, and can function almost autonomously by using artificial intelligence. By linking software and IT/cyber) with electric and mechanical or physical parts, data can be monitored and analysed over a communication network. Often, sensors simply gather data that is processed centrally in the cloud. That information is subsequently sent to the location where it is needed. With Edge Computing, data is processed at the point of collection or at the "edge"

instead of inon a central server. This reduces latency and the amount of data that must be moved. With an increasing number of IoT devices, a mix of on-site and cloud processing will be needed. The idea itself is not new. To take a simple example to visualise this, windshield wipers on cars get their information from sensors in the vehicle. The car does not need to send rainfall data to a cloud to get back the information on which action is needed. The data is directly analysed and action is immediately taken. This concept is now being applied to more complex situations and implemented in a network of private and government infrastructures. Using this form of computing, autonomous driving, smart homes, and smart grids are made possible.

In public institutions, hybrid combinations of Cloud and Edge Computing can serve as platforms where sensors are combined to support customer relationship management, enterprise resource planning and supply chain systems.[2] For example, equipping roads and snowploughs with sensors, combined with data from weather and driving apps and tweets, improves snow removal, cuts costs by 10 per cent and frees up human and government resources.[3]

8.2.4. Virtual and Augmented Reality

Virtual Reality (VR) enables users to immerse themselves in a digital world. Augmented Reality (AR) shows the world in real time enriched with digital images, and digital and physical objects interact. With augmented and virtual reality and intelligent things, information is added to the space around the user. This helps the user in processing critical information, visualizing scenarios, improving the quality and speed of decision-making, and communicating with others. Examples of application of augmented reality in the public sector can include public infrastructure management and spatial planning, public safety services (such as firefighting), transportation management and tourism.

The World Economic Forum in 2017 stressed the potential: "AR serves as the visual portal to data across the public and private sectors"[4]. In health care, tele-health formats can be supported by virtual examinations that can improve customer satisfaction and result in treatment success. In the area of defence, AR can help soldiers to see and hear under all conditions. Commanders can communicate more efficiently and make more educated decisions, based on first-hand information and their assessment of the situation. With virtual reality tours of buildings and surroundings, wheelchair access can be checked and planned, benefitting persons with disabilities and their caregivers. With hands-free AR devices, maintenance workers can see exactly which action to perform next with guidance from technical experts and supervisors. Augmented Reality also can be effective in training and education, such as by highlighting cultural artefacts or ecological phenomena while providing information about their appropriate use.

Virtual and Augmented Reality technologies are being used increasingly by governments to streamline processes and improve constituent experience. Some of the early adopters were the military, law enforcement and national security agencies. These technologies deliver context, immersion and have the potential to retool training environments, redefine the role of field service workers, improve communication, and reshape public sector business processes. Technological improvements, such as the digital twin concept, which is a cloud-based virtual representation of a physical asset, also are being adopted. Such innovations have the potential to redefine markets, industries and societies.

8.2.5. High Performance- and Quantum Computing

By 2020, 25 billion connected devices will generate more than two zettabyte annual data traffic.[5] By then, High Performance Computers or "supercomputers" executing 1 trillion operations per second will be needed to cope with the massive amount of data. By aggregating computing power, large amounts of data can be processed, thereby solving complex problems in engineering, manufacturing,

science and business. High Performance Computing can cut through complexity, understand patterns and detect anomalies. By processing highly complex data with accuracy, such tools are especially useful in forecasting and real-time-prediction. The potential benefits for the public sector can be vast in such areas as combating disease, forecasting and managing traffic flows, monitoring climate conditions, and allocating tax revenues. High Performance Computers can accelerate science and innovation to solve questions that were previously too complex to tackle. Given the high investment in their use, cooperation between public and private actors is beneficial.

Quantum computing, as opposed to regular computing, leverages the laws of nature to process information in a different way. It can compute for different resultsresults simultaneously, thus increasing computing power exponentially. This allows for discovery of relationships between data that otherwise would not have been possible, leading to improvements in health care, climate change monitoring and managing logistical challenges.

Both high performance computing and quantum computing can help process the vast amount of available data faster, paving the way for new insights into ways to overcome obstacles to achieving sustainable development. Combined with new algorithms in the field of Artificial Intelligence, the potential for its use in tackling the challenges of the 2030 Agenda is significant but have yet to be fully exploited by the public sector.

8.2.6. Distributed Ledger Technologies

Distributed Ledger Technologies are ways of storing information in a distributed manner across numerous actors. Instead of information being stored in one central database, it is stored in several locations among multiple actors. Blockchain is a well-known example of a form of Distributed Ledger Technology where value exchange transactions are sequentially grouped into blocks. Each block is chained to the previous one and immutably recorded across a peer-to-peer network using cryptographic trust and assurance mechanisms. Identified as a game-changing technology, Blockchain has the potential to solve such problems as those related to control over information and access, as well as security and privacy of data with a high degree of sensitivity. Given its decentralised nature, blockchain holds the potential to become the ledger for creating decentralized data management systems that ensure users full control over their data. Blockchain is already being used for, among other things, land registries, speeding up registration processes andreducing possibilities for fraud and corruption.[6] These benefits can augment the building of resilient societies in the context of achieving SDGs, by keeping track of data across various activities and actors, authenticating and guaranteeing the execution of tasks, and enabling the emergence of more transparent and accountable governments. Blockchain solutions can even facilitate cash transfers in refugee camps, identify Stateless refugees or register Global Conservation areas.[7]

Distributed Ledger Technologies benefit the public sector in certifying identities, establishing trust, exchanging assets between parties across borders, and sealing digital contracts. Payment and authentication processes can be made more convenient for citizens and can include parties that are currently outside the traditional financial system.[8] Governments in emerging markets are supporting Blockchain, hoping to create an advantage for the population and economy in ways that facilitate development and growth.[9]

The key game-changing innovation of Distributed Ledger Technology is decentralized trust and traceability of information. It allows for more efficient handling of information, and greater security, because the ledgers cannot be tampered with. The holonic architecture of Distributed Ledger Technologies also means scalability issues can be solved logically and transparently.

The advantages of Blockchain over traditional centralized databases are that it can offer resilience in cases where central databases are difficult to secure. It also distributes management of the ledger, increasing trust in it by not centralizing its management in the hands of more actors. This does however require a large peer-to-peer network to resist manipulation of the blockchain. Having only a small number of nodes can increase the likelihood of the blockchain being compromised. To increase the size of the peer-to-peer network also means that there should also be an incentive to do so. In commercial applications such as cryptocurrencies, those incentives are financial. For public services, alternative incentives should be devised. Advances in computing also present a possible risk to the cryptography, technology that Blockchain currently relies on. It is thus crucial to consider security in any application. Additionally, while decentralizing data offers many advantages, it also creates an increasingly complex network that must communicate and validate information constantly, resulting in an exponential increase in energy consumption.

Blockchain has potential public sector application for record management, identity management, voting, taxes and remittances, and even Blockchain-enabled regulatory reporting. A proof of concept was developed, for example, in Ireland.[10] Blockchain can equally be used to better manage development aid by enhancing security and transparency, as well as making international payments more accessible and easier to monitor. In that regard, multiple pilot projects have been launched, such as by the World Food Programme in Jordan,[11] and in connection with banking services for refugees in Indonesia.[12]

UNECE's United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT), which has played a fundamentally important role in the development, promotion and implementation of trade facilitation, is following the Blockchain developments closely and working to help governments understand and use their potential. (See Box. 8.1)

Box 8.1. United Nations Economic Commission for Europe (UNECE) : whitepapers on Blockchain

UNECE

UNECE's United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) is developing two white papers to address the following questions: What is the impact on existing UN/CEFACT electronic business standards and what gaps could be usefully addressed by new UN/CEFACT specifications? What opportunities do these technologies present for improving e-business, trade facilitation and the international supply chain? The second whitepaper on the opportunities for trade facilitation and e-commerce will be available for comment this autumn. How could blockchain technology be used to facilitate trade? What do government decision-makers who deal with information technology need to be aware of? And how could UNECE contribute to the development of this technology as a trade facilitation tool? The international supply chain can be characterised as a set of three flows - of goods, funds and data. Goods flow from exporter to importer in return for funds that flow in the reverse direction. The flow of goods and funds is supported by a bidirectional flow of data such as invoices, shipping notices, bills of lading, certificates of origin and import/export declarations lodged with regulatory authorities. At the same time, an essential requirement for each of these flows is trust. Where there is no trust at all, there will be no flow of goods, funds and related data. Establishing the minimum level of trustworthiness for carrying out trade can be done in a number of ways. Reducing the delays and costs created by the use of trust services has been one of the focuses of trade facilitation which seeks to increase the transparency and efficiency of international trade processes. At the same time, business, legal and other constraints have limited the ability of trade facilitation measures to reduce the costs and delays created by trust services. Today, "blockchain", or Digital Ledger Technology (DLT), has the potential to provide the trustworthiness that traders need, at a much lower cost and using fewer trust guarantors."

Source: UNECE

8.3. Deep Dive into a cluster of new technology revolving around data

Data is becoming critical to many government organizations and will fuel the development of new e-government services.[13] Digital data is defined as "a reinterpretable representation of information in a formalised manner, suitable for communication, interpretation or processing", which is authored by people or generated by machines/sensors, often as a by-product.[14] See table 8.1 for further definitions.

Data is useless if it is not processed and analysed, delivering insights, which are leveraged for better decision-making and the development new products and services.[15,16]

Table 8.1. Definitions

- Algorithms are a set of step-based instructions to solve mathematical problems that are used to query and analyse data. The Algorithm Economy is an emerging concept describing the increasing amount of data analytics performed by economic operators, aimed at tailoring their services and products.
- APIs or Application Programming Interfaces are interfaces for technology products that allow software components to communicate. The Internet of Things has substantially unleashed the volume of machine-to-machine communication.
- Big Data has been coined to describe the exponential growth and availability of data, both structured and unstructured and is defined by 3 V's: Volume, Velocity and Variety.[17]
- Data science is the study of the generalised extraction of knowledge from data by employing machine learning, predictive and prescriptive methodologies, thereby creating direct value on an experimental and ad-hoc basis.
- IoT is the use of interconnected sensors and controls that help gather and analyse data about the environment, the objects that exist within it and the people that act within it, to improve understanding and automate previously manual processes.
- Open Data is information that is open in terms of access, redistribution, reuse, absence of technological restriction, attribution, integrity, no discrimination.[18]
- Open Government Data is data produced or commissioned by public bodies or government-controlled entities, which is then made accessible, and can be used feely, reused and redistributed by anyone.[19]

8.3.1. Integrating government services – public service as a platform

Taking advantage of the data economy and the data that governments already possess can allow for a much greater integration of services. Such digital transformation is based on a data infrastructure which can either be centralized or decentralized, and rely on two fundamental components. The first concerns the re-use of data already collected from the citizens; the second revolves around the use of Application Programming Interfaces (API) as a core component of the public-sector data infrastructure.

One-time provision of data: Governments making better use of data

With digital technology, public administrations can easily retrieve data and limit the number of user requests the data may address. Citizens in turn have the right to modify and/or delete the data and be informed as to how and where the data is being used, in line with data protection regulation.

In the Europe Union, a number of initiatives have been launched around the "Once Only Principle", which aims to streamline the use of authentic data sources and foster machine-to- machine communication across the different IT systems of various public bodies. That approach is expected to generate a total net savings of approximately 5 billion euros per year[20] across the Union. Additional benefits[21] include: (i) ensuring better control of data as the data is only provided once, which reduces errors and discrepancies; (ii) helping public administrations work faster, more transparently and more efficiently, thereby saving costs; (iii) reducing fraud through the use of consistent and authoritative information; and (iv) making evidence-based decisions through the use of complete and consistent information.

Use of Application Programming Interfaces, and their ability to securely connect applications across government and support the development of new services

Moving towards API-based information systems can improve the efficiency of business operations by providing stronger integration between the organizational value chain and partners such as suppliers and national public administrations. APIs are the connecting links between applications, systems, databases and devices.[22] Accessing data already collected by public administrations allows the use of an internal API to improve public services. Based on their access rights, public administrations can retrieve the data they need, such as an address, a profession, or a social security number.[23]

Several countries, such as Estonia and Finland, along with New South Wales in Australia are using APIs to strengthen government platforms and turn governments into fully integrated one-stop-shops.[24] In Singapore, the Land Authority saved $11.5 million in application costs for 70 government agencies through geospatial data-sharing through the GeoSpace's APIs and Web services. Machine-to-machine access among data-enabled agencies make it possible to adjust applications 30 per cent faster and cut storage costs by 60 per cent. It also eliminates data duplication.[25] There are several instances of non-government API use as well. The De Waag Society in the Netherlands, for example, uses API for smart cities and the preservation of cultural heritage data. Setting up public or so-called open APIs can also stimulate businesses and civil society to develop new services that address areas that may not fall under the direct competence of the government. Box 8.1 further explores Government as an API.

Box 8.2. Government as an API

Estonia created X-Road,[26] an application network for exchanging data among agency systems so that all government services are effectively available in one spot. In addition to offering querying mechanisms across multiple databases and supporting the secure exchange of documents, X-Road seamlessly integrates different government portals and applications.

The private sector can also connect with X-Road to make queries and benefit from access to a secure data exchange layer.[27]

X-Road has made it possible to bring 99 per cent of public services online. On average, 500 million queries per year are made annually using X-Road. Indeed, its use has been estimated to save as many as 800 years of working time. The solution has been equally successful in its roll-out to Finland, Azerbaijan, Namibia, as well as the Faroe Islands. Furthermore, cross-border digital data exchanges have been set up between Estonia and Finland, making X-Road the first cross-border data exchange platform.

Source: https://e-estonia.com/solutions/interoperability-services/x-road/

8.3.2. Insights for decision-making and intelligence at the point of action

Data analysis can bring unprecedented insight. Governments are able to take advantage of the data revolution by making use of insights gained through data analytics as well as formulating their response at the point and time of action.[28] As shown in the *2018 United Nations E-Government Survey* as well as in other international benchmarks and indicators, governments have been increasing their efforts to publish open data.[29] This reinforces the drive to align with good governance principles, and underlines the economic and societal benefits governments can expect from open data. Going beyond data publishing, governments are starting to understand the benefits of re-using their own data more efficiently and effectively. As highlighted in the report on Open Data Maturity in Europe 2017, 19 European countries are now using open data in their decision-making. Successes range from better urban planning, thanks to the systematic use of geospatial data in Denmark, to efficiency in public procurement spending in Slovenia. These examples are not limited only to Europe. The use of open data assisted in the formulation of solutions to eliminate or reduce air pollution in Mexico City, for which it received an award at the Data for Climate Action Challenge (D4CA)[30] Australia has been exploring ways to improve data sharing for more efficient research[31] and has renewed its commitment to open data by signing the Open Data Charter in April 2017.[32]

8.3.3. Insights and Data-Driven decision-making in the public sector

Although evidence-based policy-making is not a novel concept, the growth in the volume of data sources as well as in analytics tools, present an opportunity to deliver better informed policy-making. It also has the potential to accelerate data collection, thereby reducing the time spent on policy cycles and iterations. Analyses performed on the data collected can equally be refined.

Algorithms are another useful tool, as they drive digital innovation and redefine the approach to technologies, leadership and execution.[33] Algorithms can determine information flows and influence public-interest decisions, which, until recently, were handled exclusively by human beings. Data analytics also witnessed a shift from sample focus groups to exhaustive analysis or 'real' demand which is increasingly recognised as limiting the bias of statistics and forecast inaccuracy. Taking advantage of Big Data in the public sector also implies expanding the data pool of public-sector information and statistics to include new data sources stemming from the digital economy. These sources include mobile data, Internet of Things, and social media, among others. Finally, data held by private entities such as in the health and financial sectors, as well as eCommerce platforms could also aid policy-making.

Data-driven decision making can be applied in different areas of the public sector. For example, in Latvia, insolvency data is used to plan policies or support operations in both the public and private sector[34]. In the health sector in France, as part of the implementation of the national deployment of telemedicine strategy, the French Ministry of Health has been implementing a data-driven approach to manage acute stroke.[35] It combines data on the distribution of population using census data and the distribution of geographical location of health facilities in the area. Box 8.2. on the Global Pulse Initiative, 2009, underlines how data has been used bu the UN in the context of the SDGs.

To provide a practical illustration for the above, typical applications of data-driven insight for the public sector can advance the following goals, among others:

- SDG 3 on ensuring lives and promoting well-being by developing health-care systems which detect epidemics in their early stages, compile diagnostics, analyse prescription drug use and improve access to medications at the right time and in the right place. This has been witnessed successfully during the ebola outbreak. Further research is currently conducted on monitoring the spread of mosquitoe borne disease.

- SDG 8 on decent work and economic growth by adopting a more prospective vision of the employment market based on the use of professional social networks and job boards. The idea is to enhance Machine Learning engine tools so as to match job offers with job applications.

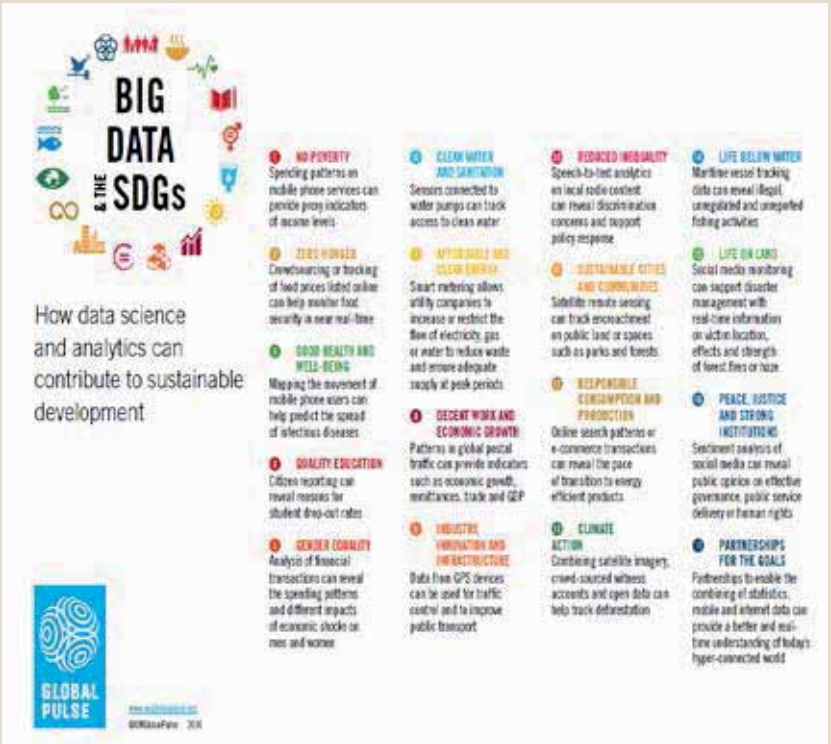
- SDG 14 on the conservation and sustainable use of oceans by such projects as Life Below Water & Resource management. One example is the Global Fishing Watch[36] prototype, developed by Oceana, Google and Skytruth, which combines data gleaned from scanning behavioural patterns of vessels, in order to identify which are potential fishing vessels and which are not.

- SDG 16 on peace, justice and strong institutions by offering enhanced analyses in support of security, combatting crime, and fraud prevention. Data mining techniques, for instance, can drive the analysis of large amounts of text and evidence to support the structuring of evidence in court cases.

The challenges in implementing data-driven and insights-based policy-making are further developed in section 8.5.

Box 8.3. Global Pulse Initiative, 2009[37]

Global Pulse is a flagship initiative of the United Nations Secretary-General on big data. Its vision is a future in which big data is harnessed safely and responsibly as a public good. Its mission is to accelerate discovery, development and scaled adoption of big data innovation for sustainable development and humanitarian action. The initiative was established based on a recognition that digital data offers the opportunity to gain a better understanding of changes in human well-being, and to get real-time feedback on how well policy responses are working. To this end, Global Pulse is working to promote awareness of the opportunities Big Data presents for sustainable development and humanitarian action, forge public-private data sharing partnerships, generate high-impact analytical tools and approaches through its network of Pulse Labs, and drive broad adoption of useful innovations across the UN System.



Source:http://unglobalpulse.org/

8.3.4. Insights at the time and point of action: streamlining the use of real-time data

Sensors monitoring traffic, air pollution, energy consumption, among other things, combined with increasing mobile data, are making real-time data available. The benefit of real-time data is its ability to prompt action at very specific locations, as described in Chapter 3. Real-time data, for instance, was used to find housing solutions for victims of natural disasters, such as in the aftermath of the earthquake in Emilia Romagna, Italy.[38] Rapid mobile phone-based surveys were deployed by the Red Cross to complement traditional communication methods, which shaped the response during the critical first days of the Ebola outbreaks in Sierra Leone, Benin, Guinea and Cote d'Ivoire.[39]

The United Nations Food and Agriculture Organisation (FAO) has developed a Water Productivity Open-access portal, known as WaPOR, which uses real-time satellite data to monitor water productivity. That real-time data allows farmers to optimise the use of water in their irrigation systems, rendering a more reliable crop yield.[40] Also notable is the use of real-time data in Slovenia to protect vineyards from pests. Singapore has announced its intention to make port management more efficient with the use of drones capable of capturing real-time data, data analytics as well as mobile applications.[41] These are just a few of the examples of real-time satellite data use.

Box 8.4. Streamlining the use of Earth Observation

The use of Earth Observation data and Geographic Information Systems (GIS) has already been underlined in the *2016 United Nations E-Government Survey* as a promising technology for improving service delivery. With an increase in the availability of satellite data worldwide, thanks to NASA's Earth Observing system[42] and the European multi-stakeholder Copernicus programme,[43] data, and the insights gleaned from it, can be delivered more rapidly. Indeed, the different applications of satellite data, be it GPS or Earth Observation data, have a specific shelf value. Satellite revisit times have proven critical in providing supporting data in the context of wildfires in the United States,[44] Australia and Italy,[45] Initiatives are growing across the globe addressing multiple environmental issues. The Satellite-based Wetland Observation Service (SWOS), for example, makes use of Earth Observation data, which enables large-scale dynamic monitoring of the evolution of the wetlands in Europe, Africa and Asia[46]. Farming by satellite is another advantage of Earth Observation data, which can assist in monitoring crops such as rice.[47] In June 2018, to drive innovation leveraging Earth Observation data, the EU has launched the Data Infrastructure Access Services (DIAS) providing access to data, cloud services as well as data tools and professional support services.[48]

Source:http://swos-service.eu/

Data use is expected to grow exponentially in the next decade and offer the ability to systematically analyze and act in real time to solve more challenging business problems, enhance competitive advantage and lead to more informed decisions in today's tightly connected world.

8.4. Deep dive into a cluster of new technology revolving around AI and Robotics

The term "Artificial Intelligence", or AI, has been around for nearly 60 years, but it is only recently that AI appears to be on the brink of revolutionizing industries as diverse as health care, law, journalism, aerospace, and manufacturing, with the potential to profoundly affect how people live, work, and play.

AI can be mono- or multi-layered, performing simple automated tasks to highly advanced automation. While robotic process automation enables machines to do repetitive and rules-based work, AI enables robots to do judgment-based processing, such as thinking and learning (machine intelligence) and even making decisions (synthetic, computer-based AI).[49] Robots can appear in the shape of cyber-physical systems, imitating humans. These systems perform tangible work linked to the physical world, such as supporting the elderly, treating patients, and even harvesting fields and manufacturing cars.[50] Robots can also appear formless like virtual assistance on websites, apps, and platforms. By automating responses to matters that arise most frequently, employees can focus on more complex inquiries. The benefits lay in greater capacity, efficiency, service quality, and accuracy. A recent policy inat the European Union level is further illustrated inwithin Box 8.4. Europe rolls out an integrated approach to Artificial Intelligence.

Box 8.5. Europe rolls out an integrated approach to Artificial Intelligence

In April 2018, the European Union chose to pool its resources to foster innovation through the use of artificial intelligence. The Declaration[51] signed by European countries aims to ensure a sustainable vision for AI to thrive, by collectively addressing ethical and societal challenges linked to its growing and pervasive use. This states "where needed [to] review and modernise national policies to ensure that the opportunities arising from AI are seized and the emerging challenges are addressed." The European approach is based on three pillars.[52] The first foresees an increase in financial support, to reach 20 billion Euros by 2020, thereby promoting the uptake of AI in both the public and the private sector. The second pillar is based on ensuring framework conditions for socio-economic success. Actions here aim at accompanying the transition of the labour market by modernizing education and training. The third pillar addresses the development of an adequate ethical and legal framework. The first series of draft guidelines is expected by the end of 2018 and will build upon the Union's Charter of Fundamental Rights[53].

Source:http://ec.europa.eu

AI has the potential to bring many societal benefits. It can impact all sectors and industries, with the ability to improve mobility, mortality rates, education, hygiene, food provision and supply, and decrease emissions, crime, and human error. Robotic automation is slowly assuming repetitive tasks previously done by low-paid workers, although low-paid tasks are less likely to be replaced by expensive robots, at least, not in the short term.[54]

Still, AI is expected to displace many low-skilled workers. Robots already perform many jobs on the assembly line, and that trend is expected to increase. According to a World Economic Forum study in 2016, around 5.1 million jobs across 15 countries are expected to be lost to Artificial Intelligence over the next five years alone. A study by the United Nations Department of Economic and Social Affairs found that up to 80 per cent of all existing jobs could be at risk of being automated in the long run.[55]

Although many tasks can be automated, there are still numerous challenges to be addressed, including ethical considerations, social acceptance and economic aspects. Some decisions cannot be left entirely to machines. Human beings can consider unique circumstances when making decisions, which artificial intelligence may never be able to do. Data privacy and security concerns must also be carefully considered. In designing AI solutions, preventing external attacks, anomalies and cyber-attacks must be addressed. Ethical issues, ranging from preventing discrimination and biases to aligning AI systems with respective applications should also be considered. AI development requires the involvement of experts from multi-disciplinary fields such as computer science, social and behavioral sciences, ethics, biomedical science, psychology, economics, law and policy research. This has been the case, as illustrated in Box 8.5 during the AI for Good Global Summit.

Box 8.6. AI for Good Global Summit[56]

The AI for Good series is the leading United Nations platform for dialogue on beneficial AI. The Summit is organized by ITU in partnership with the XPRIZE Foundation, the Association for Computing Machinery (ACM) and 32 sister United Nations Agencies. The AI for Good series aims to ensure that AI accelerates progress towards the achievement of the United Nations sustainable development goals. The AI for Good Global Summit in June 2017 was the first event to launch inclusive global dialogue on the actions necessary to ensure that AI benefits humanity. The action-oriented 2018 Summit identified AI applications capable of improving the quality and sustainability of life on the planet. The Summit also formulated strategies to ensure trusted, safe and inclusive development of AI technologies and equitable access to their benefits.

Source:https://www.itu.int/en/ITU-T/AI/2018/Pages/default.aspx

8.5. Harnessing technology for societal resilience

The Internet and the development of ICTs have enabled governments to reduce administrative burdens as well as reorganise their services, from design to delivery. Nonetheless, harnessing fast-evolving technologies poses a number of challenges for governments. Whereas technology is a tool, people are key in driving the development of innovative services and products. The pervasive nature of technology calls for more symmetry across the different operators and users. Ethical questions also must be addressed.

8.5.1. People and Technology driving new uses and new services

Complex emerging crises herald deep changes in how people live together on the planet. The more people are implicated in the management of these changes the better they can be catalysed to change negative behaviours. However, carrots and not sticks are required in order to productively engage populations. Europeans with their "Open Innovation 2.0[57]" and the Japanese "Ba" approach, (see Box 8.6), highlight the need for change in innovation policy in the coming decades if technology is to play a constructive role in development. That requires deep collaboration between the Information Technology community and society at large. On its own, purely technological advances devoid of context can and often do drive unsustainable material consumption and exploitation. Hence, the broader societal challenge is to create the conditions for sustainable and resilient socio-economic shifts. Increased flexibility in decision making systems will be needed to allow for different perspectives to emerge, in order to challenge the linear extrapolation of the past when seeking new solutions. This in turn requires out-of-the-box thinking and large-scale experimentation to assess impact in real world settings.

Box 8.7. Process innovation insight

Source: https://ec.europa.eu/digital-single-market/en

The European approach to a modern innovation policy is based on the Open Innovation 2.0 paradigm characterised by citizen participation and prototyping approaches to socio-technical challenges in real world settings.

Similarly, the Japan Innovation Network (JIN)[58] is driven by Professor Ikujiro Nonaka's ideas on "Ba" – a place for deep interaction and wisdom sharing among stakeholders to create common value. JIN acts as an innovation accelerator, fostering both creativity and productivity.

They are recognised as two descriptions of one key component in modern innovation ecosystem thinking: deep collaboration.

Source: https://ji-network.org/en/

E-government at its core can enable better interaction within the entire society, leading to socially sustainable and acceptable solutions to complex societal issues. Key to balancing the inevitable techno-societal transformation is the creation of a safety net. "There is a need for better balance between short-term economic gain on the one side and ground-breaking research by the universities of science and technology that tackle grand societal challenges on the other."[59] In achieving societal resilience, access to high-speed Internet is key – everyone should be included in the digital economy. This point has been underscored in numerous digital for development initiatives launched by the United Nations and the European Union.

With the rise of new technologies comes the fear of unemployment, which creates anxiety and perceived insecurity.[60] Artificial Intelligence, in particular, may thwart human interaction for certain processes, as new demands and functions arise. History has indeed shown that machines can replace humans, but many experts agree that they can also create new functions for human beings, albeit, equipped with a different skill set. [61] AI will not be an exception. [62]

Artificial Intelligence and related issues - from big data to artificial vision - have been in fashion for several years. At the same time, AI algorithm and technology experiments span multiple sectors of the economy and society, from finance to medicine. Nowadays, AI techniques and the immeasurable storage and processing capacity of modern data centres make it possible to analyze signals and images collected by modern biomedical instruments. For example, in case studies on the early diagnosis of neurodegenerative diseases using non-invasive MRI to focus on the visual or automatic analysis of particular anatomical districts, such as, for example, the hippocampus in the case of Alzheimer's disease, AI can identify changes in the brains of people likely to get Alzheimer's disease almost a decade before doctors can diagnose the disease from symptoms alone. (See box 8.7.)

Box 8.8. AI and deep machine learning for early diagnosis of brain diseases

A team of researchers at the Physics Department of the Bari University in Italy and the local branch of the National Institute of Nuclear Physics has developed a novel brain connectivity model to reveal early signs of Parkinson's disease in T1-weighted Magnetic Resonance Imaging scans. The same group reported the possibility to detect Alzheimer's disease with analogous techniques just a year ago.

Parkinson's disease is the most common neurological disorder, after Alzheimer's disease, and is characterized by a long so-called prodromal or early phase lasting up to 20 years. The Italian research team lead by Prof. Bellotti has developed a novel approach using complex networks based on the publicly available Parkinson's Progressive Markers Initiative (PPMI) database, a mixed cohort including 169 healthy controls and 374 Parkinson patients. In particular, their analyses allowed the detection of the disease in subjects reported within the prodromal phase: accordingly, when tremor symptoms are yet to appear. The algorithm reported a classification accuracy of 93 per cent,% and these results were cross-validated hundreds of times to grant the statistical robustness of the results.

The physicists of the Bari Medical Physics Group[63] have developed cross-disciplinary research approaches and big data techniques with clinical purposes. The team was awarded by Harvard Medical School for the development of an accurate machine learning tool for schizophrenia diagnosis. These big data analyses, usually computational intensive, are performed thanks to the ReCaS computer facility.

Source:https://www.recas-bari.it/index.php/it/) .

Space science and technology are always at the forefront of human development as they help to break barriers. Through research and innovation, spin-offs stemming from our efforts in space impact virtually all fields of human activities. Utilizing the frontier technologies in outer space has also offered us new insights, knowledge and understanding of the functioning of our planet and its four interconnected spheres: lithosphere, hydrosphere, biosphere, and atmosphere. Space technologies have an impact on almost all aspects of development and the United Nations promote the utilization of space science and technology for sustainable economic and social development. Space is an invaluable tool that can help the UN in achieving the goals and targets of the 2030 Agenda for Sustainable Development and its 17 SDGs. Nearly 40% of the SDG indicators underpinning the goals are reliant on the use space science and technology. The SDGs provide an additional framework for the work of United Nations (See Box. 8.8) as it employs new, more holistic and tangible approaches to its traditional capacity-building role.

Box 8.9. The United Nations Office for Outer Space Affairs (UNOOSA)

The United Nations Office for Outer Space Affairs (UNOOSA) is the United Nations office responsible for the promotion of international cooperation, and for leading and facilitating the promotion of peaceful uses of outer space. UNOOSA is as the main UN entity dealing with space matters and coordinates UN activities in the utilization of space-related technology for improvement of human conditions globally.

UNOOSA, as a global facilitator, plays a leading role in promoting the peaceful use of outer space and the utilization of space-related technology for sustainable economic and social development. The Office's vision is to bring the benefits of space to all humankind by strengthening the capacity of United Nations Member States to use space science technology, applications, data and services by helping to integrate space capabilities into national development programmes. UNOOSA is part of the UN secretariat with its headquarters in Vienna and two offices in Bonn and Beijing.

UNOOSA serves as the secretariat for the General Assembly's only committee dealing exclusively with international cooperation in the peaceful uses of outer space: the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS). It is also responsible for implementing the Secretary-General's responsibilities under international space law and maintaining the United Nations Register of Objects Launched into Outer Space.

Through its Programme on Space Applications, UNOOSA conducts workshops, training courses, technical advisory missions and other projects worldwide as part of its capacity-building efforts as it strives to promote and facilitate the use of space for the benefit of all United Nations Member States, with a special focus on developing nations. UNOOSA has conducted over 300 capacity-building projects in countries all over the world for over 18,000 participants.

Furthermore, to address global challenges including climate change, disaster risk reduction and building more resilient societies, the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) was established in 2006 and is implemented by UNOOSA to support United Nations Member States in accessing and using satellite data for all phases of disaster management – disaster recovery, risk reduction and emergency response.

Source: http://www.unoosa.org/oosa/en/aboutus/index.html.

Additionally, UNOOSA serves as the secretariat of the International Committee on Global Navigation Satellite Systems (ICG) and as a permanent secretariat to the Space Mission Planning Advisory Group (SMPAG), which concentrates on asteroid impact mitigation.

8.5.2 Symmetry and ethics as the way forward

It is quite important for governments to understand the challenges and opportunities of the new technologies and to be aware of new public policy professions that specialize in machine learning andbut also data science ethics.

The main challenges raised by future and emerging technologies should be clarified. The first concerns data ownership, particularly who owns the data and the algorithms used to access and manage it. A second challenge concerns net neutrality64, which requires a non-discriminatory infrastructure and transparency in network management practices. The third is ethics. The question, for example, of whether one would prefer to undergo surgery by a robot or by a human surgeon raises a number of ethical concerns. Considering the broad scope of the above topics, the *2018 World Economic and Social Survey* is equally addressing a number of these challenges.

The 2030 Agenda has introduced the concept of a data-driven governance, highlighting the challenge to "increase significantly the availability of high-quality, timely, reliable and disaggregated data by

2020". To do so, governments require systemic policies for data production, collection, management and analysis. Society will have to adapt in order to take advantage of ICTs. Today, the hierarchical structures of governments are being challenged as these new technologies equip individuals and informal networks and communities with the necessary tools to better participate in public decision-making processes, and have a societal impact at a much faster pace than ever before. This implies discussing and redefining values, which, in turn, begs the question of the nature of a coherent set of policy actions to address the challenges. Open Innovation invites policymakers to think outside the policy toolbox. Creating linkages between communities could be valuable in that regard. What would Watson[65] do? If the citizens owned their own data, what would they do? The notion of "prosumer" – producer and consumer – is rising, as can be seen by the increase in blockchain-based applications: everyone can create- and benefit from ICT use.

However, the Internet has been developing in an asymmetrical manner, with data in the hands of a limited, albeit growing, number of players as examined by the *2018 World Economic and Social Survey.* Another challenge is the nature of ICT use where users leave a digital footprint. This serves to give away their data, which is then served back to them in the form of commercial offerings which also heightens fears of ever more intrusive monitoring. The rise of AI, as examined in the previous section, also carries uncertainty in terms of work placement, skills and overall employment. Symmetry can be achieved by providing a mechanism which will reduce the gap between the data providers and the data users. The notion of a "citizen salary" is gaining some traction as a way to create a more symmetric model. The idea is to pay citizens as 'data generators' for the data they produce, which has economic value when it is in turn re-used. By being paid for data generation, citizens are rewarded for their efforts and encouraged to continue producing valuable data. The questions arises as to whether the public sector should equally purchase data from its citizens.

8.6. Conclusion

Transforming the world and realizing the sustainable development goals by 2030 will require a paradigm shift in the way societies govern themselves. It will require rethinking the role of government and the way it interacts with civil society and the private sector in managing the public affairs of a country and responding to the needs of its people. ICTs and e-government have the potential to ensure that no one is left behind in sustainable development. The 2030 Agenda specifically recognized the vital role of these two components as a catalyst for realizing its vision, and stated that "the spread of information and communications technology and global interconnectedness have great potential to accelerate human progress, bridge the digital divide, develop knowledge societies such as scientific and technological innovation among different sectors".

This chapter has considered issues facing governments in light of the widespread deployment and use of fast-evolving technologies, such as Artificial Intelligence, in e-government. The scope of the endeavour is vast and carries human rights, technical, and socio-economic challenges. These questions are not only critical to the e-government mission but represent some of the most difficult questions facing society today. Finding answers will not be easy, nor are there turn-key solutions. However, Member States can leverage their influence to lay a foundation that will bring answers within reach.

From resource allocation, predictive public utilities maintenance, to managing public hotlines, health-care chatbots and real-time verification of digital identity, governments around the world are deploying AI for both back-end and front-end public services. But AI can also actually result in more social exclusion such as through its impacts on jobs and job skills.

This will be the fastest transition on record for humankind. As seen, societies need to prepare for the impact of new technologies on the job market. In reviewing the implementation of the SDGs, the 2017 High Level Political Forum Ministerial Declaration acknowledged "the transformative and disruptive potential of new technologies, particularly advances in automation, on our labour markets, and on the jobs of the future", and recognized the need "to prepare our societies and economies for these effects". As initiated in the 1990s with the beginning of the digital revolution and reiterated in the 2017 High Level Committee on Programmes paper on future of work, technology will affect many aspects of society with unprecedented speed, scale and breadth. Policy responses must take an equally comprehensive and proactive approach to harness the challenges of technology into opportunities. This calls for a system-wide effort, building on existing initiatives, that reflects the 2030 Agenda for rights-based, normative and integrated solutions tailored to the needs of individual Member States as each strives to achieve inclusive and sustainable growth. Efforts to implement AI in government should be approached in a way that augments human capital and does not reduce jobs. With these principles in mind, the United Nations System should lead governments in handling the use of AI under the principles of 2030 Agenda.[66]

The Agenda pays particular attention to effective means of implementation, including the need for special efforts to stimulate digital transformation and to foster and share technology and policy innovation, such as through effective and meaningful deployment of AI.

Without targeted measures, the digital divide will widen with profound implications for inequality, and the principle of leaving no one behind will be challenged by the fourth industrial revolution, unless the needs of both developing and least developed countries and all segments of the population are considered. Scientific knowledge, technologies and know how spawned by the digital age will require careful management to eliminate the risks of new and wider digital divides. To have a significant social impact in using new technologies, governments should partner with the private sector in research and development, including addressing the broadband connectivity gap.

Digital transformation will not only depend on technologies, but also require a comprehensive approach that offers people accessible, fast, reliable and personalized services. The public sector in many countries is ill-prepared for this transformation. Traditional forms of regulation may not apply, and thus, a paradigm shift in strategic thinking, legislation and regulation is needed. Governments can respond by developing the necessary policy, services and regulation. This response will serve as a mission statement and endorse the role of education around core objectives. Services can be delivered to address specific needs and adapted for a defined audience, administration, business or citizen. Law-making can take the form of legally binding acts, regulation, directives, norms and standards that define the parameters of what can and cannot be done. Some governments have already started to prepare ethical and legal frameworks on AI development. It is important to embed new technologies in specific social contexts and ensure that they are properly regulated to have a positive impact on society.

However, many of these legal instruments are slow in being "brought to the market". It is therefore principles such as effectiveness, inclusiveness, accountability, trustworthy and openness that should direct the technologies and not the other way around. Similarly, functionalities should determine the technology to be used. Governments around the world will need to rethink their governance models to meet the core principles of the 2030 Agenda and to respond to demands of the people for more responsive and inclusive services. While e-government was about bringing services online, the future will be about the power of digital government in leveraging societal innovation and resilience and transforming governance to achieve the Sustainable Development Goals.

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64 Note: Over the years, policy debates and regulations on net neutrality have crystallised a few key principles, please see Internet Governance Forum (IGF) for ongoing debate on this issue.

65 Note: Watson is a deep-machine learning AI computer system capable of answering questions posed in natural language, developed in IBM's DeepQA project by a research team led by principal investigator David Ferrucci. Watson was named after IBM's first CEO, industrialist Thomas J. Watson. For details, see: https://www.ibm.com/watson/

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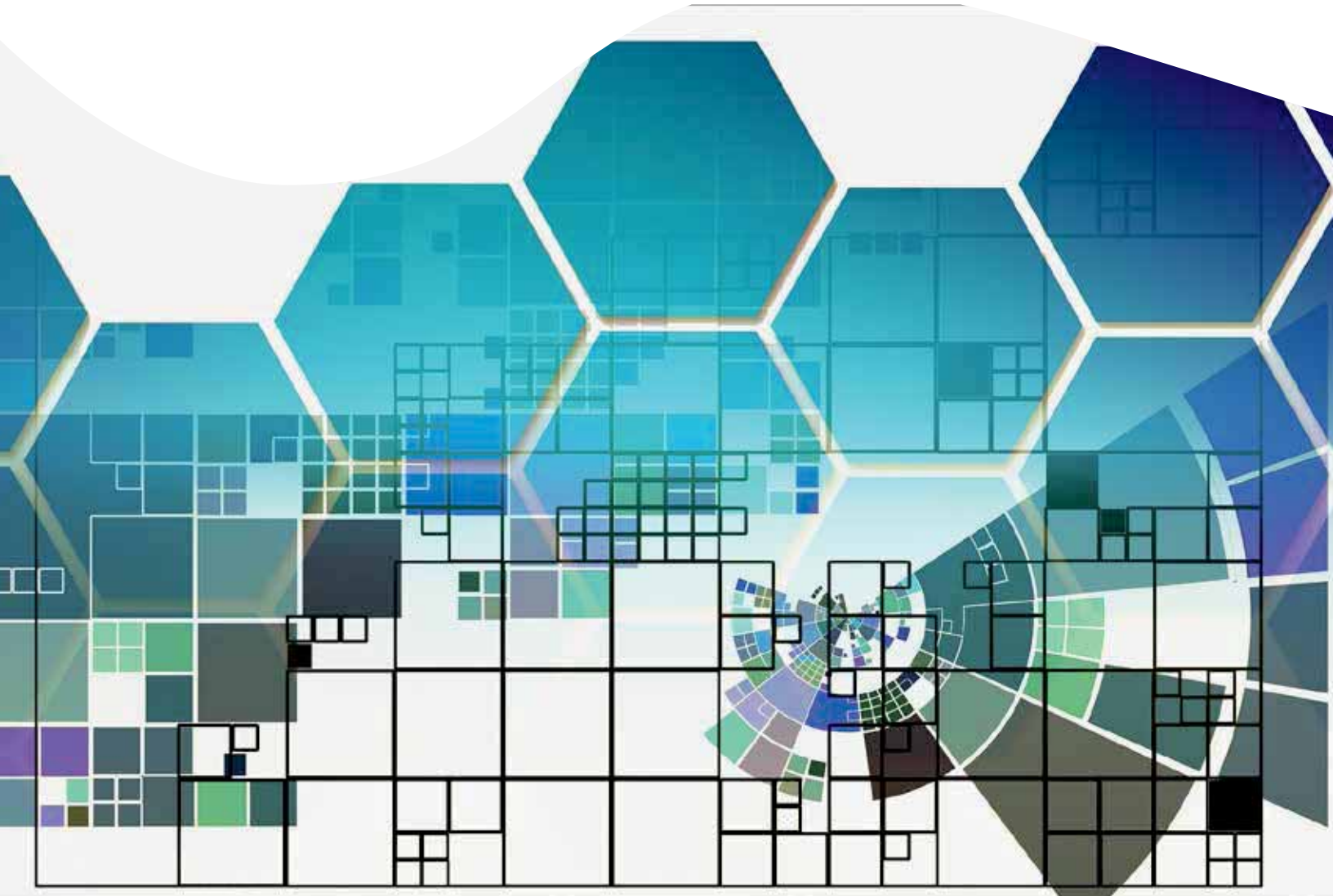
ANNEXES



Annexes

Survey Methodology

A.1. E-Government Development Index: An Overview

Mathematically, the E-Government Development Index (EGDI) is the weighted average of normalized scores on the three most important dimensions of egovernment, namely: (i) the scope and quality of online services quantified as the Online Service Index (OSI); (ii) the status of the development of telecommunication infrastructure or the Telecommunication Infrastructure Index (TII); and (iii) the inherent human capital or the Human Capital Index (HCI). Each of these indices is a composite measure that can be extracted and analyzed independently.

$$EGDI = \frac{1}{3}(OSI_{normalized} + TII_{normalized} + HCI_{normalized})$$

Prior to the normalization of the three component indicators, the Z-score standardization procedure is implemented for each component indicator to ensure that the overall EGDI is equally decided by the three component indexes, that is, each component index presents comparable variance subsequent to the Z-score standardization. In the absence of the Z-score standardization treatment, the EGDI would mainly depend on the component index with the greatest dispersion. After the Z-score standardization, the arithmetic average sum becomes a good statistical indicator, where "equal weights" truly means "equal importance."

For standard Z-score calculation of each component indicator:

$$Xnew = \frac{x - \mu}{\sigma}$$

Where:

x is a raw score to be standardized;

μ is the mean of the population;

σ is the standard deviation of the population.

The composite value of each component index is then normalized to fall between the range of 0 to 1 and the overall EGDI is derived by taking the arithmetic average of the three component indexes.

The EGDI is used as a benchmark to provide a numerical ranking of e-government development of all United Nations Member States. While the methodological framework for EGDI has remained consistent across

Photo credit: pixabay.com

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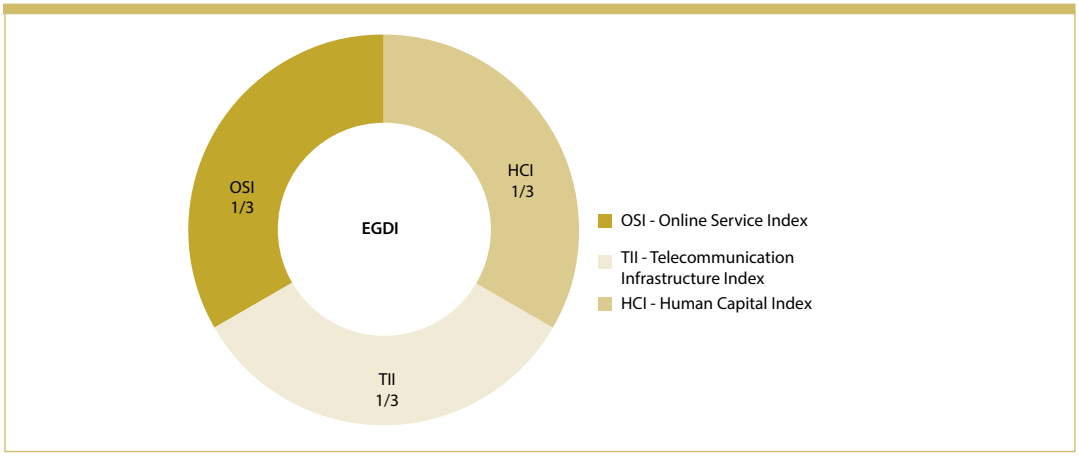
the editions of the *United Nations E-Government Survey,* each edition of the Survey has been adjusted to reflect emerging trends of e-government strategies, evolving knowledge of best practices in e-government, changes in technology and other factors. In addition, data collection practices have been periodically refined.

Figure A.1. The three components of the E-Government Development Index (EGDI)



The imputation of missing data is an important step in the construction of a good quality composite indicator. The problem has been studied since 2001; in the EGDI methodology, the cold deck imputation or use of older values for the missing data has always been the first choice of action. Nevertheless, there are cases where no data is available at all. In these cases, a combination of the unconditional mean imputation and the hot deck imputation was used. This combination is based on the "donor imputation" methodology, which replaces missing values in a record with the corresponding values from a complete and valid record.

A.2. Telecommunication Infrastructure Index (TII)

The Telecommunication Infrastructure Index is an arithmetic average composite of five indicators: (i) estimated Internet users per 100 inhabitants; (ii) number of main fixed telephone lines per 100 inhabitants; (iii) number of mobile subscribers per 100 inhabitants; (iv) number of wireless broadband subscriptions per 100 inhabitants; and (v) number of fixed broadband subscriptions per 100 inhabitants. The International Telecommunication Union is the primary source of data in each case. (See Figure A.2)

The definitions of the five components of TII[1] are:

(i) Internet users per 100 inhabitants refer to individuals who used the Internet from any location in the last three months[2].

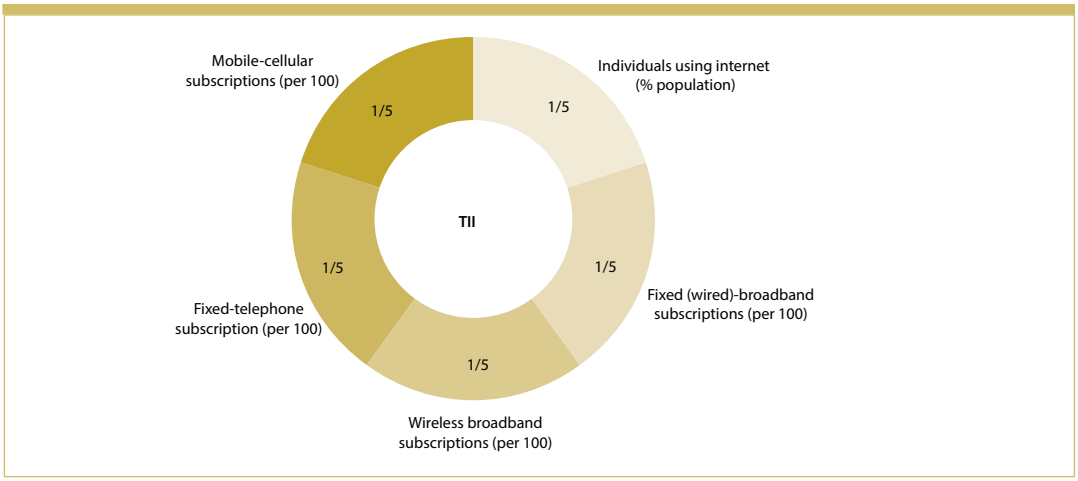
(ii) Main fixed telephone lines per 100 inhabitants refer to telephone lines connecting a customer's terminal equipment, such as telephone set, facsimile machine to the public switched telephone network (PSTN), which has a dedicated port on a telephone exchange. This term is synonymous with the terms main station or Direct Exchange Line (DEL), which are commonly used in telecommunication documents. It may not be the same as an access line or a subscription.

(iii) Mobile subscribers per 100 inhabitants are the number of subscriptions to mobile service in the last three months. A mobile/cellular telephone refers to a portable telephone subscribed to a public mobile telephone service using cellular technology, which provides access to the PSTN. This includes analogue and digital cellular systems and technologies such as IMT-2000 (3G) and IMT-Advanced. Users of both post-paid subscriptions and prepaid accounts are included.

(iv) Active mobile-broadband subscriptions refer to the sum of data and voice mobile-broadband subscriptions and data-only mobile-broadband subscriptions to the public Internet. It covers subscriptions being used to access the Internet at broadband speeds, not subscriptions with potential access, even though the latter may have broadband-enabled handsets. Subscriptions must include a recurring subscription fee to access the Internet or pass a usage requirement – users must have accessed the Internet in the previous three months. It includes subscriptions to mobile-broadband networks that provide download speeds of at least 256 kbit/s (e.g. WCDMA, HSPA, CDMA2000 1x EV-DO, WiMAX IEEE 802.16e and LTE), and excludes subscriptions that only have access to GPRS, EDGE and CDMA 1xRTT.[3]

(v) Fixed broadband subscriptions per 100 inhabitants refers to fixed subscriptions to high-speed access to the public Internet or a TCP/IP connection, at downstream speeds equal to, or greater than, 256 kbit/s. This includes cable modem, DSL, fiber-to-home/building, other fixed/ wired-broadband subscriptions, satellite broadband and terrestrial fixed wireless broadband. This total is measured irrespective of the method of payment. It excludes subscriptions that have access to data communications, including the Internet via mobile-cellular networks. It should include fixed WiMAX and any other fixed wireless technologies. It includes both residential subscriptions and subscriptions for organizations.

Figure A.2. Telecommunication Infrastructure Index (TII) and its components



Conceptually, the TII has remained largely unchanged since 2002. Three components, i.e. internet users, mobile-cellular phone subscriptions and fixed-telephone subscriptions have been used in the past Surveys since 2002. However, given the availability of suitable data, several replacements were introduced over the years, such as the replacement of online population with fixed-broadband subscription and the removal of number of television sets in 2008; the replacement of personal computer users with fixed Internet subscriptions in 2012; the replacement of fixed Internet subscriptions with wireless broadband subscriptions in 2014 (See Table A.1). In 2018, wireless broadband subscriptions indicator was replaced by active mobile-broadband subscriptions.

The improvement of data quality and coverage has led to the reduction of data gaps that appeared in prior Surveys. However, in cases where gaps still occur, data is retrieved first from the Word Bank data base, and when all previous measures prove unsuccessful, the most recent ITU data is used.

Each of these indicators was standardized through the Z-score procedure to derive the Zscore for each component indicator. The telecommunication infrastructure composite value for country "x" is the simple arithmetic mean of the five standardized indicators derived as follows:

Telecommunication infrastructure composite value=

Average (Internet user Z-score

+ Fixed telephone subscription Z-score

+ Mobile/Cellular telephone subscription Z-score

+ Active mobile broadband subscription Z-score

+ Fixed broadband Z-score)

Table A.1. Telecommunication infrastructure index (TII) and changes of its components (2003-2018)

TII (2001)	TII (2003)	TII (2004)	TII (2005)	TII (2008)	TII (2010)	TII (2012)	TII (2014)	TII (2016)	TII (2018)
Internet users	Internet users	Internet users	Internet users	Internet users	Internet users	Internet users	Internet users	Internet users	Internet users
Online population	Online population	Online population	Online population	Fixed-broadband subscriptions	Fixed-broadband subscriptions	Fixed-broadband subscriptions	Fixed-broadband subscriptions	Fixed-broadband subscriptions	Fixed-broadband subscriptions
Personal computer (PC) users	Personal computer (PC) users	Personal computer (PC) users	Personal computer (PC) users	Personal computer (PC) users	Personal computer (PC) users	Fixed Internet subscriptions	Wireless broadband subscriptions	Wireless broadband subscriptions	Active mobile-broadband subscriptions
Fixed-telephone subscriptions	Fixed-telephone subscriptions	Fixed-telephone subscriptions	Fixed-telephone subscriptions	Fixed-telephone subscriptions	Fixed-telephone subscriptions	Fixed-telephone subscriptions	Fixed-telephone subscriptions	Fixed-telephone subscriptions	Fixed-telephone subscriptions
Mobile-cellular subscriptions	Mobile-cellular subscriptions	Mobile-cellular subscriptions	Mobile-cellular subscriptions	Mobile-cellular subscriptions	Mobile-cellular subscriptions	Mobile-cellular subscriptions	Mobile-cellular subscriptions	Mobile-cellular subscriptions	Mobile-cellular subscriptions
Television sets	Television sets	Television sets	Television sets	-	-	-	-	-	-

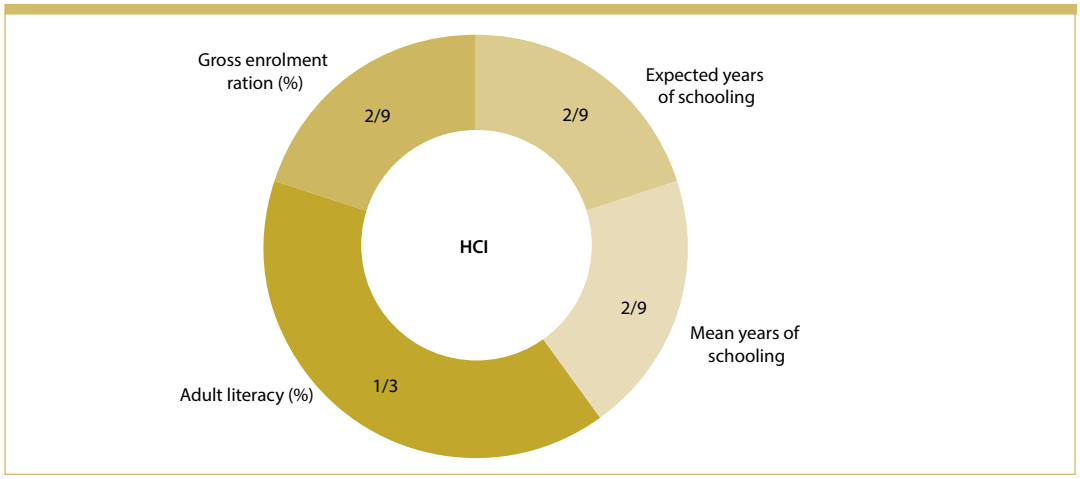
Finally, the TII composite value is normalized by taking its value for a given country, subtracting the lowest composite value in the Survey and dividing by the range of composite values for all countries. For example, if country "x" has the composite value of 1.3813, and the lowest composite value for all countries is -1.1358 and the highest is 2.3640, then the normalized value of TII for country "x" would be:

$$\text{TII (Country "x")} = \frac{[1.3813 - (-1.1358)]}{[2.3640 - (-1.1358)]} = 0.7192$$

A.3. Human Capital Index (HCI)

The Human Capital Index (TII) consists of four components, namely: (i) adult literacy rate; (ii) the combined primary, secondary and tertiary gross enrolment ratio; (iii) expected years of schooling; and (iv) average years of schooling. (See Figure A.3)

Figure A.3. Telecommunication Infrastructure Index (TII) and its components



The four indicators of HCI are defined as follows:

1. Adult literacy is measured as the percentage of people aged 15 years and above who can, with understanding, both read and write a short simple statement on their everyday life.

2. Gross enrolment ratio is measured as the combined primary, secondary and tertiary gross enrolment ratio, of the total number of students enrolled at the primary, secondary and tertiary level, regardless of age, as a percentage of the population of school age for that level.

3. Expected years of schooling is the total number of years of schooling that a child of a certain age can expect to receive in the future, assuming that the probability of his or her being in school at any specific age is equal to the current enrolment ratio age.

4. Mean years of schooling (MYS) provides the average number of years of education completed by a country's adult population (25 years and older), excluding the years spent repeating grades (add reference 6).

The first two components, i.e. adult literacy rate and the combined primary, secondary and tertiary gross enrolment ratio have been used for the past Surveys since 2002. Recognizing that education is the fundamental pillar in supporting human capital, the 2014 Survey introduced two new components to the human capital index (HCI), namely (i) expected years of schooling; and (ii) mean years of schooling. The preliminary statistical study commissioned by DESA/DPADM validated the use of the new HCI, accentuating that the two new components have strengthened the HCI without introducing any error[4].

Table A.2. Human Capital Index and changes of its components (2003-2014)

Components of HCI in past surveys 2002, 2003, 2004, 2008, 2010, 2012)	Components of HCI in 2014 survey
Adult literacy	Adult literacy
Gross enrolment ratio	Gross enrolment ratio
-	Expected years of schooling
-	Mean years of schooling

The HCI is a weighted average composite of the four indicators. In the same manner the TII is computed, each of the four component indicators is first standardized through the Z-score procedure to derive the Z-score value for each component indicator. The human capital composite value for country "x" is the weighted arithmetic mean with one-third weight assigned to adult literacy rate and two-ninth weight assigned to the gross enrolment ratio, estimated years of schooling and mean years of schooling.

Human capital composite value =

1/3 x Adult literacy rate Z-score +

2/9 x Gross enrolment ratio Z-score +

2/9 x Estimated years of schooling Z-score +

2/9 x Mean years of schooling Z-score

The human capital composite value is then normalized by taking its composite value for a given country, subtracting the lowest composite value in the Survey and dividing by the range of composite values for all countries. For example, if country "x" has the composite value at 0.8438, and the lowest composite value for all countries is –3.2354 and the highest equal to 1.2752, then the normalized value of the Human Capital Index for country "x" would be:

$$\text{Human Capital Index (Country "x")} = \frac{[0.8438 - (-3.2354)]}{[1.2752 - (-3.2354)]} = 0.9044$$

A.4. Online Service Index (OSI)

The Online Service Index (OSI) is a composite normalized score derived on the basis on an Online Service Questionnaire. The 2018 Online Service Questionnaire (OSQ) consists of a list of 140 questions. Each question calls for a binary response. Every positive answer generates "more in-depth question" inside and across the patterns. The outcome is an enhanced quantitative survey with a wider range of point distributions reflecting the differences in the levels of e-government development among Member States.

The total number of points scored by each country is normalized to a range of 0 to 1. The online index value for a given country is equal to the actual total score less the lowest total score divided by the range of total score values for all countries. For example, if country "x" has a score of 114, and the lowest score of any country is 0 and the highest equal to 153, then the online services value for country "x" would be:

$$Online\ Service\ Index\ (Country\ "x") = \frac{(114-0)}{(153-0)} = 0.7451$$

To arrive at a set of Online Service Index values for 2018, a total of 206 online United Nations Volunteer (UNV) researchers from 89 countries covering 66 languages, assessed each country's national website in the native language, including the national portal, e-services portal and e-participation portal, as well as the websites of the related ministries of education, labour, social services, health, finance and environment, as applicable. The UNVs included qualified graduate students and volunteers from universities in the field of public administration.

To ensure consistency of assessments, all the researchers were provided with a rigorous training by e-government and online service delivery experts with years of experience in conducting the assessments, and guided by Data Team Coordinators who provided support throughout the assessment period. Researchers were instructed and trained to assume the mind-set of an average citizen user in assessing sites. Thus, responses were generally based on whether the relevant features could be found and accessed easily, not whether they in fact exist but are hidden somewhere in the site(s). The key point is that the average user needs to find information and features quickly and intuitively for a site to be "usable" with content readily discoverable by the intended beneficiaries.

The data collection and Survey research ran from August 2017 until the end of November 2017. Each country was assessed by at least two researchers who conducted the assessment in the country's national language. After the initial assessment, the evaluations by the two researchers on each country were compared and questions regarding discrepancies were reviewed together and resolved by the researchers. The third phase, from October to November, was the final review by the Data Team Reviewers, who analyzed all the answers and, where needed, carried out further review and verification processes using multiple methods and sources. The scores were then sent for approval to a Senior Reviewer. Through this multilevel approach, all surveyed sites were thoroughly assessed by at least three people, one of whom has years of experience in assessing public sector online services, and reviewed by one of the Data Team Coordinators.

Once the evaluation phase was completed, the statistics team produced the first draft of the OSI ranking. Data was extracted from the platform and the raw OSI scores were created. Rankings were compared with previous OSI scores, and discrepancies were thoroughly reviewed.

A.5. List of Features Assessed

Multiple linkages to the Sustainable Development Goals (SDG) have been included in both the OSQ and the Member State Questionnaire (MSQ).The MSQ is further discussed in more detail in Section A.8 of this Chapter. As done in analytical chapters of past editions of the Survey, selected or proxy themes related to egovernment and sustainable development have been also analyzed, for example, open government data, e-participation, mobile-government and whole-of-government approach. A complete review of the OSQ has been undertaken to include questions related to key services across the SDG domains, including health, education, social protection, gender equality, and decent work and employment, as well as through the SDG principles highlighted in Goal 16, including effectiveness, inclusion, openness, trustworthiness, and accountability.

Below is a list of areas assessed in the 2018 edition of the *United Nations EGovernment Survey.* It should be noted that this list is dynamic and is updated for each edition of the Survey. The language for the areas start with:

- "information about" something such as laws, policies, legislation or expenditures
- "existence of" a feature such as social networking tools
- "ability to" do something on the website i.e. run a transaction

Information about women's right to access to sexual/reproductive healthcare, information and education (policy/legislation)
Information about using open data sets
Information about upcoming procurements
Information about upcoming e-participation activities
Information about technical and vocational skills training for youth
Information about social protection policy or budget
Information about services in partnership with third parties
Information about schools with accessible facilities
Information about road traffic accidents statistics
Information about road safety
Information about results of any government procurement/bidding process
Information about reproductive health-care services
Information about reduction, recycling and reuse of waste
Information about public sector work force distribution by gender
Information about programs/initiatives benefiting the poor or vulnerable groups
Information about privacy statement
Information about primary government expenditures
Information about pollution and precautionary measures
Information about personal data protection
Information about payments for government services through different channels
Information about organizational structure of the government
Information about national budget or budget policy
Information about local/regional government agencies
Information about laws and regulations against discrimination
Information about labour laws and regulation
Information about housing support for older persons
Information about health-emergency preparedness
Information about health policy or budget
Information about government-wide Chief Information Officer (CIO) or equivalent online
Information about government scholarship programmes or education funding
Information about gender equality (policy/legislation)
Information about equal access to education for persons with disabilities
Information about equal access to education for children in vulnerable situations
Information about environment-related policy or budget
Information about employment/labour policy or budget
Information about electricity or power outage

Information about education policy or budget
Information about early childhood development, care and pre-primary education
Information about diseases affecting older persons
Information about citizenship application
Information about citizen's rights to access government information
Information about affordable public housing
Information about accessible public transportation
Existence of up-to-date information on the portal
Existence of tools to obtain inputs for policy deliberation
Existence of support for authentication or digital ID
Existence of support for all official languages
Existence of social networking features
Existence of security features on the portal
Existence of search engine effectiveness
Existence of a site map
Existence of search and advanced search features
Existence of open government data on education, employment, environment, health and social protection
Existence of open data competitions
Existence of online tools helping children with disabilities to participate at all levels of education
Existence of online skills training for youths and/or adults
Existence of online service for female-headed households, immigrants, migrant workers, refugees and/or internally displaced persons, older persons, persons with disabilities, the poor (below poverty line), women, youth
Existence of online participation in public issues related to education, employment, environment, health and social protection
Existence of mobile services in education, employment, environment, health, social protection
Existence of live support functionality
Existence of linkage/reference to technical, vocational and tertiary education
Existence of linkage between national portal and sectoral/ministerial services of education, employment/labour and health
Existence of help, FAQs, contact us features
Existence of help links and references for youth employment
Existence of free access to government services through kiosks, community centres, post offices, libraries, public spaces of free Wi-Fi
Existence of features to configure font size, type, colour and background colour
Existence of features relates accessibility
Existence of digital security or cybersecurity act/legislation online
Existence of cross-browser compatibility of website including in mobile/smartphones
Existence of an outcome of an e-consultation resulted in new policy decisions
Existence of an open government data policy online
Existence of an e-procurement platform
Existence of an e-participation policy/mission statement

Existence of a national portal, an open data portal
Existence of a national e-government/digital government strategy online
Existence of a mobile app to provide e-government services
Existence of a data dictionary or metadata repository in the portal
Existence of tutorials and/or guidance for using the portal
Ability to submit online income and other taxes
Ability to request new open data sets
Ability to report online any form of discrimination
Ability to report online about trafficking, sexual abuse or other form of exploitation
Ability to report and track unethical behaviour of public servants/institutions
Ability to report a violation of labour law
Ability to register online for vehicle
Ability to register online for a new business
Ability to receive updates or alerts on issues related to education, employment, health, social protection, weather conditions or agricultural technology
Ability to receive updates or alerts on environment-related issues
Ability to pay for water, energy bills online
Ability to pay for any government related fees
Ability to monitor and evaluate existing government procurement contracts
Ability to make address change online
Ability to make a police declaration online
Ability to file complaint for public services
Ability to enrol online for primary or secondary education
Ability to apply online for social protection
Ability to apply online for government scholarships/fellowships
Ability to apply for personal ID cards online
Ability to apply for marriage certificates online
Ability to apply for land title registration online
Ability to apply for government jobs online
Ability to apply for environment-related permits online
Ability to apply for driver's license online
Ability to apply for death certificates online
Ability to apply for business licenses or patents online
Ability to apply for building permits online
Ability to apply for birth certificates online
Ability to apply for any visa to enter or transit through this country
Ability to access/modify own data

A.6. Challenges in reviewing the online presence of a country

Selecting the appropriate site/URL at the national level

One of the essential decisions for researchers when undertaking the country assessment is identifying the specific site(s) to review as the national government site for each country. Regardless of the sophistication of e-government in a specific country, the priority for users is to identify which of the many potentially available government sites would be deemed as the "official" national government site—the gateway or starting point for national users. A simple, clear statement at the chosen website is sufficient to start an important step towards providing government information and services to the public in an integrated, usable and easy-to-find manner. Many national sites state that it is the "official" Government site, or "Gateway to Government," or other similar statement.

As done for each edition of the Survey, the United Nations Member States were requested, through the Member State Questionnaire (MSQ), to provide information on the website addresses (URL) of their national portal(s) and the different government ministries. This information was then utilized during the assessment process.

Not all countries provide the appropriate URLs. Thus, some discretion is exerted in deciding whether to use only the websites provided by the Member State. What is noteworthy in this Survey is that the researchers not only reviewed the national portals but also undertook exhaustive research on e-participation and open government data, where applicable.

One dilemma researchers encountered is that several countries provided more than one legitimate national access point. While some have simply not yet consolidated their government entry points into a single site or portal that could be clearly distinguished, others have taken this approach on purpose, that is, offering different access points to different audiences. Considering that the use of integrated portals or multi-portals is emerging as a trend in e-government strategies worldwide, researchers would select the integrated website as a national portal or another portal if it was deemed to be the official homepage of the government. However, more than one site could be scored if the sites were clearly part of a tightly integrated "network" of national sites. It should be noted that during the assessment of the national portals, having more than one national entry is neither a disadvantage nor a benefit.

Some countries offer certain public services at the sub-national or local level rather than the federal level. No country is penalized for offering a service at the sub-national level as opposed to the federal level. In fact, when the issue arises, researchers tend to be inclusive in assessing the matter if the information and/or service can be found at the national portal.

A more difficult problem arises when not only a specific service is located at the local level but when the entire ministerial functions are altogether missing at the national level. If researchers are unable to locate a ministry as per the above described method, then the next step is to find out whether the country in question actually has such a ministry at the national level or whether the functions might be locally administered.

Integrated Portal and Multi-Portal Approaches

Some countries have adopted a different approach to their online e-government portal, by utilizing multiple websites for different topics. Instead of centralizing all the e-information, e-services, e-participation, open data and other online features into one portal, they are made available in separate websites for a more audience-targeted approach. Researchers made sure to examine all possible websites when making the assessment, through links or search engines, to ensure coverage of all government websites where relative information can be found.

Even if the norm recommended is a one-stop-shop type of service delivery or an integrated portal approach, countries that opted for a decentralized approach were not penalized in their score, and the assessment was conducted as if an integrated approach was utilized.

For example, Finland has a website www.valtioneuvosto.fi, providing information on the Finnish Government, while the website www.suomi.fi provides e-service, public service information portal and open government data. Information on e-participation is centralized on the websites www.kansalaisaloite.fi and www.otakantaa.fi. This approach of having several websites for different purposes, such as information, services, participation and open government data, is typical for European countries.

Accessing in national official languages

The research team was fully equipped to handle the six official languages of the United Nations, namely Arabic, Chinese, English, French, Russian and Spanish. However, as in previous assessment cycles, the team went beyond this mandate and reviewed each website in the official language of the country, or where that was not possible, in one of the languages available on the site. Translators aided as necessary so that possible errors based on language are reduced to a minimum.

Towards a more citizen-centric approach

In line with the global trend towards a more citizen-centric approach and the demand for greater efficiency and cost-effectiveness of the public sector, the MSQ has been designed to reflect this paradigm of e-government. User uptake has been included as a special subject in the Survey, encouraging governments to take account not only of the supply side of e-services but also of what is demanded/needed by the target users. Accordingly, the research team was instructed to enforce this approach consistently throughout the entire assessment. Where features could not be found easily, quickly and intuitively, then a site scores poorly.

Data Quality Assurance (QA)

To ensure data quality, UNDESA has put assessment procedures under close monitoring including by developing a web-based application platform for data collection and storage, preparing the methodological and training guidelines for researchers, and instituting a training programme for both group training or individual hands-on support for researchers in resolving thorny issues.

Among other tasks, team members were asked to justify the selection of URLs and to indicate whether the URLs had been reviewed in past Surveys. Regular discussions were held to discuss concerns and ensure consistency of evaluation methods.

UNDESA applied the assessment scores to generate an ordering of online service presence of all United Nations Member States and compared them with the historical results in previous Surveys

so as to detect possible shortcomings in the process. The new scores are then compared to scores from the previous Surveys by removing the new questions and only considering the ones that remain unchanged. The team was assisted in the research by United Nations interns and volunteers with language skills not otherwise covered by the core group.

Below is a list of the criteria adopted for data QA:

Three levels of assessment/supervision (volunteers, First Report Officer, Second Report Officer)
First check of consistency of data with data patterns by group ranking (VH, H, M, L OSI)
Tuning of OSI questions to stabilize the dataset and to be consistent with EGDI data model
Second check of consistency of data with data patterns by group ranking (VH, H, M, L OSI)
First calculation of OSI
Two levels of assessment/supervision of the outliners - Compensation with MSQ (if doable)
Second calculation of OSI
Data analysis of target countries (outliners or cases with significant drop/improvement …)
Random check of OSI subset of questions / URL - Compensation with MSQ (if doable)
Third calculation of OSI
Second check of consistency of data with data patterns by group ranking (VH, H, M, L OSI)
Check for consistency with other international benchmark reports and 3rd party Sources (MSQ)
Recalculation of OSI (Final)
Data analysis of target countries (those jumping from on group to another)
Final calculation of EGDI

A.7. E-Participation Index (EPI)

The E-Participation Index (EPI) is derived as a supplementary index to the *United Nations EGovernment Survey.* It extends the dimension of the Survey by focusing on the government use of online services in providing information to its citizens or "einformation sharing", interacting with stakeholders or "e-consultation" and engaging in decision-making processes or "e-decision-making" (See Box A.1)

Box A.1. E-Participation Framework

- E-information: Enabling participation by providing citizens with public information and access to information without or upon demand
- E-consultation: Engaging citizens in contributions to and deliberation on public policies and services
- E-decision-making: Empowering citizens through co-design of policy options and co-production of service components and delivery modalities.

A country's EPI reflects the e-participation mechanisms that are deployed by the government as compared to all other countries. The purpose of this measure is not to prescribe any specific practice, but rather to offer insight into how different countries are using online tools in promoting interaction between the government and its citizens, as well as among the citizens, for the benefit of all. As the EPI is a qualitative assessment based on the availability and relevance of participatory services available on government websites, the comparative ranking of countries is for illustrative purposes and only serves as an indicator of the broad trends in promoting citizen engagement. As with the

EGDI, the EPI is not intended as an absolute measurement of e-participation, but rather, as an attempt to capture the e-participation performance of counties relative to one another at a point in time.

In the *2018 Survey,* the e-participation questions were carefully reviewed and expanded to reflect current trends and modalities on how governments engage their citizens in public policy-making, implementation and evaluation. New questions were added to address data publishing and sharing by government agencies. Other updates included: (i) the availability of information on the citizens' rights to access government information; (ii) feedback from citizens concerning the improvement of online public services; and (iii) public opinion tools on policy deliberation through social media, online polls and online discussion forums. While EPI provides a useful qualitative analytical tool when comparing the data and ranking of countries for one specific year, caution must be taken in comparing e-participation rankings with past editions of the Survey.

Mathematically, the EPI is normalized by taking the total score value for a given country, subtracting the lowest total score for any country in the Survey and dividing by the range of total score values for all countries. For example, if country "x" has an e-participation score of 29, and the lowest value of any country is 0 and the highest equal to 38, then the normalized index value for country "x" would be:

$$\text{E} - \text{Participation Index (Country "x")} = \frac{(29 - 0)}{(38 - 0)} = 0.7632$$

The e-participation ranking of countries is determined by the value of EPI through the "standard competition ranking". In standard competition ranking, countries with the same EPI receive the same ranking number and a gap is left in the ranking numbers. This ranking strategy is adopted in view that if two or more countries tie for a position in the ranking, the positions of all those ranked below them are unaffected. For example, if country A ranks ahead of B and C, both of which share the same EPI value and scores ahead of D, then A is ranked first (1st), B and C are ranked second (2nd) and D is ranked fourth (4th). In 2012, the "modified competition ranking" was used and for comparison reasons, all ranks were adjusted in 2014 and 2016 using the standard competition ranking.

A.8. Member State Questionnaire (MSQ)

As done for each edition of the Survey, Member States were requested, through the Member State Questionnaire (MSQ) to provide information on the website addresses (URL) of their respective national portal(s) as well as those of the different government ministries. Information on efforts in support of egovernment development, open government data, e-participation and the designated authority in charge of e-government policies was also requested. One hundred (100) Member States comprising 51.8 per cent of United Nations membership returned the completed questionnaires. The appropriate submitted sites were then utilized during the assessment process. Some information provided in the MSQ were also used in the case studies included in the Survey.

The Questionnaire

Member States Questionnaire (MSQ) for the 2018 United Nations EGovernment Survey

Please provide the most recent information on your country, as this information will be used in preparation of the United Nations E-Government Survey 2018. Please feel free to skip question for which you feel you do not have the relevant information.

Strategy/Implementation Plan/Policy (where available, please specify URLs or attach relevant documents)

- Is there a national development strategy or equivalent incorporating the Sustainable Development Goals (SDGs)?
- Is there a national e-Government Strategy or Digital Government Strategy or equivalent?
- If yes:
  - Is there an implementation plan for the Strategy?
  - Is the e-Government Strategy aligned with the national development strategy and with the Sustainable Development Goals (SDGs)?
- Is there an ICT for development strategy?
- Is there a national policy on e-participation and/or inclusion in Digital Government?
- Is there a Cybersecurity strategy?
- Does the e-Government or other strategy provide other specific measures to ensure e-Government is used by the most vulnerable segments of the population?

Legal Framework (where available, please specify URLs or attach relevant documents)

- Has specific legislation been adopted in relation to the SDGs?
- Is there any e-Government related legislation?
- Is there a law on access to information such as Freedom of Information Act?
- Is there a personal data protection law such as Data Protection Act?
- Are there government-wide guidelines or ethical frameworks related to collection, retention or management of public data?
- Is there a digital security law such as Cybersecurity Act?
- Is there any legislation on open government and/or open government data?
- Is there legislation governing the reuse of government software and systems?
- Is there legislation in place to promote (or enforce) interoperability?

Portals (National level) (where available, please specify URLs or attach relevant documents)

- Is there an official e-Government portal? Please name all portals if there is more than one national portal.
- Is there an official open data portal?
- Please provide the URLs for the ministries of education, health, social protection, labor (employment, taxation, and decent work), environmental protection, energy, finance or any institutions performing the equivalent functions of these ministries. Please also provide relevant URLs including one-stop portals for these sectors.

Usage of online services and user satisfaction (where available, please specify URLs or attach relevant documents)

- Do you conduct surveys to measure satisfaction of e-Government services?
- If yes, do you publish the results online and share them with the public institutions concerned? Please provide details and any outcome if possible.

- Do you collect usage statistics of e-Government services? If yes, is there disaggregation by age, gender, vulnerable groups, and other dimensions?
- Do you publish such usage statistics? Please provide details and any outcome if possible.
- Do you have information on the share of public services or other operations conducted online compared to in person operations? If yes, please provide details.
- Does your government have a preferred modality for people to access services or interact with public administration?

Mobile Government (where available, please specify URLs or attach relevant documents)

- What are the public services available through mobile devices such as smartphones and tablets?
- Are there dedicated mobile apps (through platforms like Android, iOS, etc.) to deliver online services? Please provide details.
- Do you provide any mobile service through short message service (SMS) or equivalent? Please provide details.
- Do you track usage and user satisfaction of mobile services? If yes, please provide details.

E-government at the local level (where available, please specify URLs or attach relevant documents)

- What is the percentage of local governments and/or municipalities with a web presence?
- What is the percentage of local governments and/or municipalities with an e-Government/ Digital Government Strategy or equivalent?
- Do you know the approximate share of online public services delivered at local level? Please indicate the key sectors concerned.

Indicators (within government organizations) (where available, please specify URLs or attach relevant documents)

- What is the proportion of persons employed in central government organizations routinely using computers?
- What is the proportion of persons employed in central government organizations routinely using the Internet?
- What is the proportion of central government organizations with Internet access, by type of access? (Such as broadband, dial-up, cable)
- What is the proportion of central government organizations with a local area network?
- What is the proportion of central government organizations with a web presence?
- What is the proportion of central government organizations with a social media presence?
- What is the proportion of central government organizations releasing data in open formats (either at the national open data portal or in their own open data portal)?
- What percentage of your GDP is allocated for e-government at the national level?
- What percentage of your GDP is allocated for R&D (Research and Development) purposes?

Institutional Framework (National level) (where available, please specify URLs or attach relevant documents)

- Please provide the name of the government authority (department or ministry) in charge of e-Government/Digital Government. What is its positioning within the government?
- Does your country have a Chief Information Officer (CIO), or a similar senior official with a leadership role, to manage national cross-agency e-Government programs/projects?
- Is your government offering or planning to offer support to other countries in the area of e-Government?

Please provide details and contact point if possible.

Others (where available, please specify URLs or attach relevant documents)

- Is ICT training provided to civil servants to promote digital literacy and improve service delivery?
- Do you systematically collect large amount of digital data (social media data, IoT sensors, etc.) for public policy design or implementation? If so, do you utilize big data analytics technology in policy-making cycle?
- Do you utilize artificial intelligence, Internet of Things (IoT), blockchain, robotics, or other new and emerging technologies in delivering and managing online services? Please provide details.
- Do you have a digital ID system? Please provide details Does it target a specific segment of the population?
- In which area does your government plan to expand e-Government?

Please select whichever applies:

☐ I did not have the full information to respond to this questionnaire
☐ This questionnaire did not apply to my country but I did my best to respond to most questions.
☐ I mostly provided my own opinion/assessment rather than official information.
☐ Other:

Please provide additional information and/or data or docs that in your view are relevant for this questionnaire:

Contact details:

- Name:
- Job title:
- Email:
- Department/Organization:
- Country:
- Date Submitted:

Responding Member States

Afghanistan	Japan	Republic of Korea
Albania	Jordan	Republic of Moldova
Argentina	Kazakhstan	Romania
Armenia	Latvia	Russian Federation
Australia	Lebanon	Rwanda
Austria	Liechtenstein	Samoa
Azerbaijan	Lithuania	Saudi Arabia
Bahamas	Luxembourg	Serbia
Bahrain	Malawi	Seychelles
Bangladesh	Malaysia	Singapore
Barbados	Malta	Slovakia
Belarus	Marshall Islands	Slovenia
Belgium	Mauritius	Somalia
Brazil	Mexico	South Africa
Bulgaria	Mongolia	Spain
Burundi	Montenegro	Sweden
Cambodia	Morocco	Thailand
Chile	Mozambique	Timor-Leste
Colombia	Myanmar	Togo
Czech Republic	Namibia	Tonga
Denmark	Nauru	Tunisia
Dominican Republic	Netherlands	Turkey
Ecuador	New Zealand	Uganda
Eswatini	Niger	Ukraine
Ethiopia	Norway	United Arab Emirates
Finland	Oman	United Kingdom
Gambia	Panama	Uruguay
Georgia	Papua New Guinea	Uzbekistan
Ghana	Paraguay	Vanuatu
Guatemala	Peru	Viet Nam
Guinea	Philippines	Yemen
Iran	Poland	Zambia
Israel	Portugal	
Italy	Qatar	

A.9. Local Online Service Index

For the first time, assessment of sub-national or local delivery of e-government services has been carried out through a pilot exercise using a subset of cities/municipalities from each region. An ad-hoc local assessment questionnaire has been used to derive a Local Online Service Index (LOSI).

LOSI is a multi-criteria index that captures e-government development at the local level, by assessing information and services provided by municipalities to citizens through their official websites. LOSI is composed of 60 indicators organized into four criteria: (i) technology, (ii) content provision, (iii) services provision, and (iv) participation and engagement. The technology criterion focuses on the content and services assembled and made available in a municipality/city website. It addresses issues related to ease of navigation, website quality, visual appeal, functionality and reliability.

The focus of the content provision criterion is on the relevance of information provided to the citizens. It assesses the quality, availability, relevance, and concise presentation of specific information provided on a municipality's website. This criterion also assesses issues such as access to contact information about the organizational structure of the municipal government; access to public documents; access to sectorial information such as those on health, education, social security, economy. The presence of website privacy policies is also analyzed, since it has the potential to improve public perception, trust in government, and to enable greater citizen engagement with government.

In the services provision criterion, the focus is on the delivery of fundamental electronic services. This criterion includes aspects of electronic service delivery such as online application and delivery of certificates and licenses, employment search/offer, electronic payments, and the ability of users to apply or register for municipal events or services online, forms and reports submission and registration for services, participation in tenders and e-Procurement. Issues related to electronic authentication are likewise addressed in this criterion. This criterion also covers issues related to different aspects regarding how municipalities respond to citizen email requests for information.

The participation and engagement criterion assesses the existence of relevant online participation and engagement mechanisms and initiatives such as forums, complaint forms, and on-line surveys. Other features considered in this criterion includes the availability of social media features and the possibility to send comments/suggestions/complains to the concerned local government and more advanced participatory initiatives such as participatory budget, citizen engagement in online deliberations regarding public policies and services, and citizen empowerment through co-designing of policy options and coproduction of service components and delivery modalities.

Each of the 60 indicators is ascribed a "value 1" if it is found in a city/municipality website, "value 0" if it is absent and nothing if it is not applicable. The LOSI value of a municipality is the sum of the values of all the 60 indicators for that municipality.

The 60 indicators utilized are listed below:

Technology
Browser compatibility
Ease of portal finding
Portal loading speed
Mobile device accessibility
Navigability
Internal search mechanism
Internal advanced search mechanism
Alignment with markup validation standards
Alignment with display standards
Alignment with accessibility standards
Customization of display features
Foreign language support
Content Provision
Contact details
Organization structure
Names and contacts about heads of departments
Municipality information
Budget related information

Information about procurement announcements
Information about procurement results
Information about provided services
Information about municipality partnership with third parties
Facilitation of free internet access
Health information
Environmental information
Education information
Social welfare information
Sport and culture information
Privacy policy
Open data policy
Open data provision
OGD metadata
Smart cities initiatives
Use of emergent technologies
Online user support
Guiding information on online services use
Links for government agencies
Statistical data and studies provision
Evidence of portal content update
Service Provision
Portal authentication
Personal data accessibility
Personal data updating
Municipality responsiveness to emails
Delay of email response
Quality of email response
e-Procurement service
Police online declaration
Address change notification
Online application for residency
Online building permit
Online vacancies
e-Payment
Participation and engagement
Real time communication
Feedback/complaint submission
Online deliberation processes
Social networking features
Reporting of occurrences in public spaces
Participatory budgeting
Participatory land use plan
Announcement of upcoming e-participation activities
Feedback about consultation processes

The assessment of the 60 indicators for each city/municipality is done by a native speaker of the official language of that city/municipality. Instructions and guidance regarding the assessment process, and about email messages to be sent to the municipality to assess municipalities' responsiveness to email contacts, are provided to the assessors. To ensure validity and comparability of the data collected by the assessors, an expert review of all the data is conducted.

The cities/municipalities assessed are selected based on geographical coverage and population size. All geopolitical regional groups of United Nations Member States are represented. The number of countries included per region is determined based on the percentage of that region's total population in the context of the global population. Where possible, all subregions in a region are covered. Within regions, the countries with the largest population are selected, wherever possible. Where this is not possible, other criteria such as gross domestic product (GDP) and e-government ranking are considered. Within countries, the city with the largest population is selected. City population information are obtained from the United Nations Statistics Division (UNSD) website: (http://data.un.org/Data.aspx?d=POP&f=tableCode%3A240).

A.10. Country Classifications and Nomenclature in the Survey

Regional groupings are taken from the classification of the United Nations Statistics Division. For details, see http://unstats.un.org/unsd/methods/m49/m49regin.htm.

Economies are divided according to 2016 GNI per capita, calculated using the World Bank Atlas method. The groups are: low income, US$1,005 or less; lower middle income, US$1,006 - $3,955; upper middle income, US$3,956 - $12,235; and high income, US$12,236 or more[5]. Where data and statistics are reported by income groups, the Survey classifies countries according to the World Bank income classification of high, middle and low-income groups.

For details, see http://data.worldbank.org/about/country-classifications.

The lists of least developing countries, landlocked developing countries and small island developing countries were obtained from the United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States (UN-OHRLLS).

For details, see http://www.unohrlls.org/en/ldc/25/

A.11. United Nations e-government knowledge base

The Division for Public Institutions and Digital Government (formerly Division for Public Administration and Development Management) of the United Nations Department of Economic and Social Affairs maintains the United Nations egovernment knowledge base (egovkb) to provide governments and all stakeholders with easy access to data and information on e-government development.

The egovkb is an interactive online tool to view, sort and download information and datasets in open data formats from the 2018 UN E-Government Survey and as well as previous editions (2003, 2004, 2005, 2008, 2010, 2012. 2014 and 2016). The egovkb also includes advanced research features such as customizable regional and country comparisons, rankings and country profiles.

For more information and details, see the United Nations e-Government Knowledge Base at https://publicadministration.un.org/egovkb/

A.12. Evolving definitions and understanding of egovernment and its related development

Sources	Definition
2001 Benchmarking E-government: A Global Perspective (UNDESA, 2001)	E-government is 'a tool for information and service provision to citizens'
2003 World Public Sector Report: E-Government at the Crossroads (UNDESA, 2003)	E-government enhances the capacity of public administration using ICTs to increase the supply of public value (i.e., to deliver the things that people want)
United Nations Global E-Government Readiness Report 2004: Towards Access for Opportunity (UNDESA, 2004)	E-government is defined as the use of all ICTs by government to provide information and services to the public. This is a broader concept than in cases where it refers only to G-2-G networking.
United Nations Global E-Government Readiness Report 2005: From E-Government to E-Inclusion (UNDESA, 2005)	The definition of e-government needs to be enhanced from simply 'government-to-government networking' or 'use of ICTs by governments to provide information and services to the public' to one which encompasses the role of the government in promoting equality and social inclusion.
United Nations E-Government Survey 2008: From E-Government to Connected Governance (UNDESA, 2008)	E-government is the continuous innovation in the delivery of services, public participation and governance through the transformation of external and internal relationships using information technology, especially the Internet.
UN E-Government Survey 2014: E-Government for the Future We Want (UNDESA, 2014)	E-government can be referred to as the use and application of information technologies in public administration to streamline and integrate workflows and processes, to effectively manage data and information, enhance public service delivery, as well as expand communication channels for engagement and empowerment of people.
Organisation for Economic Co-operation and Development (OECD)	E-government is defined as 'the use of information and communications technologies (ICTs), and particularly the Internet, to achieve better government'.
World Bank (WB, 2015)	E-government refers to government agencies' use of information technologies (such as Wide Area Networks, the Internet, and mobile computing) that can transform relations with citizens, businesses, and other arms of government. These technologies can serve a variety of different ends: better delivery of government services to citizens, improved interactions with business and industry, citizen empowerment through access to information, or more efficient government management. The resulting benefits can be less corruption, increased transparency, greater convenience, revenue growth and/or cost reductions.

Table 1. Country Profiles

Rank	Country	Region	Sub-Region	EGDI 2018	OSI	TII	HCI	Level of Income	LDC	LLDC	SIDS
177	Afghanistan	Asia	Southern Asia	0.2585	0.3056	0.1138	0.3562	Low income	x	x	
74	Albania	Europe	Southern Europe	0.6519	0.7361	0.4318	0.7877	Upper middle income			
130	Algeria	Africa	Northern Africa	0.4227	0.2153	0.3889	0.6640	Upper middle income			
62	Andorra	Europe	Southern Europe	0.6857	0.6042	0.7220	0.7309	High income			
155	Angola	Africa	Middle Africa	0.3376	0.4097	0.0972	0.5060	Lower middle income	x		
90	Antigua and Barbuda	Americas	Caribbean	0.5906	0.4583	0.5617	0.7518	High income			x
43	Argentina	Americas	South America	0.7335	0.7500	0.5927	0.8579	Upper middle income			
87	Armenia	Asia	Western Asia	0.5944	0.5625	0.4660	0.7547	Lower middle income		x	
2	Australia	Oceania	Australia and New Zealand	0.9053	0.9722	0.7436	1.0000	High income			
20	Austria	Europe	Western Europe	0.8301	0.8681	0.7716	0.8505	High income			
70	Azerbaijan	Asia	Western Asia	0.6574	0.7292	0.5062	0.7369	Upper middle income		x	
72	Bahamas	Americas	Caribbean	0.6552	0.7014	0.5393	0.7249	High income			x
26	Bahrain	Asia	Western Asia	0.8116	0.7986	0.8466	0.7897	High income			
115	Bangladesh	Asia	Southern Asia	0.4862	0.7847	0.1976	0.4763	Lower middle income	x		
46	Barbados	Americas	Caribbean	0.7229	0.6667	0.6719	0.8301	High income			x
38	Belarus	Europe	Eastern Europe	0.7641	0.7361	0.6881	0.8681	Upper middle income			
27	Belgium	Europe	Western Europe	0.8080	0.7569	0.6930	0.9740	High income			
132	Belize	Americas	Central America	0.4115	0.3333	0.2247	0.6765	Upper middle income			x
159	Benin	Africa	Western Africa	0.3264	0.4722	0.1418	0.3653	Low income	x		
126	Bhutan	Asia	Southern Asia	0.4274	0.5000	0.3080	0.4743	Lower middle income	x	x	
103	Bolivia(Plurinational State of)	Americas	South America	0.5307	0.5625	0.3148	0.7148	Lower middle income		x	
105	Bosnia and Herzegovina	Europe	Southern Europe	0.5303	0.4306	0.4385	0.7217	Upper middle income			
127	Botswana	Africa	Southern Africa	0.4253	0.2083	0.3982	0.6694	Upper middle income		x	
44	Brazil	Americas	South America	0.7327	0.9236	0.5220	0.7525	Upper middle income			
59	Brunei Darussalam	Asia	South-Eastern Asia	0.6923	0.7222	0.6066	0.7480	High income			
47	Bulgaria	Europe	Eastern Europe	0.7177	0.7639	0.5785	0.8106	Upper middle income			
165	Burkina Faso	Africa	Western Africa	0.3016	0.5347	0.1603	0.2097	Low income	x	x	
166	Burundi	Africa	Eastern Africa	0.2985	0.3056	0.0786	0.5113	Low income	x	x	
145	Cambodia	Asia	South-Eastern Asia	0.3753	0.2500	0.3132	0.5626	Lower middle income	x		
136	Cameroon	Africa	Middle Africa	0.3997	0.4583	0.1790	0.5618	Lower middle income			
23	Canada	Americas	Northern America	0.8258	0.9306	0.6724	0.8744	High income			
112	Cabo Verde	Africa	Western Africa	0.4980	0.4861	0.3926	0.6152	Lower middle income			x

Table 1. Country Profiles (continued)

Rank	Country	Region	Sub-Region	EGDI 2018	OSI	TII	HCI	Level of Income	LDC	LLDC	SIDS
188	Central African Republic	Africa	Middle Africa	0.1584	0.2083	0.0322	0.2347	Low income	x	x	
190	Chad	Africa	Middle Africa	0.1257	0.1458	0.0669	0.1644	Low income	x	x	
42	Chile	Americas	South America	0.7350	0.8333	0.5377	0.8339	High income			
65	China	Asia	Eastern Asia	0.6811	0.8611	0.4735	0.7088	Upper middle income			
61	Colombia	Americas	South America	0.6871	0.8819	0.4412	0.7382	Upper middle income			
182	Comoros	Africa	Eastern Africa	0.2336	0.0972	0.0871	0.5166	Low income	x		x
164	Congo	Africa	Middle Africa	0.3024	0.1667	0.1889	0.5515	Lower middle income			
56	Costa Rica	Americas	Central America	0.7004	0.6736	0.6343	0.7933	Upper middle income			
172	Côte d'Ivoire	Africa	Western Africa	0.2776	0.2222	0.2748	0.3357	Lower middle income			
55	Croatia	Europe	Southern Europe	0.7018	0.6806	0.6051	0.8196	Upper middle income			
134	Cuba	Americas	Caribbean	0.4101	0.2986	0.1455	0.7862	Upper middle income			x
36	Cyprus	Asia	Western Asia	0.7736	0.7847	0.7279	0.8083	High income			
54	Czech Republic	Europe	Eastern Europe	0.7084	0.6528	0.5971	0.8752	High income			
185	Democratic People's Republic of Korea	Asia	Eastern Asia	0.2159	0.0000	0.0327	0.6150	Low income			
176	Democratic Republic of the Congo	Africa	Middle Africa	0.2612	0.2083	0.0645	0.5108	Low income	x		
1	Denmark	Europe	Northern Europe	0.9150	1.0000	0.7978	0.9472	High income			
179	Djibouti	Africa	Eastern Africa	0.2401	0.2917	0.0961	0.3325	Lower middle income	x		
93	Dominica	Americas	Caribbean	0.5794	0.6111	0.4775	0.6497	Upper middle income			x
95	Dominican Republic	Americas	Caribbean	0.5726	0.6597	0.3655	0.6927	Upper middle income			x
84	Ecuador	Americas	South America	0.6129	0.7292	0.3699	0.7395	Upper middle income			
114	Egypt	Africa	Northern Africa	0.4880	0.5347	0.3222	0.6072	Lower middle income			
100	El Salvador	Americas	Central America	0.5469	0.6250	0.3810	0.6348	Lower middle income			
184	Equatioral Guinea	Africa	Middle Africa	0.2298	0.0486	0.1010	0.5397	Upper middle income			
189	Eritrea	Africa	Eastern Africa	0.1337	0.0833	0.0000	0.3179	Low income	x		
16	Estonia	Europe	Northern Europe	0.8486	0.9028	0.7613	0.8818	High income			
141	Eswatini	Africa	Southern Africa	0.3820	0.3750	0.1772	0.5939	Lower middle income		x	
151	Ethiopia	Africa	Eastern Africa	0.3463	0.6319	0.0976	0.3094	Low income	x	x	
102	Fiji	Oceania	Melanesia	0.5348	0.4583	0.3562	0.7899	Upper middle income			x
6	Finland	Europe	Northern Europe	0.8815	0.9653	0.7284	0.9509	High income			
9	France	Europe	Western Europe	0.8790	0.9792	0.7979	0.8598	High income			
125	Gabon	Africa	Middle Africa	0.4313	0.2292	0.4250	0.6398	Upper middle income			

Table 1. Country Profiles (continued)

Rank	Country	Region	Sub-Region	EGDI 2018	OSI	TII	HCI	Level of Income	LDC	LLDC	SIDS
168	Gambia	Africa	Western Africa	0.2958	0.2708	0.2627	0.3539	Low income	x		
60	Georgia	Asia	Western Asia	0.6893	0.6944	0.5403	0.8333	Lower middle income			
12	Germany	Europe	Western Europe	0.8765	0.9306	0.7952	0.9036	High income			
101	Ghana	Africa	Western Africa	0.5390	0.6944	0.3558	0.5669	Lower middle income			
35	Greece	Europe	Southern Europe	0.7833	0.8194	0.6439	0.8867	High income			
89	Grenada	Americas	Caribbean	0.5930	0.4931	0.4658	0.8202	Upper middle income			x
113	Guatemala	Americas	Central America	0.4974	0.6458	0.2941	0.5524	Lower middle income			
181	Guinea	Africa	Western Africa	0.2348	0.3125	0.1513	0.2406	Low income	x		
187	Guinea-Bissau	Africa	Western Africa	0.1887	0.0764	0.1028	0.3869	Low income	x		x
124	Guyana	Americas	South America	0.4316	0.4306	0.2541	0.6102	Upper middle income			x
163	Haiti	Americas	Caribbean	0.3047	0.4444	0.1078	0.3620	Low income	x		x
123	Honduras	Americas	Central America	0.4474	0.5139	0.2268	0.6015	Lower middle income			
45	Hungary	Europe	Eastern Europe	0.7265	0.7361	0.6071	0.8364	High income			
19	Iceland	Europe	Northern Europe	0.8316	0.7292	0.8292	0.9365	High income			
96	India	Asia	Southern Asia	0.5669	0.9514	0.2009	0.5484	Lower middle income			
107	Indonesia	Asia	South-Eastern Asia	0.5258	0.5694	0.3222	0.6857	Lower middle income			
86	Iran (Islamic Republic of)	Asia	Southern Asia	0.6083	0.6319	0.4566	0.7364	Upper middle income			
155	Iraq	Asia	Western Asia	0.3376	0.3194	0.1840	0.5094	Upper middle income			
22	Ireland	Europe	Northern Europe	0.8287	0.8264	0.6970	0.9626	High income			
31	Israel	Asia	Western Asia	0.7998	0.8264	0.7095	0.8635	High income			
24	Italy	Europe	Southern Europe	0.8209	0.9514	0.6771	0.8341	High income			
118	Jamaica	Americas	Caribbean	0.4697	0.3194	0.3941	0.6957	Upper middle income			x
10	Japan	Asia	Eastern Asia	0.8783	0.9514	0.8406	0.8428	High income			
98	Jordan	Asia	Western Asia	0.5575	0.4931	0.4406	0.7387	Lower middle income			
39	Kazakhistan	Asia	Central Asia	0.7597	0.8681	0.5723	0.8388	Upper middle income		x	
122	Kenya	Africa	Eastern Africa	0.4541	0.6250	0.1901	0.5472	Lower middle income			
153	Kiribati	Oceania	Micronesia	0.3450	0.2986	0.0773	0.6591	Lower middle income	x		x
41	Kuwait	Asia	Western Asia	0.7388	0.7917	0.7394	0.6852	High income			
91	Kyrgizistan	Asia	Central Asia	0.5835	0.6458	0.3418	0.7628	Lower middle income		x	
162	"Lao People's Democratic Republic"	Asia	South-Eastern Asia	0.3056	0.1667	0.2246	0.5254	Lower middle income	x	x	
57	Latvia	Europe	Northern Europe	0.6996	0.6667	0.6188	0.8132	High income			

Table 1. Country Profiles (continued)

Rank	Country	Region	Sub-Region	EGDI 2018	OSI	TII	HCI	Level of Income	LDC	LLDC	SIDS
99	Lebanon	Asia	Western Asia	0.5530	0.4722	0.5219	0.6649	Upper middle income			
167	Lesotho	Africa	Southern Africa	0.2968	0.1111	0.2468	0.5324	Lower middle income	x	x	
173	Liberia	Africa	Western Africa	0.2737	0.3403	0.1036	0.3772	Low income	x		
140	Libya	Africa	Northern Africa	0.3833	0.0972	0.3353	0.7173	Upper middle income			
25	Liechtenstein	Europe	Western Europe	0.8204	0.7986	0.8389	0.8237	High income			
40	Lithuania	Europe	Northern Europe	0.7534	0.7986	0.6293	0.8323	High income			
18	Luxembourg	Europe	Western Europe	0.8334	0.9236	0.7964	0.7803	High income			
170	Madagascar	Africa	Eastern Africa	0.2792	0.3056	0.0499	0.4822	Low income	x		
175	Malawi	Africa	Eastern Africa	0.2708	0.2569	0.0834	0.4720	Low income	x	x	
48	Malaysia	Asia	South-Eastern Asia	0.7174	0.8889	0.5647	0.6987	Upper middle income			
97	Maldives	Asia	Southern Asia	0.5615	0.4931	0.5159	0.6754	Upper middle income			x
178	Mali	Africa	Western Africa	0.2424	0.2639	0.2074	0.2558	Low income	x	x	
30	Malta	Europe	Southern Europe	0.8011	0.8403	0.7657	0.7973	High income			
149	Marshall Islands	Oceania	Micronesia	0.3543	0.2292	0.1037	0.7301	Upper middle income			x
183	Mauritania	Africa	Western Africa	0.2314	0.1597	0.1878	0.3467	Lower middle income	x		
66	Mauritius	Africa	Eastern Africa	0.6678	0.7292	0.5435	0.7308	Upper middle income			x
64	Mexico	Americas	Central America	0.6818	0.9236	0.4173	0.7044	Upper middle income			
161	Micronesia	Oceania	Micronesia	0.3155	0.1458	0.1118	0.6889	Lower middle income			x
28	Monaco	Europe	Western Europe	0.8050	0.6250	1.0000	0.7901	High income			
92	Mongolia	Asia	Eastern Asia	0.5824	0.5972	0.3602	0.7899	Lower middle income		x	
58	Montenegro	Europe	Southern Europe	0.6966	0.6667	0.6059	0.8172	Upper middle income			
110	Morocco	Africa	Northern Africa	0.5214	0.6667	0.3697	0.5278	Lower middle income			
160	Mozambique	Africa	Eastern Africa	0.3195	0.4236	0.1398	0.3951	Low income	x		
157	Myanmar	Asia	South-Eastern Asia	0.3328	0.2292	0.2565	0.5127	Lower middle income	x		
121	Namibia	Africa	Southern Africa	0.4554	0.4514	0.3299	0.5850	Upper middle income			
158	Nauru	Oceania	Micronesia	0.3324	0.1319	0.3033	0.5619	Upper middle income			x
117	Nepal	Asia	Southern Asia	0.4748	0.6875	0.2413	0.4957	Low income	x	x	
13	Netherlands	Europe	Western Europe	0.8757	0.9306	0.7758	0.9206	High income			
8	New Zealand	Oceania	Australia and New Zealand	0.8806	0.9514	0.7455	0.9450	High income			
129	Nicaragua	Americas	Central America	0.4233	0.4028	0.2825	0.5847	Lower middle income			
192	Niger	Africa	Western Africa	0.1095	0.1597	0.0795	0.0894	Low income	x	x	
143	Nigeria	Africa	Western Africa	0.3807	0.5278	0.1883	0.4261	Lower middle income			

Table 1. Country Profiles (continued)

Rank	Country	Region	Sub-Region	EGDI 2018	OSI	TII	HCI	Level of Income	LDC	LLDC	SIDS
14	Norway	Europe	Northern Europe	0.8557	0.9514	0.7131	0.9025	High income			
63	Oman	Asia	Western Asia	0.6846	0.8125	0.5399	0.7013	High income			
148	Pakistan	Asia	Southern Asia	0.3566	0.5486	0.1529	0.3682	Lower middle income			
111	Palau	Oceania	Micronesia	0.5024	0.3264	0.3346	0.8462	High income			x
85	Panama	Americas	Central America	0.6092	0.6597	0.4543	0.7137	Upper middle income			
171	Papua New Guinea	Oceania	Melanesia	0.2787	0.2708	0.0875	0.4778	Lower middle income			x
108	Paraguay	Americas	South America	0.5255	0.5556	0.3507	0.6701	Upper middle income		x	
77	Peru	Americas	South America	0.6461	0.8194	0.3913	0.7276	Upper middle income			
75	Philippines	Asia	South-Eastern Asia	0.6512	0.8819	0.3547	0.7171	Lower middle income			
33	Poland	Europe	Eastern Europe	0.7926	0.9306	0.5805	0.8668	High income			
29	Portugal	Europe	Southern Europe	0.8031	0.9306	0.6617	0.8170	High income			
51	Qatar	Asia	Western Asia	0.7132	0.7917	0.6797	0.6683	High income			
3	Republic of Korea	Asia	Eastern Asia	0.9010	0.9792	0.8496	0.8743	High income			
69	Republic of Moldova	Europe	Eastern Europe	0.6590	0.7708	0.4787	0.7274	Lower middle income		x	
67	Romania	Europe	Eastern Europe	0.6671	0.6597	0.5471	0.7944	Upper middle income			
32	Russian Federation	Europe	Eastern Europe	0.7969	0.9167	0.6219	0.8522	Upper middle income			
120	Rwanda	Africa	Eastern Africa	0.4590	0.7222	0.1733	0.4815	Low income	x	x	
71	Saint Kittis and Nevis	Americas	Caribbean	0.6554	0.5347	0.6825	0.7491	High income			x
119	Saint Lucia	Americas	Caribbean	0.4660	0.2847	0.4110	0.7022	Upper middle income			x
104	"Saint Vincent and the Grenadines"	Americas	Caribbean	0.5306	0.4514	0.4583	0.6820	Upper middle income			x
128	Samoa	Oceania	Polynesia	0.4236	0.3403	0.2064	0.7241	Upper middle income			x
76	San Marino	Europe	Southern Europe	0.6471	0.4236	0.7075	0.8102	High income			
154	Sao Tome and Principe	Africa	Middle Africa	0.3424	0.1389	0.3053	0.5830	Lower middle income	x		x
52	Saudi Arabia	Asia	Western Asia	0.7119	0.7917	0.5339	0.8101	High income			
150	Senegal	Africa	Western Africa	0.3486	0.4792	0.2240	0.3427	Low income	x		
49	Serbia	Europe	Southern Europe	0.7155	0.7361	0.6208	0.7896	Upper middle income			
83	Seychelles	Africa	Eastern Africa	0.6163	0.6181	0.5008	0.7299	High income			x
174	Sierra Leone	Africa	Western Africa	0.2717	0.3472	0.1597	0.3081	Low income	x		
7	Singapore	Asia	South-Eastern Asia	0.8812	0.9861	0.8019	0.8557	High income			x
49	Slovakia	Europe	Eastern Europe	0.7155	0.7361	0.5964	0.8141	High income			
37	Slovenia	Europe	Southern Europe	0.7714	0.7986	0.6232	0.8923	High income			

Table 1. Country Profiles (continued)

Rank	Country	Region	Sub-Region	EGDI 2018	OSI	TII	HCI	Level of Income	LDC	LLDC	SIDS
169	Solomon Islands	Oceania	Melanesia	0.2816	0.2431	0.1285	0.4732	Lower middle income	x		x
193	Somalia	Africa	Eastern Africa	0.0566	0.1111	0.0586	0.0000	Low income	x		
68	South Africa	Africa	Southern Africa	0.6618	0.8333	0.4231	0.7291	Upper middle income			
191	South Sudan	Africa	Eastern Africa	0.1214	0.1111	0.0262	0.2269	Low income	x	x	
17	Spain	Europe	Southern Europe	0.8415	0.9375	0.6986	0.8885	High income			
94	Sri Lanka	Asia	Southern Asia	0.5751	0.6667	0.3136	0.7451	Lower middle income			
180	Sudan	Africa	Northern Africa	0.2394	0.1528	0.1780	0.3873	Lower middle income	x		
116	Suriname	Americas	South America	0.4773	0.2917	0.4595	0.6808	Upper middle income			x
5	Sweden	Europe	Northern Europe	0.8882	0.9444	0.7835	0.9366	High income			
15	Switzerland	Europe	Western Europe	0.8520	0.8472	0.8428	0.8660	High income			
152	Syrian Arab Republic	Asia	Western Asia	0.3459	0.2986	0.2532	0.4860	Lower middle income			
131	Tajikistan	Asia	Central Asia	0.4220	0.3403	0.2254	0.7002	Lower middle income		x	
73	Thailand	Asia	South-Eastern Asia	0.6543	0.6389	0.5338	0.7903	Upper middle income			
79	The former Yugoslav Republic of Macedonia	Europe	Southern Europe	0.6312	0.7153	0.4859	0.6924	Upper middle income		x	
142	Timor-Leste	Asia	South-Eastern Asia	0.3816	0.3125	0.2937	0.5387	Lower middle income	x		x
138	Togo	Africa	Western Africa	0.3989	0.5556	0.1353	0.5058	Low income	x		
109	Tonga	Oceania	Polynesia	0.5237	0.4722	0.2951	0.8039	Upper middle income			x
78	Trinidad and Tobago	Americas	Caribbean	0.6440	0.6389	0.5735	0.7195	High income			x
80	Tunisia	Africa	Northern Africa	0.6254	0.8056	0.4066	0.6640	Lower middle income			
53	Turkey	Asia	Western Asia	0.7112	0.8889	0.4298	0.8148	Upper middle income			
147	Turkmenistan	Asia	Central Asia	0.3652	0.1319	0.3011	0.6626	Upper middle income		x	
144	Tuvalu	Oceania	Polynesia	0.3779	0.2222	0.2693	0.6422	Upper middle income	x		x
135	Uganda	Africa	Eastern Africa	0.4055	0.5694	0.1566	0.4906	Low income	x	x	
82	Ukraine	Europe	Eastern Europe	0.6165	0.5694	0.4364	0.8436	Lower middle income			
21	United Arab Emirates	Asia	Western Asia	0.8295	0.9444	0.8564	0.6877	High income			
4	United Kingoom of Great Britain and Northern Ireland	Europe	Northern Europe	0.8999	0.9792	0.8004	0.9200	High income			
139	United Republic of Tanzania	Africa	Eastern Africa	0.3929	0.5625	0.1403	0.4759	Low income	x		
11	United States of America	Americas	Northern America	0.8769	0.9861	0.7564	0.8883	High income			
34	Uruguay	Americas	South America	0.7858	0.8889	0.6967	0.7719	High income			

Table 1. Country Profiles (continued)

Rank	Country	Region	Sub-Region	EGDI 2018	OSI	TII	HCI	Level of Income	LDC	LLDC	SIDS
81	Uzbekistan	Asia	Central Asia	0.6207	0.7917	0.3307	0.7396	Lower middle income		x	
137	Vanuatu	Oceania	Melanesia	0.3990	0.4375	0.1920	0.5675	Lower middle income	x		x
106	Venuzuela (Bolivian Republic of)	Americas	South America	0.5287	0.4097	0.4148	0.7615	Upper middle income			
88	Viet Nam	Asia	South-Eastern Asia	0.5931	0.7361	0.3890	0.6543	Lower middle income			
186	Yemen	Asia	Western Asia	0.2154	0.0972	0.1454	0.4037	Lower middle income	x		
133	Zambia	Africa	Eastern Africa	0.4111	0.4792	0.1853	0.5689	Lower middle income	x	x	
146	Zimbabwe	Africa	Eastern Africa	0.3692	0.3264	0.2144	0.5668	Low income		x	

Table 2. E-Government Development Index (EGDI)

Rank	Country	EGDI Level	EGDI	Online Service Component	Telecomm. Infrustrcture Component	Human Capital Component
177	Afghanistan	Middle EGDI	0.2585	0.3056	0.1138	0.3562
74	Albania	High EGDI	0.6519	0.7361	0.4318	0.7877
130	Algeria	Middle EGDI	0.4227	0.2153	0.3889	0.6640
62	Andorra	High EGDI	0.6857	0.6042	0.7220	0.7309
155	Angola	Middle EGDI	0.3376	0.4097	0.0972	0.5060
90	Antigua and Barbuda	High EGDI	0.5906	0.4583	0.5617	0.7518
43	Argentina	High EGDI	0.7335	0.7500	0.5927	0.8579
87	Armenia	High EGDI	0.5944	0.5625	0.4660	0.7547
2	Australia	Very High EGDI	0.9053	0.9722	0.7436	1.0000
20	Austria	Very High EGDI	0.8301	0.8681	0.7716	0.8505
70	Azerbaijan	High EGDI	0.6574	0.7292	0.5062	0.7369
72	Bahamas	High EGDI	0.6552	0.7014	0.5393	0.7249
26	Bahrain	Very High EGDI	0.8116	0.7986	0.8466	0.7897
115	Bangladesh	Middle EGDI	0.4862	0.7847	0.1976	0.4763
46	Barbados	High EGDI	0.7229	0.6667	0.6719	0.8301
38	Belarus	Very High EGDI	0.7641	0.7361	0.6881	0.8681
27	Belgium	Very High EGDI	0.8080	0.7569	0.6930	0.9740
132	Belize	Middle EGDI	0.4115	0.3333	0.2247	0.6765
159	Benin	Middle EGDI	0.3264	0.4722	0.1418	0.3653
126	Bhutan	Middle EGDI	0.4274	0.5000	0.3080	0.4743
103	Bolivia(Plurinational State of)	High EGDI	0.5307	0.5625	0.3148	0.7148
105	Bosnia and Herzegovina	High EGDI	0.5303	0.4306	0.4385	0.7217
127	Botswana	Middle EGDI	0.4253	0.2083	0.3982	0.6694
44	Brazil	High EGDI	0.7327	0.9236	0.5220	0.7525
59	Brunei Darussalam	High EGDI	0.6923	0.7222	0.6066	0.7480
47	Bulgaria	High EGDI	0.7177	0.7639	0.5785	0.8106
165	Burkina Faso	Middle EGDI	0.3016	0.5347	0.1603	0.2097
166	Burundi	Middle EGDI	0.2985	0.3056	0.0786	0.5113
145	Cambodia	Middle EGDI	0.3753	0.2500	0.3132	0.5626
136	Cameroon	Middle EGDI	0.3997	0.4583	0.1790	0.5618
23	Canada	Very High EGDI	0.8258	0.9306	0.6724	0.8744
112	Cabo Verde	Middle EGDI	0.4980	0.4861	0.3926	0.6152
188	Central African Republic	Low EGDI	0.1584	0.2083	0.0322	0.2347
190	Chad	Low EGDI	0.1257	0.1458	0.0669	0.1644
42	Chile	High EGDI	0.7350	0.8333	0.5377	0.8339
65	China	High EGDI	0.6811	0.8611	0.4735	0.7088
61	Colombia	High EGDI	0.6871	0.8819	0.4412	0.7382
182	Comoros	Low EGDI	0.2336	0.0972	0.0871	0.5166
164	Congo	Middle EGDI	0.3024	0.1667	0.1889	0.5515
56	Costa Rica	High EGDI	0.7004	0.6736	0.6343	0.7933
172	Côte d'Ivoire	Middle EGDI	0.2776	0.2222	0.2748	0.3357
55	Croatia	High EGDI	0.7018	0.6806	0.6051	0.8196

Table 2. E-Government Development Index (EGDI) (continued)

Rank	Country	EGDI Level	EGDI	Online Service Component	Telecomm. Infrustrcture Component	Human Capital Component
134	Cuba	Middle EGDI	0.4101	0.2986	0.1455	0.7862
36	Cyprus	Very High EGDI	0.7736	0.7847	0.7279	0.8083
54	Czech Republic	High EGDI	0.7084	0.6528	0.5971	0.8752
185	Democratic People's Republic of Korea	Low EGDI	0.2159	0.0000	0.0327	0.6150
176	Democratic Republic of the Congo	Middle EGDI	0.2612	0.2083	0.0645	0.5108
1	Denmark	Very High EGDI	0.9150	1.0000	0.7978	0.9472
179	Djibouti	Low EGDI	0.2401	0.2917	0.0961	0.3325
93	Dominica	High EGDI	0.5794	0.6111	0.4775	0.6497
95	Dominican Republic	High EGDI	0.5726	0.6597	0.3655	0.6927
84	Ecuador	High EGDI	0.6129	0.7292	0.3699	0.7395
114	Egypt	Middle EGDI	0.4880	0.5347	0.3222	0.6072
100	El Salvador	High EGDI	0.5469	0.6250	0.3810	0.6348
184	Equatioral Guinea	Low EGDI	0.2298	0.0486	0.1010	0.5397
189	Eritrea	Low EGDI	0.1337	0.0833	0.0000	0.3179
16	Estonia	Very High EGDI	0.8486	0.9028	0.7613	0.8818
141	Eswatini	Middle EGDI	0.3820	0.3750	0.1772	0.5939
151	Ethiopia	Middle EGDI	0.3463	0.6319	0.0976	0.3094
102	Fiji	High EGDI	0.5348	0.4583	0.3562	0.7899
6	Finland	Very High EGDI	0.8815	0.9653	0.7284	0.9509
9	France	Very High EGDI	0.8790	0.9792	0.7979	0.8598
125	Gabon	Middle EGDI	0.4313	0.2292	0.4250	0.6398
168	Gambia	Middle EGDI	0.2958	0.2708	0.2627	0.3539
60	Georgia	High EGDI	0.6893	0.6944	0.5403	0.8333
12	Germany	Very High EGDI	0.8765	0.9306	0.7952	0.9036
101	Ghana	High EGDI	0.5390	0.6944	0.3558	0.5669
35	Greece	Very High EGDI	0.7833	0.8194	0.6439	0.8867
89	Grenada	High EGDI	0.5930	0.4931	0.4658	0.8202
113	Guatemala	Middle EGDI	0.4974	0.6458	0.2941	0.5524
181	Guinea	Low EGDI	0.2348	0.3125	0.1513	0.2406
187	Guinea-Bissau	Low EGDI	0.1887	0.0764	0.1028	0.3869
124	Guyana	Middle EGDI	0.4316	0.4306	0.2541	0.6102
163	Haiti	Middle EGDI	0.3047	0.4444	0.1078	0.3620
123	Honduras	Middle EGDI	0.4474	0.5139	0.2268	0.6015
45	Hungary	High EGDI	0.7265	0.7361	0.6071	0.8364
19	Iceland	Very High EGDI	0.8316	0.7292	0.8292	0.9365
96	India	High EGDI	0.5669	0.9514	0.2009	0.5484
107	Indonesia	High EGDI	0.5258	0.5694	0.3222	0.6857
86	Iran (Islamic Republic of)	High EGDI	0.6083	0.6319	0.4566	0.7364
155	Iraq	Middle EGDI	0.3376	0.3194	0.1840	0.5094
22	Ireland	Very High EGDI	0.8287	0.8264	0.6970	0.9626
31	Israel	Very High EGDI	0.7998	0.8264	0.7095	0.8635

Table 2. E-Government Development Index (EGDI) (continued)

Rank	Country	EGDI Level	EGDI	Online Service Component	Telecomm. Infrustrcture Component	Human Capital Component
24	Italy	Very High EGDI	0.8209	0.9514	0.6771	0.8341
118	Jamaica	Middle EGDI	0.4697	0.3194	0.3941	0.6957
10	Japan	Very High EGDI	0.8783	0.9514	0.8406	0.8428
98	Jordan	High EGDI	0.5575	0.4931	0.4406	0.7387
39	Kazakhistan	Very High EGDI	0.7597	0.8681	0.5723	0.8388
122	Kenya	Middle EGDI	0.4541	0.6250	0.1901	0.5472
153	Kiribati	Middle EGDI	0.3450	0.2986	0.0773	0.6591
41	Kuwait	High EGDI	0.7388	0.7917	0.7394	0.6852
91	Kyrgizistan	High EGDI	0.5835	0.6458	0.3418	0.7628
162	Lao People's Democratic Republic	Middle EGDI	0.3056	0.1667	0.2246	0.5254
57	Latvia	High EGDI	0.6996	0.6667	0.6188	0.8132
99	Lebanon	High EGDI	0.5530	0.4722	0.5219	0.6649
167	Lesotho	Middle EGDI	0.2968	0.1111	0.2468	0.5324
173	Liberia	Middle EGDI	0.2737	0.3403	0.1036	0.3772
140	Libya	Middle EGDI	0.3833	0.0972	0.3353	0.7173
25	Liechtenstein	Very High EGDI	0.8204	0.7986	0.8389	0.8237
40	Lithuania	Very High EGDI	0.7534	0.7986	0.6293	0.8323
18	Luxembourg	Very High EGDI	0.8334	0.9236	0.7964	0.7803
170	Madagascar	Middle EGDI	0.2792	0.3056	0.0499	0.4822
175	Malawi	Middle EGDI	0.2708	0.2569	0.0834	0.4720
48	Malaysia	High EGDI	0.7174	0.8889	0.5647	0.6987
97	Maldives	High EGDI	0.5615	0.4931	0.5159	0.6754
178	Mali	Low EGDI	0.2424	0.2639	0.2074	0.2558
30	Malta	Very High EGDI	0.8011	0.8403	0.7657	0.7973
149	Marshall Islands	Middle EGDI	0.3543	0.2292	0.1037	0.7301
183	Mauritania	Low EGDI	0.2314	0.1597	0.1878	0.3467
66	Mauritius	High EGDI	0.6678	0.7292	0.5435	0.7308
64	Mexico	High EGDI	0.6818	0.9236	0.4173	0.7044
161	Micronesia	Middle EGDI	0.3155	0.1458	0.1118	0.6889
28	Monaco	Very High EGDI	0.8050	0.6250	1.0000	0.7901
92	Mongolia	High EGDI	0.5824	0.5972	0.3602	0.7899
58	Montenegro	High EGDI	0.6966	0.6667	0.6059	0.8172
110	Morocco	High EGDI	0.5214	0.6667	0.3697	0.5278
160	Mozambique	Middle EGDI	0.3195	0.4236	0.1398	0.3951
157	Myanmar	Middle EGDI	0.3328	0.2292	0.2565	0.5127
121	Namibia	Middle EGDI	0.4554	0.4514	0.3299	0.5850
158	Nauru	Middle EGDI	0.3324	0.1319	0.3033	0.5619
117	Nepal	Middle EGDI	0.4748	0.6875	0.2413	0.4957
13	Netherlands	Very High EGDI	0.8757	0.9306	0.7758	0.9206
8	New Zealand	Very High EGDI	0.8806	0.9514	0.7455	0.9450
129	Nicaragua	Middle EGDI	0.4233	0.4028	0.2825	0.5847
192	Niger	Low EGDI	0.1095	0.1597	0.0795	0.0894

Table 2. E-Government Development Index (EGDI) (continued)

Rank	Country	EGDI Level	EGDI	Online Service Component	Telecomm. Infrustrcture Component	Human Capital Component
143	Nigeria	Middle EGDI	0.3807	0.5278	0.1883	0.4261
14	Norway	Very High EGDI	0.8557	0.9514	0.7131	0.9025
63	Oman	High EGDI	0.6846	0.8125	0.5399	0.7013
148	Pakistan	Middle EGDI	0.3566	0.5486	0.1529	0.3682
111	Palau	High EGDI	0.5024	0.3264	0.3346	0.8462
85	Panama	High EGDI	0.6092	0.6597	0.4543	0.7137
171	Papua New Guinea	Middle EGDI	0.2787	0.2708	0.0875	0.4778
108	Paraguay	High EGDI	0.5255	0.5556	0.3507	0.6701
77	Peru	High EGDI	0.6461	0.8194	0.3913	0.7276
75	Philippines	High EGDI	0.6512	0.8819	0.3547	0.7171
33	Poland	Very High EGDI	0.7926	0.9306	0.5805	0.8668
29	Portugal	Very High EGDI	0.8031	0.9306	0.6617	0.8170
51	Qatar	High EGDI	0.7132	0.7917	0.6797	0.6683
3	Republic of Korea	Very High EGDI	0.9010	0.9792	0.8496	0.8743
69	Republic of Moldova	High EGDI	0.6590	0.7708	0.4787	0.7274
67	Romania	High EGDI	0.6671	0.6597	0.5471	0.7944
32	Russian Federation	Very High EGDI	0.7969	0.9167	0.6219	0.8522
120	Rwanda	Middle EGDI	0.4590	0.7222	0.1733	0.4815
71	Saint Kittis and Nevis	High EGDI	0.6554	0.5347	0.6825	0.7491
119	Saint Lucia	Middle EGDI	0.4660	0.2847	0.4110	0.7022
104	Saint Vincent and the Grenadines	High EGDI	0.5306	0.4514	0.4583	0.6820
128	Samoa	Middle EGDI	0.4236	0.3403	0.2064	0.7241
76	San Marino	High EGDI	0.6471	0.4236	0.7075	0.8102
154	Sao Tome and Principe	Middle EGDI	0.3424	0.1389	0.3053	0.5830
52	Saudi Arabia	High EGDI	0.7119	0.7917	0.5339	0.8101
150	Senegal	Middle EGDI	0.3486	0.4792	0.2240	0.3427
49	Serbia	High EGDI	0.7155	0.7361	0.6208	0.7896
83	Seychelles	High EGDI	0.6163	0.6181	0.5008	0.7299
174	Sierra Leone	Middle EGDI	0.2717	0.3472	0.1597	0.3081
7	Singapore	Very High EGDI	0.8812	0.9861	0.8019	0.8557
49	Slovakia	High EGDI	0.7155	0.7361	0.5964	0.8141
37	Slovenia	Very High EGDI	0.7714	0.7986	0.6232	0.8923
169	Solomon Islands	Middle EGDI	0.2816	0.2431	0.1285	0.4732
193	Somalia	Low EGDI	0.0566	0.1111	0.0586	0.0000
68	South Africa	High EGDI	0.6618	0.8333	0.4231	0.7291
191	South Sudan	Low EGDI	0.1214	0.1111	0.0262	0.2269
17	Spain	Very High EGDI	0.8415	0.9375	0.6986	0.8885
94	Sri Lanka	High EGDI	0.5751	0.6667	0.3136	0.7451
180	Sudan	Low EGDI	0.2394	0.1528	0.1780	0.3873
116	Suriname	Middle EGDI	0.4773	0.2917	0.4595	0.6808
5	Sweden	Very High EGDI	0.8882	0.9444	0.7835	0.9366
15	Switzerland	Very High EGDI	0.8520	0.8472	0.8428	0.8660

Table 2. E-Government Development Index (EGDI) (continued)

Rank	Country	EGDI Level	EGDI	Online Service Component	Telecomm. Infrustrcture Component	Human Capital Component
152	Syrian Arab Republic	Middle EGDI	0.3459	0.2986	0.2532	0.4860
131	Tajikistan	Middle EGDI	0.4220	0.3403	0.2254	0.7002
73	Thailand	High EGDI	0.6543	0.6389	0.5338	0.7903
79	The former Yugoslav Republic of Macedonia	High EGDI	0.6312	0.7153	0.4859	0.6924
142	Timor-Leste	Middle EGDI	0.3816	0.3125	0.2937	0.5387
138	Togo	Middle EGDI	0.3989	0.5556	0.1353	0.5058
109	Tonga	High EGDI	0.5237	0.4722	0.2951	0.8039
78	Trinidad and Tobago	High EGDI	0.6440	0.6389	0.5735	0.7195
80	Tunisia	High EGDI	0.6254	0.8056	0.4066	0.6640
53	Turkey	High EGDI	0.7112	0.8889	0.4298	0.8148
147	Turkmenistan	Middle EGDI	0.3652	0.1319	0.3011	0.6626
144	Tuvalu	Middle EGDI	0.3779	0.2222	0.2693	0.6422
135	Uganda	Middle EGDI	0.4055	0.5694	0.1566	0.4906
82	Ukraine	High EGDI	0.6165	0.5694	0.4364	0.8436
21	United Arab Emirates	Very High EGDI	0.8295	0.9444	0.8564	0.6877
4	United Kingoom of Great Britain and Northern Ireland	Very High EGDI	0.8999	0.9792	0.8004	0.9200
139	United Republic of Tanzania	Middle EGDI	0.3929	0.5625	0.1403	0.4759
11	United States of America	Very High EGDI	0.8769	0.9861	0.7564	0.8883
34	Uruguay	Very High EGDI	0.7858	0.8889	0.6967	0.7719
81	Uzbekistan	High EGDI	0.6207	0.7917	0.3307	0.7396
137	Vanuatu	Middle EGDI	0.3990	0.4375	0.1920	0.5675
106	Venuzuela (Bolivian Republic of)	High EGDI	0.5287	0.4097	0.4148	0.7615
88	Viet Nam	High EGDI	0.5931	0.7361	0.3890	0.6543
186	Yemen	Low EGDI	0.2154	0.0972	0.1454	0.4037
133	Zambia	Middle EGDI	0.4111	0.4792	0.1853	0.5689
146	Zimbabwe	Middle EGDI	0.3692	0.3264	0.2144	0.5668

Table 3. Regional and Economic Groupings for E-Government Development Index (EGDI)

Region	EGDI	Online Service Component	Telecomm. Infrastructure Component	Human Capital Component
Africa	0.3423	0.3633	0.2034	0.4602
Americas	0.5898	0.6095	0.4441	0.7157
Asia	0.5779	0.6216	0.4385	0.6735
Europe	0.7727	0.7946	0.6765	0.8471
Oceania	0.4611	0.3929	0.2825	0.7078
World	**0.5491**	**0.5691**	**0.4155**	**0.4155**

	EGDI	Online Service Component	Telecomm. Infrastructure Component	Human Capital Component
Small Island Developing States	0.4744	0.4090	0.3460	0.6684
Land Locked Developing Countries	0.4100	0.4481	0.2502	0.5318
Least Developed Countries	0.2961	0.3251	0.1521	0.4113

Levels of Income	EGDI	Online Service Component	Telecomm. Infrastructure Component	Human Capital Component
High income	0.7838	0.8120	0.7018	0.8375
Upper middle income	0.5655	0.5479	0.4256	0.7231
Lower middle income	0.4411	0.4688	0.2703	0.5843
Low income	0.2735	0.3329	0.1191	0.3684

Table 4. E-Government Development Index (EGDI) by region - AFRICA

Rank	Country	Sub-Region	EGDI	Online Service Component	Telecomm. Infrustructure Component	Human Capital Component
130	Algeria	Northern Africa	0.4227	0.2153	0.3889	0.6640
155	Angola	Middle Africa	0.3376	0.4097	0.0972	0.5060
159	Benin	Western Africa	0.3264	0.4722	0.1418	0.3653
127	Botswana	Southern Africa	0.4253	0.2083	0.3982	0.6694
165	Burkina Faso	Western Africa	0.3016	0.5347	0.1603	0.2097
166	Burundi	Eastern Africa	0.2985	0.3056	0.0786	0.5113
136	Cameroon	Middle Africa	0.3997	0.4583	0.1790	0.5618
112	Cabo Verde	Western Africa	0.4980	0.4861	0.3926	0.6152
188	Central African Republic	Middle Africa	0.1584	0.2083	0.0322	0.2347
190	Chad	Middle Africa	0.1257	0.1458	0.0669	0.1644
182	Comoros	Eastern Africa	0.2336	0.0972	0.0871	0.5166
164	Congo	Middle Africa	0.3024	0.1667	0.1889	0.5515
172	Côte d'Ivoire	Western Africa	0.2776	0.2222	0.2748	0.3357
176	Democratic Republic of the Congo	Middle Africa	0.2612	0.2083	0.0645	0.5108
179	Djibouti	Eastern Africa	0.2401	0.2917	0.0961	0.3325
114	Egypt	Northern Africa	0.4880	0.5347	0.3222	0.6072
184	Equatioral Guinea	Middle Africa	0.2298	0.0486	0.1010	0.5397
189	Eritrea	Eastern Africa	0.1337	0.0833	0.0000	0.3179
141	Eswatini	Southern Africa	0.3820	0.3750	0.1772	0.5939
151	Ethiopia	Eastern Africa	0.3463	0.6319	0.0976	0.3094
125	Gabon	Middle Africa	0.4313	0.2292	0.4250	0.6398
168	Gambia	Western Africa	0.2958	0.2708	0.2627	0.3539
101	Ghana	Western Africa	0.5390	0.6944	0.3558	0.5669
181	Guinea	Western Africa	0.2348	0.3125	0.1513	0.2406
187	Guinea-Bissau	Western Africa	0.1887	0.0764	0.1028	0.3869
122	Kenya	Eastern Africa	0.4541	0.6250	0.1901	0.5472
167	Lesotho	Southern Africa	0.2968	0.1111	0.2468	0.5324
173	Liberia	Western Africa	0.2737	0.3403	0.1036	0.3772
140	Libya	Northern Africa	0.3833	0.0972	0.3353	0.7173
170	Madagascar	Eastern Africa	0.2792	0.3056	0.0499	0.4822
175	Malawi	Eastern Africa	0.2708	0.2569	0.0834	0.4720
178	Mali	Western Africa	0.2424	0.2639	0.2074	0.2558
183	Mauritania	Western Africa	0.2314	0.1597	0.1878	0.3467
66	Mauritius	Eastern Africa	0.6678	0.7292	0.5435	0.7308
110	Morocco	Northern Africa	0.5214	0.6667	0.3697	0.5278
160	Mozambique	Eastern Africa	0.3195	0.4236	0.1398	0.3951
121	Namibia	Southern Africa	0.4554	0.4514	0.3299	0.5850
192	Niger	Western Africa	0.1095	0.1597	0.0795	0.0894
143	Nigeria	Western Africa	0.3807	0.5278	0.1883	0.4261
120	Rwanda	Eastern Africa	0.4590	0.7222	0.1733	0.4815
154	Sao Tome and Principe	Middle Africa	0.3424	0.1389	0.3053	0.5830

Table 4. E-Government Development Index (EGDI) by region - AFRICA (continued)

Rank	Country	Sub-Region	EGDI	Online Service Component	Telecomm. Infrustructure Component	Human Capital Component
150	Senegal	Western Africa	0.3486	0.4792	0.2240	0.3427
83	Seychelles	Eastern Africa	0.6163	0.6181	0.5008	0.7299
174	Sierra Leone	Western Africa	0.2717	0.3472	0.1597	0.3081
193	Somalia	Eastern Africa	0.0566	0.1111	0.0586	0.0000
68	South Africa	Southern Africa	0.6618	0.8333	0.4231	0.7291
191	South Sudan	Eastern Africa	0.1214	0.1111	0.0262	0.2269
180	Sudan	Northern Africa	0.2394	0.1528	0.1780	0.3873
138	Togo	Western Africa	0.3989	0.5556	0.1353	0.5058
80	Tunisia	Northern Africa	0.6254	0.8056	0.4066	0.6640
135	Uganda	Eastern Africa	0.4055	0.5694	0.1566	0.4906
139	United Republic of Tanzania	Eastern Africa	0.3929	0.5625	0.1403	0.4759
133	Zambia	Eastern Africa	0.4111	0.4792	0.1853	0.5689
146	Zimbabwe	Eastern Africa	0.3692	0.3264	0.2144	0.5668

Table 5. E-Government Development Index (EGDI) by region - AMERICAS

Rank	Country	Sub-Region	EGDI	Online Service Component	Telecomm. Infrustructure Component	Human Capital Component
90	Antigua and Barbuda	Caribbean	0.5906	0.4583	0.5617	0.7518
43	Argentina	South America	0.7335	0.7500	0.5927	0.8579
72	Bahamas	Caribbean	0.6552	0.7014	0.5393	0.7249
46	Barbados	Caribbean	0.7229	0.6667	0.6719	0.8301
132	Belize	Central America	0.4115	0.3333	0.2247	0.6765
103	Bolivia(Plurinational State of)	South America	0.5307	0.5625	0.3148	0.7148
44	Brazil	South America	0.7327	0.9236	0.5220	0.7525
23	Canada	Northern America	0.8258	0.9306	0.6724	0.8744
42	Chile	South America	0.7350	0.8333	0.5377	0.8339
61	Colombia	South America	0.6871	0.8819	0.4412	0.7382
56	Costa Rica	Central America	0.7004	0.6736	0.6343	0.7933
134	Cuba	Caribbean	0.4101	0.2986	0.1455	0.7862
93	Dominica	Caribbean	0.5794	0.6111	0.4775	0.6497
95	Dominican Republic	Caribbean	0.5726	0.6597	0.3655	0.6927
84	Ecuador	South America	0.6129	0.7292	0.3699	0.7395
100	El Salvador	Central America	0.5469	0.6250	0.3810	0.6348
89	Grenada	Caribbean	0.5930	0.4931	0.4658	0.8202
113	Guatemala	Central America	0.4974	0.6458	0.2941	0.5524
124	Guyana	South America	0.4316	0.4306	0.2541	0.6102
163	Haiti	Caribbean	0.3047	0.4444	0.1078	0.3620
123	Honduras	Central America	0.4474	0.5139	0.2268	0.6015
118	Jamaica	Caribbean	0.4697	0.3194	0.3941	0.6957
64	Mexico	Central America	0.6818	0.9236	0.4173	0.7044
129	Nicaragua	Central America	0.4233	0.4028	0.2825	0.5847
85	Panama	Central America	0.6092	0.6597	0.4543	0.7137
108	Paraguay	South America	0.5255	0.5556	0.3507	0.6701
77	Peru	South America	0.6461	0.8194	0.3913	0.7276
71	Saint Kittis and Nevis	Caribbean	0.6554	0.5347	0.6825	0.7491
119	Saint Lucia	Caribbean	0.4660	0.2847	0.4110	0.7022
104	Saint Vincent and the Grenadines	Caribbean	0.5306	0.4514	0.4583	0.6820
116	Suriname	South America	0.4773	0.2917	0.4595	0.6808
78	Trinidad and Tobago	Caribbean	0.6440	0.6389	0.5735	0.7195
11	United States of America	Northern America	0.8769	0.9861	0.7564	0.8883
34	Uruguay	South America	0.7858	0.8889	0.6967	0.7719
106	Venuzuela (Bolivian Republic of)	South America	0.5287	0.4097	0.4148	0.7615

Table 6. E-Government Development Index EGDI by region - ASIA

Rank	Country	Sub-Region	EGDI	Online Service Component	Telecomm. Infrustructure Component	Human Capital Component
177	Afghanistan	Southern Asia	0.2585	0.3056	0.1138	0.3562
87	Armenia	Western Asia	0.5944	0.5625	0.4660	0.7547
70	Azerbaijan	Western Asia	0.6574	0.7292	0.5062	0.7369
26	Bahrain	Western Asia	0.8116	0.7986	0.8466	0.7897
115	Bangladesh	Southern Asia	0.4862	0.7847	0.1976	0.4763
126	Bhutan	Southern Asia	0.4274	0.5000	0.3080	0.4743
59	Brunei Darussalam	South-Eastern Asia	0.6923	0.7222	0.6066	0.7480
145	Cambodia	South-Eastern Asia	0.3753	0.2500	0.3132	0.5626
65	China	Eastern Asia	0.6811	0.8611	0.4735	0.7088
36	Cyprus	Western Asia	0.7736	0.7847	0.7279	0.8083
185	Democratic People's Republic of Korea	Eastern Asia	0.2159	0.0000	0.0327	0.6150
60	Georgia	Western Asia	0.6893	0.6944	0.5403	0.8333
96	India	Southern Asia	0.5669	0.9514	0.2009	0.5484
107	Indonesia	South-Eastern Asia	0.5258	0.5694	0.3222	0.6857
86	Iran (Islamic Republic of)	Southern Asia	0.6083	0.6319	0.4566	0.7364
155	Iraq	Western Asia	0.3376	0.3194	0.1840	0.5094
31	Israel	Western Asia	0.7998	0.8264	0.7095	0.8635
10	Japan	Eastern Asia	0.8783	0.9514	0.8406	0.8428
98	Jordan	Western Asia	0.5575	0.4931	0.4406	0.7387
39	Kazakhistan	Central Asia	0.7597	0.8681	0.5723	0.8388
41	Kuwait	Western Asia	0.7388	0.7917	0.7394	0.6852
91	Kyrgizistan	Central Asia	0.5835	0.6458	0.3418	0.7628
162	Lao People's Democratic Republic	South-Eastern Asia	0.3056	0.1667	0.2246	0.5254
99	Lebanon	Western Asia	0.5530	0.4722	0.5219	0.6649
48	Malaysia	South-Eastern Asia	0.7174	0.8889	0.5647	0.6987
97	Maldives	Southern Asia	0.5615	0.4931	0.5159	0.6754
92	Mongolia	Eastern Asia	0.5824	0.5972	0.3602	0.7899
157	Myanmar	South-Eastern Asia	0.3328	0.2292	0.2565	0.5127
117	Nepal	Southern Asia	0.4748	0.6875	0.2413	0.4957
63	Oman	Western Asia	0.6846	0.8125	0.5399	0.7013
148	Pakistan	Southern Asia	0.3566	0.5486	0.1529	0.3682
75	Philippines	South-Eastern Asia	0.6512	0.8819	0.3547	0.7171
51	Qatar	Western Asia	0.7132	0.7917	0.6797	0.6683
3	Republic of Korea	Eastern Asia	0.9010	0.9792	0.8496	0.8743
52	Saudi Arabia	Western Asia	0.7119	0.7917	0.5339	0.8101
7	Singapore	South-Eastern Asia	0.8812	0.9861	0.8019	0.8557
94	Sri Lanka	Southern Asia	0.5751	0.6667	0.3136	0.7451
152	Syrian Arab Republic	Western Asia	0.3459	0.2986	0.2532	0.4860
131	Tajikistan	Central Asia	0.4220	0.3403	0.2254	0.7002
73	Thailand	South-Eastern Asia	0.6543	0.6389	0.5338	0.7903

Table 6. E-Government Development Index EGDI by region - ASIA (continued)

Rank	Country	Sub-Region	EGDI	Online Service Component	Telecomm. Infrustructure Component	Human Capital Component
142	Timor-Leste	South-Eastern Asia	0.3816	0.3125	0.2937	0.5387
53	Turkey	Western Asia	0.7112	0.8889	0.4298	0.8148
147	Turkmenistan	Central Asia	0.3652	0.1319	0.3011	0.6626
21	United Arab Emirates	Western Asia	0.8295	0.9444	0.8564	0.6877
81	Uzbekistan	Central Asia	0.6207	0.7917	0.3307	0.7396
88	Viet Nam	South-Eastern Asia	0.5931	0.7361	0.3890	0.6543
186	Yemen	Western Asia	0.2154	0.0972	0.1454	0.4037

Table 7. E-Government Development Index EGDI by region - EUROPE

Rank	Country	Sub-Region	EGDI	Online Service Component	Telecomm. Infrustructure Component	Human Capital Component
74	Albania	Southern Europe	0.6519	0.7361	0.4318	0.7877
62	Andorra	Southern Europe	0.6857	0.6042	0.722	0.7309
20	Austria	Western Europe	0.8301	0.8681	0.7716	0.8505
38	Belarus	Eastern Europe	0.7641	0.7361	0.6881	0.8681
27	Belgium	Western Europe	0.808	0.7569	0.693	0.974
105	Bosnia and Herzegovina	Southern Europe	0.5303	0.4306	0.4385	0.7217
47	Bulgaria	Eastern Europe	0.7177	0.7639	0.5785	0.8106
55	Croatia	Southern Europe	0.7018	0.6806	0.6051	0.8196
54	Czech Republic	Eastern Europe	0.7084	0.6528	0.5971	0.8752
1	Denmark	Northern Europe	0.915	1	0.7978	0.9472
16	Estonia	Northern Europe	0.8486	0.9028	0.7613	0.8818
6	Finland	Northern Europe	0.8815	0.9653	0.7284	0.9509
9	France	Western Europe	0.879	0.9792	0.7979	0.8598
12	Germany	Western Europe	0.8765	0.9306	0.7952	0.9036
35	Greece	Southern Europe	0.7833	0.8194	0.6439	0.8867
45	Hungary	Eastern Europe	0.7265	0.7361	0.6071	0.8364
19	Iceland	Northern Europe	0.8316	0.7292	0.8292	0.9365
22	Ireland	Northern Europe	0.8287	0.8264	0.697	0.9626
24	Italy	Southern Europe	0.8209	0.9514	0.6771	0.8341
57	Latvia	Northern Europe	0.6996	0.6667	0.6188	0.8132
25	Liechtenstein	Western Europe	0.8204	0.7986	0.8389	0.8237
40	Lithuania	Northern Europe	0.7534	0.7986	0.6293	0.8323
18	Luxembourg	Western Europe	0.8334	0.9236	0.7964	0.7803
30	Malta	Southern Europe	0.8011	0.8403	0.7657	0.7973
28	Monaco	Western Europe	0.805	0.625	1	0.7901
58	Montenegro	Southern Europe	0.6966	0.6667	0.6059	0.8172
13	Netherlands	Western Europe	0.8757	0.9306	0.7758	0.9206
14	Norway	Northern Europe	0.8557	0.9514	0.7131	0.9025
33	Poland	Eastern Europe	0.7926	0.9306	0.5805	0.8668
29	Portugal	Southern Europe	0.8031	0.9306	0.6617	0.817
69	Republic of Moldova	Eastern Europe	0.659	0.7708	0.4787	0.7274
67	Romania	Eastern Europe	0.6671	0.6597	0.5471	0.7944
32	Russian Federation	Eastern Europe	0.7969	0.9167	0.6219	0.8522
76	San Marino	Southern Europe	0.6471	0.4236	0.7075	0.8102
49	Serbia	Southern Europe	0.7155	0.7361	0.6208	0.7896
49	Slovakia	Eastern Europe	0.7155	0.7361	0.5964	0.8141
37	Slovenia	Southern Europe	0.7714	0.7986	0.6232	0.8923
17	Spain	Southern Europe	0.8415	0.9375	0.6986	0.8885
5	Sweden	Northern Europe	0.8882	0.9444	0.7835	0.9366
15	Switzerland	Western Europe	0.852	0.8472	0.8428	0.866
79	The former Yugoslav Republic of Macedonia	Southern Europe	0.6312	0.7153	0.4859	0.6924

Table 7. E-Government Development Index EGDI by region - EUROPE (continued)

Rank	Country	Sub-Region	EGDI	Online Service Component	Telecomm. Infrustructure Component	Human Capital Component
82	Ukraine	Eastern Europe	0.6165	0.5694	0.4364	0.8436
4	United Kingoom of Great Britain and Northern Ireland	Northern Europe	0.8999	0.9792	0.8004	0.92

Table 8. E-Government Development Index EGDI by region - OCEANIA

Rank	Country	Sub-Region	EGDI	Online Service Component	Telecomm. Infrustructure Component	Human Capital Component
2	Australia	Australia and New Zealand	0.9053	0.9722	0.7436	1
102	Fiji	Melanesia	0.5348	0.4583	0.3562	0.7899
153	Kiribati	Micronesia	0.345	0.2986	0.0773	0.6591
149	Marshall Islands	Micronesia	0.3543	0.2292	0.1037	0.7301
161	Micronesia	Micronesia	0.3155	0.1458	0.1118	0.6889
158	Nauru	Micronesia	0.3324	0.1319	0.3033	0.5619
8	New Zealand	Australia and New Zealand	0.8806	0.9514	0.7455	0.945
111	Palau	Micronesia	0.5024	0.3264	0.3346	0.8462
171	Papua New Guinea	Melanesia	0.2787	0.2708	0.0875	0.4778
128	Samoa	Polynesia	0.4236	0.3403	0.2064	0.7241
169	Solomon Islands	Melanesia	0.2816	0.2431	0.1285	0.4732
109	Tonga	Polynesia	0.5237	0.4722	0.2951	0.8039
144	Tuvalu	Polynesia	0.3779	0.2222	0.2693	0.6422
137	Vanuatu	Melanesia	0.399	0.4375	0.192	0.5675

Table 9. E-Government Development Index EGDI of Least Developed Countries(LDCs)

Rank	Country	Sub-Region	EGDI	Online Service Component	Telecomm. Infrustructure Component	Human Capital Component
177	Afghanistan	Southern Asia	0.2585	0.3056	0.1138	0.3562
155	Angola	Middle Africa	0.3376	0.4097	0.0972	0.506
115	Bangladesh	Southern Asia	0.4862	0.7847	0.1976	0.4763
159	Benin	Western Africa	0.3264	0.4722	0.1418	0.3653
126	Bhutan	Southern Asia	0.4274	0.5	0.308	0.4743
165	Burkina Faso	Western Africa	0.3016	0.5347	0.1603	0.2097
166	Burundi	Eastern Africa	0.2985	0.3056	0.0786	0.5113
145	Cambodia	South-Eastern Asia	0.3753	0.25	0.3132	0.5626
188	Central African Republic	Middle Africa	0.1584	0.2083	0.0322	0.2347
190	Chad	Middle Africa	0.1257	0.1458	0.0669	0.1644
182	Comoros	Eastern Africa	0.2336	0.0972	0.0871	0.5166
176	Democratic Republic of the Congo	Middle Africa	0.2612	0.2083	0.0645	0.5108
179	Djibouti	Eastern Africa	0.2401	0.2917	0.0961	0.3325
189	Eritrea	Eastern Africa	0.1337	0.0833	0	0.3179
151	Ethiopia	Eastern Africa	0.3463	0.6319	0.0976	0.3094
168	Gambia	Western Africa	0.2958	0.2708	0.2627	0.3539
181	Guinea	Western Africa	0.2348	0.3125	0.1513	0.2406
187	Guinea-Bissau	Western Africa	0.1887	0.0764	0.1028	0.3869
163	Haiti	Caribbean	0.3047	0.4444	0.1078	0.362
153	Kiribati	Micronesia	0.345	0.2986	0.0773	0.6591
162	Lao People's Democratic Republic	South-Eastern Asia	0.3056	0.1667	0.2246	0.5254
167	Lesotho	Southern Africa	0.2968	0.1111	0.2468	0.5324
173	Liberia	Western Africa	0.2737	0.3403	0.1036	0.3772
170	Madagascar	Eastern Africa	0.2792	0.3056	0.0499	0.4822
175	Malawi	Eastern Africa	0.2708	0.2569	0.0834	0.472
178	Mali	Western Africa	0.2424	0.2639	0.2074	0.2558
183	Mauritania	Western Africa	0.2314	0.1597	0.1878	0.3467
160	Mozambique	Eastern Africa	0.3195	0.4236	0.1398	0.3951
157	Myanmar	South-Eastern Asia	0.3328	0.2292	0.2565	0.5127
117	Nepal	Southern Asia	0.4748	0.6875	0.2413	0.4957
192	Niger	Western Africa	0.1095	0.1597	0.0795	0.0894
120	Rwanda	Eastern Africa	0.459	0.7222	0.1733	0.4815
154	Sao Tome and Principe	Middle Africa	0.3424	0.1389	0.3053	0.583
150	Senegal	Western Africa	0.3486	0.4792	0.224	0.3427
174	Sierra Leone	Western Africa	0.2717	0.3472	0.1597	0.3081
169	Solomon Islands	Melanesia	0.2816	0.2431	0.1285	0.4732
193	Somalia	Eastern Africa	0.0566	0.1111	0.0586	0
191	South Sudan	Eastern Africa	0.1214	0.1111	0.0262	0.2269
180	Sudan	Northern Africa	0.2394	0.1528	0.178	0.3873
142	Timor-Leste	South-Eastern Asia	0.3816	0.3125	0.2937	0.5387

Table 9. E-Government Development Index EGDI of Least Developed Countries(LDCs)

Rank	Country	Sub-Region	EGDI	Online Service Component	Telecomm. Infrustructure Component	Human Capital Component
138	Togo	Western Africa	0.3989	0.5556	0.1353	0.5058
144	Tuvalu	Polynesia	0.3779	0.2222	0.2693	0.6422
135	Uganda	Eastern Africa	0.4055	0.5694	0.1566	0.4906
139	United Republic of Tanzania	Eastern Africa	0.3929	0.5625	0.1403	0.4759
137	Vanuatu	Melanesia	0.399	0.4375	0.192	0.5675
186	Yemen	Western Asia	0.2154	0.0972	0.1454	0.4037
133	Zambia	Eastern Africa	0.4111	0.4792	0.1853	0.5689

Table 10. E-Government Development Index EGDI of Small Island Developing States (SIDS)

Rank	Country	Sub-Region	EGDI	Online Service Component	Telecomm. Infrustructure Component	Human Capital Component
90	Antigua and Barbuda	Caribbean	0.5906	0.4583	0.5617	0.7518
72	Bahamas	Caribbean	0.6552	0.7014	0.5393	0.7249
46	Barbados	Caribbean	0.7229	0.6667	0.6719	0.8301
132	Belize	Central America	0.4115	0.3333	0.2247	0.6765
112	Cabo Verde	Western Africa	0.498	0.4861	0.3926	0.6152
182	Comoros	Eastern Africa	0.2336	0.0972	0.0871	0.5166
134	Cuba	Caribbean	0.4101	0.2986	0.1455	0.7862
93	Dominica	Caribbean	0.5794	0.6111	0.4775	0.6497
95	Dominican Republic	Caribbean	0.5726	0.6597	0.3655	0.6927
102	Fiji	Melanesia	0.5348	0.4583	0.3562	0.7899
89	Grenada	Caribbean	0.593	0.4931	0.4658	0.8202
187	Guinea-Bissau	Western Africa	0.1887	0.0764	0.1028	0.3869
124	Guyana	South America	0.4316	0.4306	0.2541	0.6102
163	Haiti	Caribbean	0.3047	0.4444	0.1078	0.362
118	Jamaica	Caribbean	0.4697	0.3194	0.3941	0.6957
153	Kiribati	Micronesia	0.345	0.2986	0.0773	0.6591
97	Maldives	Southern Asia	0.5615	0.4931	0.5159	0.6754
149	Marshall Islands	Micronesia	0.3543	0.2292	0.1037	0.7301
66	Mauritius	Eastern Africa	0.6678	0.7292	0.5435	0.7308
161	Micronesia	Micronesia	0.3155	0.1458	0.1118	0.6889
158	Nauru	Micronesia	0.3324	0.1319	0.3033	0.5619
111	Palau	Micronesia	0.5024	0.3264	0.3346	0.8462
171	Papua New Guinea	Melanesia	0.2787	0.2708	0.0875	0.4778
71	Saint Kittis and Nevis	Caribbean	0.6554	0.5347	0.6825	0.7491
119	Saint Lucia	Caribbean	0.466	0.2847	0.411	0.7022
104	Saint Vincent and the Grenadines	Caribbean	0.5306	0.4514	0.4583	0.682
128	Samoa	Polynesia	0.4236	0.3403	0.2064	0.7241
154	Sao Tome and Principe	Middle Africa	0.3424	0.1389	0.3053	0.583
83	Seychelles	Eastern Africa	0.6163	0.6181	0.5008	0.7299
7	Singapore	South-Eastern Asia	0.8812	0.9861	0.8019	0.8557
169	Solomon Islands	Melanesia	0.2816	0.2431	0.1285	0.4732
116	Suriname	South America	0.4773	0.2917	0.4595	0.6808
142	Timor-Leste	South-Eastern Asia	0.3816	0.3125	0.2937	0.5387
109	Tonga	Polynesia	0.5237	0.4722	0.2951	0.8039
78	Trinidad and Tobago	Caribbean	0.644	0.6389	0.5735	0.7195
144	Tuvalu	Polynesia	0.3779	0.2222	0.2693	0.6422
137	Vanuatu	Melanesia	0.399	0.4375	0.192	0.5675

Table 11. E-Government Development Index EGDI of Landlocked Developing Counties(LLDCs)

Rank	Country	Sub-Region	EGDI	Online Service Component	Telecomm. Infrustructure Component	Human Capital Component
177	Afghanistan	Southern Asia	0.2585	0.3056	0.1138	0.3562
87	Armenia	Western Asia	0.5944	0.5625	0.466	0.7547
70	Azerbaijan	Western Asia	0.6574	0.7292	0.5062	0.7369
126	Bhutan	Southern Asia	0.4274	0.5	0.308	0.4743
103	Bolivia(Plurinational State of)	South America	0.5307	0.5625	0.3148	0.7148
127	Botswana	Southern Africa	0.4253	0.2083	0.3982	0.6694
165	Burkina Faso	Western Africa	0.3016	0.5347	0.1603	0.2097
166	Burundi	Eastern Africa	0.2985	0.3056	0.0786	0.5113
188	Central African Republic	Middle Africa	0.1584	0.2083	0.0322	0.2347
190	Chad	Middle Africa	0.1257	0.1458	0.0669	0.1644
141	Eswatini	Southern Africa	0.382	0.375	0.1772	0.5939
151	Ethiopia	Eastern Africa	0.3463	0.6319	0.0976	0.3094
39	Kazakhistan	Central Asia	0.7597	0.8681	0.5723	0.8388
91	Kyrgizistan	Central Asia	0.5835	0.6458	0.3418	0.7628
162	Lao People's Democratic Republic	South-Eastern Asia	0.3056	0.1667	0.2246	0.5254
167	Lesotho	Southern Africa	0.2968	0.1111	0.2468	0.5324
175	Malawi	Eastern Africa	0.2708	0.2569	0.0834	0.472
178	Mali	Western Africa	0.2424	0.2639	0.2074	0.2558
92	Mongolia	Eastern Asia	0.5824	0.5972	0.3602	0.7899
117	Nepal	Southern Asia	0.4748	0.6875	0.2413	0.4957
192	Niger	Western Africa	0.1095	0.1597	0.0795	0.0894
108	Paraguay	South America	0.5255	0.5556	0.3507	0.6701
69	Republic of Moldova	Eastern Europe	0.659	0.7708	0.4787	0.7274
120	Rwanda	Eastern Africa	0.459	0.7222	0.1733	0.4815
191	South Sudan	Eastern Africa	0.1214	0.1111	0.0262	0.2269
131	Tajikistan	Central Asia	0.422	0.3403	0.2254	0.7002
79	The former Yugoslav Republic of Macedonia	Southern Europe	0.6312	0.7153	0.4859	0.6924
147	Turkmenistan	Central Asia	0.3652	0.1319	0.3011	0.6626
135	Uganda	Eastern Africa	0.4055	0.5694	0.1566	0.4906
81	Uzbekistan	Central Asia	0.6207	0.7917	0.3307	0.7396
133	Zambia	Eastern Africa	0.4111	0.4792	0.1853	0.5689
146	Zimbabwe	Eastern Africa	0.3692	0.3264	0.2144	0.5668

Table 12. E-Participation Index (EPI) and its utilisation by stages

Rank	Country	EPI	Total %	Stage 1%	Stage 2%	Stage 3%
145	Afghanistan	0.3202	34.24%	63.33%	21.74%	18.18%
59	Albania	0.7584	76.63%	63.33%	91.30%	72.73%
165	Algeria	0.2022	22.83%	30.00%	34.78%	0.00%
103	Andorra	0.5674	58.15%	70.00%	65.22%	36.36%
125	Angola	0.4326	45.11%	66.67%	47.83%	18.18%
121	Antigua and Barbuda	0.4607	47.83%	56.67%	34.78%	54.55%
87	Argentina	0.6236	63.59%	76.67%	73.91%	36.36%
103	Armenia	0.5674	58.15%	60.00%	52.17%	63.64%
5	Australia	0.9831	98.37%	100.00%	95.65%	100.00%
45	Austria	0.8258	83.15%	90.00%	78.26%	81.82%
79	Azerbaijan	0.6798	69.02%	76.67%	73.91%	54.55%
92	Bahamas	0.618	63.04%	60.00%	65.22%	63.64%
53	Bahrain	0.7978	80.43%	76.67%	82.61%	81.82%
51	Bangladesh	0.8034	80.98%	86.67%	82.61%	72.73%
87	Barbados	0.6236	63.59%	80.00%	56.52%	54.55%
33	Belarus	0.882	88.59%	90.00%	78.26%	100.00%
59	Belgium	0.7584	76.63%	86.67%	78.26%	63.64%
148	Belize	0.2921	31.52%	46.67%	43.48%	0.00%
136	Benin	0.3708	39.13%	53.33%	43.48%	18.18%
111	Bhutan	0.5281	54.35%	60.00%	78.26%	18.18%
99	Bolivia(Plurinational State of)	0.5787	59.24%	63.33%	73.91%	36.36%
125	Bosnia and Herzegovina	0.4326	45.11%	53.33%	52.17%	27.27%
168	Botswana	0.1966	22.28%	43.33%	21.74%	0.00%
12	Brazil	0.9719	97.28%	96.67%	95.65%	100.00%
97	Brunei Darussalam	0.6067	61.96%	83.33%	78.26%	18.18%
35	Bulgaria	0.8708	87.50%	83.33%	95.65%	81.82%
87	Burkina Faso	0.6236	63.59%	73.33%	69.57%	45.45%
147	Burundi	0.309	33.15%	50.00%	30.43%	18.18%
171	Cambodia	0.1742	20.11%	36.67%	21.74%	0.00%
143	Cameroon	0.3258	34.78%	63.33%	30.43%	9.09%
27	Canada	0.9101	91.30%	96.67%	86.96%	90.91%
127	Cabo Verde	0.427	44.57%	66.67%	39.13%	27.27%
151	Central African Republic	0.2753	29.89%	36.67%	26.09%	27.27%
177	Chad	0.1461	17.39%	33.33%	17.39%	0.00%
46	Chile	0.8202	82.61%	96.67%	78.26%	72.73%
29	China	0.9045	90.76%	86.67%	86.96%	100.00%
23	Colombia	0.9213	92.39%	96.67%	82.61%	100.00%
190	Comoros	0.0562	8.70%	16.67%	8.70%	0.00%
169	Congo	0.1854	21.20%	23.33%	21.74%	18.18%
57	Costa Rica	0.7697	77.72%	83.33%	69.57%	81.82%
171	Côte d'Ivoire	0.1742	20.11%	23.33%	26.09%	9.09%
57	Croatia	0.7697	77.72%	63.33%	86.96%	81.82%
150	Cuba	0.2809	30.43%	56.67%	17.39%	18.18%
46	Cyprus	0.8202	82.61%	80.00%	78.26%	90.91%

Table 12. E-Participation Index (EPI) and its utilisation by stages (continued)

Rank	Country	EPI	Total %	Stage 1%	Stage 2%	Stage 3%
92	Czech Republic	0.618	63.04%	73.33%	60.87%	54.55%
193	Democratic People's Republic of Korea	0	3.26%	10.00%	0.00%	0.00%
183	Democratic Republic of the Congo	0.1236	15.22%	36.67%	8.70%	0.00%
1	Denmark	1	100.00%	100.00%	100.00%	100.00%
153	Djibouti	0.2697	29.35%	50.00%	13.04%	27.27%
106	Dominica	0.5562	57.07%	50.00%	65.22%	54.55%
79	Dominican Republic	0.6798	69.02%	73.33%	69.57%	63.64%
81	Ecuador	0.6742	68.48%	70.00%	78.26%	54.55%
109	Egypt	0.5393	55.43%	53.33%	65.22%	45.45%
82	El Salvador	0.6517	66.30%	80.00%	78.26%	36.36%
191	Equatioral Guinea	0.0506	8.15%	20.00%	4.35%	0.00%
192	Eritrea	0.0337	6.52%	20.00%	0.00%	0.00%
27	Estonia	0.9101	91.30%	96.67%	86.96%	90.91%
142	Eswatini	0.3315	35.33%	60.00%	34.78%	9.09%
101	Ethiopia	0.573	58.70%	80.00%	65.22%	27.27%
139	Fiji	0.3483	36.96%	53.33%	30.43%	27.27%
1	Finland	1	100.00%	100.00%	100.00%	100.00%
13	France	0.9663	96.74%	100.00%	91.30%	100.00%
175	Gabon	0.1685	19.57%	33.33%	8.70%	18.18%
149	Gambia	0.2865	30.98%	40.00%	26.09%	27.27%
87	Georgia	0.6236	63.59%	73.33%	69.57%	45.45%
23	Germany	0.9213	92.39%	96.67%	82.61%	100.00%
85	Ghana	0.6292	64.13%	83.33%	69.57%	36.36%
34	Greece	0.8764	88.04%	83.33%	82.61%	100.00%
116	Grenada	0.4888	50.54%	60.00%	39.13%	54.55%
92	Guatemala	0.618	63.04%	66.67%	73.91%	45.45%
138	Guinea	0.3539	37.50%	40.00%	43.48%	27.27%
186	Guinea-Bissau	0.1124	14.13%	33.33%	8.70%	0.00%
140	Guyana	0.3371	35.87%	36.67%	34.78%	36.36%
117	Haiti	0.4831	50.00%	46.67%	56.52%	45.45%
107	Honduras	0.5449	55.98%	70.00%	52.17%	45.45%
69	Hungary	0.7079	71.74%	76.67%	95.65%	36.36%
75	Iceland	0.6854	69.57%	80.00%	65.22%	63.64%
15	India	0.9551	95.65%	100.00%	95.65%	90.91%
92	Indonesia	0.618	63.04%	66.67%	73.91%	45.45%
111	Iran (Islamic Republic of)	0.5281	54.35%	60.00%	56.52%	45.45%
140	Iraq	0.3371	35.87%	60.00%	21.74%	27.27%
22	Ireland	0.9326	93.48%	90.00%	91.30%	100.00%
43	Israel	0.8315	83.70%	86.67%	82.61%	81.82%
15	Italy	0.9551	95.65%	100.00%	95.65%	90.91%
146	Jamaica	0.3146	33.70%	43.33%	30.43%	27.27%
5	Japan	0.9831	98.37%	100.00%	95.65%	100.00%
117	Jordan	0.4831	50.00%	60.00%	52.17%	36.36%
42	Kazakhistan	0.8371	84.24%	86.67%	91.30%	72.73%

Table 12. E-Participation Index (EPI) and its utilisation by stages (continued)

Rank	Country	EPI	Total %	Stage 1%	Stage 2%	Stage 3%
110	Kenya	0.5337	54.89%	66.67%	73.91%	18.18%
157	Kiribati	0.2528	27.72%	46.67%	26.09%	9.09%
72	Kuwait	0.691	70.11%	93.33%	69.57%	45.45%
75	Kyrgizistan	0.6854	69.57%	60.00%	82.61%	63.64%
171	Lao People's Democratic Republic	0.1742	20.11%	33.33%	17.39%	9.09%
75	Latvia	0.6854	69.57%	76.67%	60.87%	72.73%
122	Lebanon	0.4438	46.20%	63.33%	39.13%	36.36%
189	Lesotho	0.0787	10.87%	23.33%	8.70%	0.00%
127	Liberia	0.427	44.57%	50.00%	60.87%	18.18%
183	Libya	0.1236	15.22%	26.67%	17.39%	0.00%
63	Liechtenstein	0.7472	75.54%	86.67%	82.61%	54.55%
51	Lithuania	0.8034	80.98%	86.67%	82.61%	72.73%
19	Luxembourg	0.9382	94.02%	96.67%	86.96%	100.00%
143	Madagascar	0.3258	34.78%	50.00%	34.78%	18.18%
165	Malawi	0.2022	22.83%	40.00%	26.09%	0.00%
32	Malaysia	0.8876	89.13%	93.33%	91.30%	81.82%
129	Maldives	0.4101	42.93%	56.67%	43.48%	27.27%
159	Mali	0.2416	26.63%	43.33%	26.09%	9.09%
39	Malta	0.8483	85.33%	96.67%	78.26%	81.82%
171	Marshall Islands	0.1742	20.11%	36.67%	21.74%	0.00%
170	Mauritania	0.1798	20.65%	30.00%	21.74%	9.09%
72	Mauritius	0.691	70.11%	93.33%	69.57%	45.45%
17	Mexico	0.9438	94.57%	93.33%	91.30%	100.00%
179	Micronesia	0.1404	16.85%	26.67%	21.74%	0.00%
105	Monaco	0.5618	57.61%	80.00%	47.83%	45.45%
65	Mongolia	0.736	74.46%	73.33%	69.57%	81.82%
64	Montenegro	0.7416	75.00%	76.67%	60.87%	90.91%
56	Morocco	0.7753	78.26%	80.00%	73.91%	81.82%
122	Mozambique	0.4438	46.20%	43.33%	56.52%	36.36%
181	Myanmar	0.1348	16.30%	26.67%	13.04%	9.09%
133	Namibia	0.3933	41.30%	63.33%	47.83%	9.09%
177	Nauru	0.1461	17.39%	20.00%	21.74%	9.09%
55	Nepal	0.7809	78.80%	80.00%	82.61%	72.73%
4	Netherlands	0.9888	98.91%	96.67%	100.00%	100.00%
5	New Zealand	0.9831	98.37%	100.00%	95.65%	100.00%
134	Nicaragua	0.3876	40.76%	46.67%	39.13%	36.36%
163	Niger	0.2135	23.91%	30.00%	30.43%	9.09%
117	Nigeria	0.4831	50.00%	63.33%	56.52%	27.27%
11	Norway	0.9775	97.83%	93.33%	100.00%	100.00%
43	Oman	0.8315	83.70%	83.33%	78.26%	90.91%
115	Pakistan	0.5	51.63%	66.67%	65.22%	18.18%
157	Palau	0.2528	27.72%	46.67%	26.09%	9.09%
66	Panama	0.7191	72.83%	86.67%	60.87%	72.73%
165	Papua New Guinea	0.2022	22.83%	40.00%	26.09%	0.00%

Table 12. E-Participation Index (EPI) and its utilisation by stages (continued)

Rank	Country	EPI	Total %	Stage 1%	Stage 2%	Stage 3%
101	Paraguay	0.573	58.70%	70.00%	73.91%	27.27%
36	Peru	0.8652	86.96%	83.33%	86.96%	90.91%
19	Philippines	0.9382	94.02%	100.00%	91.30%	90.91%
31	Poland	0.8933	89.67%	100.00%	86.96%	81.82%
30	Portugal	0.8989	90.22%	96.67%	91.30%	81.82%
67	Qatar	0.7135	72.28%	73.33%	78.26%	63.64%
1	Republic of Korea	1	100.00%	100.00%	100.00%	100.00%
37	Republic of Moldova	0.8596	86.41%	76.67%	91.30%	90.91%
69	Romania	0.7079	71.74%	70.00%	65.22%	81.82%
23	Russian Federation	0.9213	92.39%	93.33%	100.00%	81.82%
59	Rwanda	0.7584	76.63%	83.33%	73.91%	72.73%
98	Saint Kittis and Nevis	0.5843	59.78%	60.00%	56.52%	63.64%
161	Saint Lucia	0.2191	24.46%	36.67%	26.09%	9.09%
113	Saint Vincent and theGrenadines	0.5169	53.26%	50.00%	47.83%	63.64%
155	Samoa	0.264	28.80%	46.67%	21.74%	18.18%
156	San Marino	0.2584	28.26%	53.33%	21.74%	9.09%
176	Sao Tome and Principe	0.1573	18.48%	20.00%	17.39%	18.18%
67	Saudi Arabia	0.7135	72.28%	76.67%	82.61%	54.55%
114	Senegal	0.5056	52.17%	63.33%	47.83%	45.45%
48	Serbia	0.8146	82.07%	73.33%	82.61%	90.91%
84	Seychelles	0.6461	65.76%	63.33%	69.57%	63.64%
129	Sierra Leone	0.4101	42.93%	56.67%	43.48%	27.27%
13	Singapore	0.9663	96.74%	100.00%	91.30%	100.00%
50	Slovakia	0.809	81.52%	80.00%	82.61%	81.82%
48	Slovenia	0.8146	82.07%	90.00%	82.61%	72.73%
163	Solomon Islands	0.2135	23.91%	30.00%	30.43%	9.09%
181	Somalia	0.1348	16.30%	13.33%	17.39%	18.18%
39	South Africa	0.8483	85.33%	96.67%	78.26%	81.82%
188	South Sudan	0.0899	11.96%	26.67%	8.70%	0.00%
5	Spain	0.9831	98.37%	100.00%	95.65%	100.00%
85	Sri Lanka	0.6292	64.13%	73.33%	56.52%	63.64%
179	Sudan	0.1404	16.85%	36.67%	13.04%	0.00%
159	Suriname	0.2416	26.63%	56.67%	21.74%	0.00%
19	Sweden	0.9382	94.02%	100.00%	91.30%	90.91%
41	Switzerland	0.8427	84.78%	90.00%	82.61%	81.82%
137	Syrian Arab Republic	0.3652	38.59%	43.33%	43.48%	27.27%
134	Tajikistan	0.3876	40.76%	36.67%	47.83%	36.36%
82	Thailand	0.6517	66.30%	86.67%	65.22%	45.45%
71	The former Yugoslav Republic of Macedonia"	0.7022	71.20%	76.67%	86.96%	45.45%
153	Timor-Leste	0.2697	29.35%	46.67%	30.43%	9.09%
107	Togo	0.5449	55.98%	70.00%	73.91%	18.18%
120	Tonga	0.4663	48.37%	60.00%	47.83%	36.36%
99	Trinidad and Tobago	0.5787	59.24%	76.67%	69.57%	27.27%
53	Tunisia	0.7978	80.43%	86.67%	73.91%	81.82%

Table 12. E-Participation Index (EPI) and its utilisation by stages (continued)

Rank	Country	EPI	Total %	Stage 1%	Stage 2%	Stage 3%
37	Turkey	0.8596	86.41%	93.33%	91.30%	72.73%
186	Turkmenistan	0.1124	14.13%	23.33%	17.39%	0.00%
161	Tuvalu	0.2191	24.46%	53.33%	4.35%	18.18%
87	Uganda	0.6236	63.59%	70.00%	86.96%	27.27%
75	Ukraine	0.6854	69.57%	63.33%	65.22%	81.82%
17	United Arab Emirates	0.9438	94.57%	96.67%	95.65%	90.91%
5	United Kingoom of Great Britain and Northern Ireland	0.9831	98.37%	100.00%	95.65%	100.00%
92	United Republic of Tanzania	0.618	63.04%	83.33%	73.91%	27.27%
5	United States of America	0.9831	98.37%	100.00%	95.65%	100.00%
26	Uruguay	0.9157	91.85%	93.33%	91.30%	90.91%
59	Uzbekistan	0.7584	76.63%	93.33%	86.96%	45.45%
124	Vanuatu	0.4382	45.65%	60.00%	47.83%	27.27%
131	Venuzuela (Bolivian Republic of)	0.4045	42.39%	46.67%	43.48%	36.36%
72	Viet Nam	0.691	70.11%	83.33%	56.52%	72.73%
185	Yemen	0.118	14.67%	26.67%	8.70%	9.09%
132	Zambia	0.3989	41.85%	56.67%	47.83%	18.18%
151	Zimbabwe	0.2753	29.89%	53.33%	26.09%	9.09%

Table 13. Regional and Economic Groupings for E-Participation Index (EPI)

	EPI	Total	Stage 1	Stage 2	Stage 3
Small Island Developing States	0.3819	0.4020	0.5153	0.3890	0.2948
Landlocked Developing Countries	0.4568	0.4745	0.5740	0.5150	0.3153
Least Developed Countries	0.3270	0.3490	0.4716	0.3617	0.1992
High Income	0.8028	0.8092	0.8655	0.7997	0.7598
Upper Middle Income	0.5443	0.5592	0.6400	0.5565	0.4744
Lower Middle Income	0.4622	0.4798	0.5745	0.5013	0.3494
Low Income	0.3440	0.3654	0.4806	0.3857	0.2141
Africa	0.3566	0.3776	0.5025	0.3929	0.2222
Americas	0.6043	0.6172	0.6876	0.6174	0.5403
Asia	0.6126	0.6252	0.7014	0.6364	0.5280
Europe	0.8103	0.8165	0.8488	0.8140	0.7844
Oceania	0.3632	0.3839	0.5143	0.3696	0.2597
World	0.5654	0.5796	0.6625	0.5850	0.4823

Table 14. Telecommunication Infrastructure Index (TII) and its components

Country	TII	Fixed telephone subscritions per 100 inhabitants	Mobile cellular telephone subscriptions per 100 inhabitants	Percentage of Individuals using the Internet	Fixed (wired) broadband subscriptions per 100 inhabitants	Active mobile-broadband subscriptions per 100 inhabitants
Afghanistan	0.1138	0.33	62.33	10.6	0.03	13.47
Albania	0.4318	8.5	115.15	66.36	9.1	57.63
Algeria	0.3889	8.38	115.85	42.95	7.04	65.7
Andorra	0.7220	50.07	92.04	97.93	42.04	50.47
Angola	0.0972	1.06	45.12	13	0.43	13.97
Antigua and Barbuda	0.5617	22.29	178.28	73	9.17	40.61
Argentina	0.5927	22.67	145.33	70.97	16.49	78.05
Armenia	0.4660	18.18	117.43	67	10.23	52.87
Australia	0.7436	33.91	110.05	88.24	30.56	130.75
Austria	0.7716	40.95	163.79	84.32	28.96	87.07
Azerbaijan	0.5062	17.48	104.77	78.2	18.55	56.21
Bahamas	0.5393	30.95	92.07	80	21.41	51.3
Bahrain	0.8466	19.64	210.14	98	16.29	157.34
Bangladesh	0.1976	0.47	83.45	18.25	4.05	27.07
Barbados	0.6719	49.02	116.57	79.55	32.44	45.3
Belarus	0.6881	47.63	120.67	71.11	32.36	67.53
Belgium	0.6930	38.48	110.5	86.52	37.6	65.86
Belize	0.2247	6.27	61.86	44.58	6	13.39
Benin	0.1418	1.15	81.79	11.99	0.2	8.11
Bhutan	0.3080	2.64	87.54	41.77	2.07	68.41
Bolivia(Plurinational State of)	0.3148	7.97	92.82	39.7	2.64	56.58
Bosnia and Herzegovina	0.4385	21.18	96.79	54.74	18.84	40.51
Botswana	0.3982	6.32	146.16	39.36	2.62	62.63
Brazil	0.5220	20.15	117.54	60.87	12.88	88.47
Brunei Darussalam	0.6066	17.54	123.69	90	8.53	119.5
Bulgaria	0.5785	20.74	125.83	59.83	23.8	87.39
Burkina Faso	0.1603	0.41	82.61	13.96	0.05	19.64
Burundi	0.07860	0.19	50.91	5.17	0.04	8.79
Cambodia	0.3132	1.44	126.35	32.4	0.61	50.76
Cameroon	0.1790	4.48	79.86	25	0.2	10.51
Canada	0.6724	41.76	84.74	89.84	36.89	68.81
Cabo Verde	0.3926	12	111.56	50.32	2.88	66.55
Central African Republic	0.0322	0.04	27.17	4	0.02	3.5
Chad	0.0669	0.1	43.11	5	0.07	9.22
Chile	0.5377	18.84	130.11	66.01	16.22	72.11
China	0.4735	14.72	97.25	53.2	22.99	69.37
Colombia	0.4412	14.63	120.62	58.14	12.15	46.87
Comoros	0.0871	1.64	57.11	7.94	0.36	0
Congo	0.1889	0.33	105.82	8.12	0.01	23.41
Costa Rica	0.6343	17.5	171.51	66.03	13.1	108.05

Table 14. Telecommunication Infrastructure Index (TII) and its components (continued)

Country	TII	Fixed telephone subscritions per 100 inhabitants	Mobile cellular telephone subscriptions per 100 inhabitants	Percentage of Individuals using the Internet	Fixed (wired) broadband subscriptions per 100 inhabitants	Active mobile-broadband subscriptions per 100 inhabitants
Côte d'Ivoire	0.2748	1.22	115.85	26.53	0.58	43.72
Croatia	0.6051	34.08	104.77	72.7	24.77	77.22
Cuba	0.1455	11.52	34.75	38.77	0.13	0
Cyprus	0.7279	37.72	133.42	75.9	32.77	96.69
Czech Republic	0.5971	16.57	117.66	76.48	28.93	80.39
Democratic People's Republic of Korea	0.0327	4.65	12.9	0	0	14.21
Democratic Republic of the Congo	0.0645	0	36.69	6.21	0.001	13.18
Denmark	0.7978	27.26	122.29	96.97	42.54	123.57
Djibouti	0.0961	2.65	36.64	13.13	2.87	11.25
Dominica	0.4775	18.12	106.66	67.03	21.06	40.71
Dominican Republic	0.3655	12.63	81.78	61.33	7.21	49.77
Ecuador	0.3699	14.96	84.73	54.06	9.79	46.93
Egypt	0.3222	6.39	102.2	41.25	4.67	47.28
El Salvador	0.3810	14.71	151.89	29	6.23	29.08
Equatioral Guinea	0.1010	0.9	47.13	23.78	0.28	0.25
Eritrea	0	1.33	10.21	1.18	0.01	0
Estonia	0.7613	28.24	144.61	87.24	30.22	121.61
Eswatini	0.1772	3.13	74.08	28.57	0.52	12.59
Ethiopia	0.0976	1.12	50.02	15.37	0.55	5.23
Fiji	0.3562	8.25	116.24	46.51	1.37	54.3
Finland	0.7284	8.31	133.85	87.7	31.11	152.31
France	0.7979	60.27	104.4	85.62	42.74	82.45
Gabon	0.4250	0.96	149.64	48.05	0.76	83.36
Gambia	0.2627	1.86	139.23	18.5	0.18	21.2
Georgia	0.5403	21.24	140.95	58.01	17.57	64.03
Germany	0.7952	53.84	126.31	89.65	39.07	77.03
Ghana	0.3558	0.89	135.8	34.67	0.31	69.64
Greece	0.6439	46.5	112.12	69.09	32.32	51.05
Grenada	0.4658	24.95	110.86	55.86	19.4	32.85
Guatemala	0.2941	14.8	110.14	34.51	3.05	13.93
Guinea	0.1513	0	87.13	9.8	0.01	15.33
Guinea-Bissau	0.1028	0	70.82	3.76	0.04	6.95
Guyana	0.2541	18.31	75.61	35.66	7.4	0.24
Haiti	0.1078	0.05	59.96	12.23	0.01	10.19
Honduras	0.2268	4.86	85.95	30	2.42	23.3
Hungary	0.6071	31.99	120.78	79.26	28.86	45.09
Iceland	0.8292	49.5	120.8	98.24	38.51	106.45
India	0.2009	1.84	85.17	29.55	1.41	16.41
Indonesia	0.3222	4.12	147.66	25.37	2	33.91

Table 14. Telecommunication Infrastructure Index (TII) and its components (continued)

Country	TII	Fixed telephone subscritions per 100 inhabitants	Mobile cellular telephone subscriptions per 100 inhabitants	Percentage of Individuals using the Internet	Fixed (wired) broadband subscriptions per 100 inhabitants	Active mobile-broadband subscriptions per 100 inhabitants
Iran (Islamic Republic of)	0.4566	38.24	100.3	53.23	11.61	33.85
Iraq	0.1840	5.46	81.19	21.23	0.01	16.24
Ireland	0.6970	40.14	103.15	85.01	28.78	100.8
Israel	0.7095	40.78	129.03	79.65	27.56	91.55
Italy	0.6771	34.1	153	61.32	26.19	88.06
Jamaica	0.3941	10.77	113.4	45	9.93	55.16
Japan	0.8406	50.18	130.61	93.18	31.16	131.12
Jordan	0.4406	4.27	103.84	62.3	4.83	103.84
Kazakhistan	0.5723	21.85	141.96	74.59	13.06	74.23
Kenya	0.1901	0.15	80.44	26	0.33	25.89
Kiribati	0.0773	0.57	45.46	13.7	0.06	0.87
Kuwait	0.7394	9.95	133.07	78.37	2.5	254.42
Kyrgizistan	0.3418	6.42	127.84	34.5	4.04	44.86
Lao People's Democratic Republic	0.2246	18.74	58.57	21.87	0.36	36.65
Latvia	0.6188	18.42	134.5	79.84	26.35	76.34
Lebanon	0.5219	30.24	81.42	76.11	21.64	56.8
Lesotho	0.2468	1.87	103.59	27.36	0.1	35.9
Liberia	0.1036	0.17	67.56	7.32	0.17	5.25
Libya	0.3353	21.84	121.72	20.27	2.68	35.42
Liechtenstein	0.8389	43.5	117.61	98.09	42.31	119.48
Lithuania	0.6293	18.25	144.58	74.38	29.49	71.71
Luxembourg	0.7964	48.01	132.7	98.14	35.28	83.72
Madagascar	0.0499	0.6	32.13	4.71	0.11	8.12
Malawi	0.0834	0.06	39.68	9.61	0.05	18.21
Malaysia	0.5647	15.51	140.8	78.79	8.72	91.49
Maldives	0.5159	4.94	189.86	59.09	6.85	61.94
Mali	0.2074	1.12	112.35	11.11	0.12	23.18
Malta	0.7657	54.59	123.94	77.29	39.89	71.93
Marshall Islands	0.1037	4.46	29.25	29.79	1.88	0
Mauritania	0.1878	1.24	84.03	18	0.25	29.34
Mauritius	0.5435	30.86	143.73	52.19	16.84	51.56
Mexico	0.4173	16.04	87.6	59.54	12.58	58.86
Micronesia	0.1118	6.56	22.31	33.35	3.02	0
Monaco	1	120.98	86.49	95.21	48.35	75.05
Mongolia	0.3602	7.44	111.24	22.27	7.47	80.28
Montenegro	0.6059	23.55	165.56	69.88	18.27	59.97
Morocco	0.3697	5.87	117.68	58.27	3.56	44.84
Mozambique	0.1398	0.29	52.12	17.52	0.16	32.77
Myanmar	0.2565	0.97	95.65	25.07	0.17	56.3
Namibia	0.3230	7.58	107.27	31.03	2.59	64.98

Table 14. Telecommunication Infrastructure Index (TII) and its components (continued)

Country	TII	Fixed telephone subscritions per 100 inhabitants	Mobile cellular telephone subscriptions per 100 inhabitants	Percentage of Individuals using the Internet	Fixed (wired) broadband subscriptions per 100 inhabitants	Active mobile-broadband subscriptions per 100 inhabitants
Nauru	0.3033	0	87.25	54	9.48	32.61
Nepal	0.2413	2.96	110.83	19.69	0.77	30.54
Netherlands	0.7758	39.88	122.97	90.41	42.28	88.4
New Zealand	0.7455	37.76	124.44	88.47	32.84	100.84
Nicaragua	0.2825	5.96	125.94	24.57	2.88	23.47
Niger	0.0795	0.78	42.18	4.32	0.13	18.33
Nigeria	0.1883	0.08	82.98	25.67	0.06	23.27
Norway	0.7131	15.34	109.04	97.3	40.35	111.38
Oman	0.5310	9.55	155.18	69.93	6.43	91.46
Pakistan	0.1529	1.61	70.65	15.51	0.85	19.9
Palau	0.334	33.84	111.53	26.97	5.75	0
Panama	0.4543	15.91	127.46	54	9.59	59.18
Papua New Guinea	0.0875	1.9	46.78	9.6	0.21	8.89
Paraguay	0.3507	5.21	111.36	51.35	3.56	49.38
Peru	0.3913	9.68	116.24	45.46	6.67	61.61
Philippines	0.3547	3.71	109.37	55.5	5.47	46.36
Poland	0.5805	21.3	138.66	73.3	19.17	68.59
Portugal	0.6617	46.16	111.57	70.42	32.55	62.45
Qatar	0.6797	18.18	142.13	94.29	9.87	139.92
Republic of Korea	0.8496	55.2	120.68	92.84	40.47	109.69
Republic of Moldova	0.4787	28.85	93.32	71	13.73	47.28
Romania	0.5471	20.78	115.78	59.5	22.49	80.19
Russian Federation	0.6219	22.42	159.15	73.09	19.12	73.7
Rwanda	0.1733	0.11	74.86	20	0.18	28.92
Saint Kittis and Nevis	0.6825	31.8	139.7	76.82	29.92	78.66
Saint Lucia	0.4110	19.97	99.23	46.73	16.73	38.74
aint Vincent and the Grenadines	0.4583	18.74	102.74	55.57	19.94	49.32
Samoa	0.2064	4.96	77.39	29.41	1.11	22.51
San Marino	0.7075	48.19	110.14	49.6	36.14	110.14
Sao Tome and Principe	0.3053	2.87	89.06	28	0.71	87.66
Saudi Arabia	0.5334	11.27	148.51	73.75	10.19	74
Senegal	0.2240	1.86	98.54	25.66	0.64	26.04
Serbia	0.6208	37.53	130.24	67.06	20.78	72.81
Seychelles	0.5008	22.11	161.16	56.51	14.89	22.64
Sierra Leone	0.1597	0.23	84.9	11.77	0	20.38
Singapore	0.8019	35.54	150.48	81	25.99	148.44
Slovakia	0.5964	15.13	128.39	80.48	24.55	78.99
Slovenia	0.6231	35.2	114.82	75.5	28.31	62.3
Solomon Islands	0.1285	1.24	69.5	11	0.27	12.86
Somalia	0.0586	0.34	46.47	1.88	0.64	1.96

Table 14. Telecommunication Infrastructure Index (TII) and its components (continued)

Country	TII	Fixed telephone subscritions per 100 inhabitants	Mobile cellular telephone subscriptions per 100 inhabitants	Percentage of Individuals using the Internet	Fixed (wired) broadband subscriptions per 100 inhabitants	Active mobile-broadband subscriptions per 100 inhabitants
South Africa	0.4231	8.07	147.13	54	2.05	56.34
South Sudan	0.0262	0	22.08	6.68	0	1.15
Spain	0.6986	42.36	111.16	80.56	30.45	89.55
Sri Lanka	0.3136	11.92	124.03	32.05	4.29	19.19
Sudan	0.1780	0.34	70.26	28	0.07	25.78
Suriname	0.4595	15.94	144.51	45.4	12.75	47.29
Sweden	0.7835	31.56	127.5	89.65	37.41	123.41
Switzerland	0.8428	47.23	133.81	89.13	45.13	100.56
Syrian Arab Republic	0.2532	18.8	72.43	31.87	5.48	12.84
Tajikistan	0.2254	5.36	107.61	20.47	0.07	18.29
Thailand	0.5338	6.83	173.78	47.5	10.48	92.9
The former Yugoslav Republic of Macedonia	0.4859	17.7	98.52	72.16	18.33	57.14
Timor-Leste	0.2937	0.21	117.61	25.25	0.08	60.75
Togo	0.1353	0.44	72.38	11.31	0.59	15.02
Tonga	0.2951	10.27	74.68	39.95	2.8	56.01
Trinidad and Tobago	0.5735	19.94	158.67	73.3	18.72	46.73
Tunisia	0.4066	8.55	125.25	49.6	5.62	62.68
Turkey	0.4298	13.93	94.4	58.35	13.21	65.07
Turkmenistan	0.3011	11.74	151.43	17.99	0.07	13.62
Tuvalu	0.2693	18.02	68.49	46.01	9.01	0
Uganda	0.1566	0.89	55.05	21.88	0.26	33.69
Ukraine	0.4364	20.14	135.2	52.48	12.22	23.01
United Arab Emirates	0.8564	24.66	214.73	90.6	14	164.89
United Kingoom of Great Britain and Northern Ireland	0.8004	50.94	119.98	94.78	38.29	89.23
United Republic of Tanzania	0.1403	0.23	72.06	13	3.33	8.94
United States of America	0.7564	37.72	122.88	76.18	33	127
Uruguay	0.6967	32.33	148.57	66.4	26.76	101.88
Uzbekistan	0.3307	10.85	73.98	46.79	8.73	53.47
Vanuatu	0.1920	1.68	80.84	24	1.66	22.19
Venuzuela (Bolivian Republic of)	0.4148	24.27	87.43	60	8.27	50.53
Viet Nam	0.3890	5.92	127.53	46.5	9.61	46.44
Yemen	0.1454	4.23	59.57	24.58	1.56	5.72
Zambia	0.1853	0.61	72.43	25.51	0.19	31.08
Zimbabwe	0.2144	1.89	79.74	23.12	1.06	41.63

Note: Last accessed in December 2017

Source: International Telecommunications Union (ITU)

Table 15. Human Capital Index (HCI) and its components

		Adult Literacy (%)			Gross Enrollment Ratio			Expected Year of Schooling			Mean Year of Schooling		
Country	HCI	Index Value	Year	Source	Index Value	Year	Source	Index Value	Year	Source	Index Value	Year	Source
Afghanistan	0.3562	38.2	2015	UNDP (HDI)	69.52	2014	UNESCO	10.77	2014	UNESCO	3.5	2015	UNDP (HDI)
Albania	0.7877	97.6	2015	UNDP (HDI)	86.39	2015	UNESCO	15.52	2015	UNESCO	9.6	2015	UNDP (HDI)
Algeria	0.6640	80.2	2015	UNDP (HDI)	80.97	2011	UNESCO	14.4	2015	UNDP (HDI)	7.8	2015	UNDP (HDI)
Andorra	0.7309	100.00	2016	UNESCO	69	2014	UNESCO	13.5	2012	UNDP (HDI)	10.3	2015	UNDP (HDI)
Angola	0.5060	71.1	2015	UNDP (HDI)	67.10	2011	UNESCO	11.4	2012	UNDP (HDI)	5	2015	UNDP (HDI)
Antigua and Barbuda	0.7518	99.0	2013	UNDP (HDI)	82.03	2012	UNESCO	13.95	2015	UNDP (HDI)	9.2	2015	UNDP (HDI)
Argentina	0.8579	98.1	2015	UNDP (HDI)	101.05	2014	UNESCO	17.29	2014	UNESCO	9.8	2015	UNDP (HDI)
Armenia	0.7547	99.8	2015	UNDP (HDI)	74.48	2015	UNESCO	13.19	2015	UNESCO	11.3	2015	UNDP (HDI)
Australia	1	99	2014	UNESCO	116.23	2014	UNESCO	20.47	2014	UNESCO	13.2	2015	UNDP (HDI)
Austria	0.8505	99	2014	UNESCO	95.64	2015	UNESCO	16.04	2015	UNESCO	11.3	2015	UNDP (HDI)
Azerbaijan	0.7369	99.79	2016	UNESCO	71.11	2012	UNESCO	12.7	2014	UNDP (HDI)	11.2	2015	UNDP (HDI)
Bahamas	0.7249	95.80	2014	UNESCO	74	2014	UNESCO	12.7	2015	UNDP (HDI)	10.9	2015	UNDP (HDI)
Bahrain	0.7897	95.7	2015	UNDP (HDI)	88.54	2015	UNESCO	15.95	2015	UNESCO	9.4	2015	UNDP (HDI)
Bangladesh	0.4763	72.76	2016	UNESCO	59.22	2011	UNESCO	10.2	2015	UNDP (HDI)	5.2	2015	UNDP (HDI)
Barbados	0.8301	99.7	2014	UNESCO	95.74	2011	UNESCO	15.29	2015	UNESCO	10.5	2015	UNDP (HDI)
Belarus	0.8681	99.7	2015	UNDP (HDI)	99.93	2015	UNESCO	15.60	2015	UNESCO	12	2015	UNDP (HDI)
Belgium	0.9740	99	2014	UNESCO	119.38	2015	UNESCO	19.98	2015	UNESCO	11.4	2015	UNDP (HDI)
Belize	0.6765	82.7	2015	UNDP (HDI)	75.97	2015	UNESCO	12.82	2015	UNESCO	10.5	2015	UNDP (HDI)
Benin	0.3653	38.4	2015	UNDP (HDI)	73.10	2013	UNESCO	10.7	2015	UNDP (HDI)	3.5	2015	UNDP (HDI)
Bhutan	0.4743	64.9	2015	UNDP (HDI)	68.25	2013	UNESCO	12.52	2013	UNESCO	3.1	2015	UNDP (HDI)
Bolivia (Plurinational State of)	0.7148	95.7	2015	UNDP (HDI)	79.25	2007	UNESCO	13.8	2015	UNDP (HDI)	8.2	2015	UNDP (HDI)
Bosnia and Herzegovina	0.7217	98.5	2015	UNDP (HDI)	71	2014	UNESCO	14.2	2015	UNDP (HDI)	9	2015	UNDP (HDI)
Botswana	0.6694	88.5	2015	UNDP (HDI)	73.58	2008	UNESCO	12.6	2015	UNDP (HDI)	9.2	2015	UNDP (HDI)
Brazil	0.7525	92.6	2015	UNDP (HDI)	91.08	2015	UNESCO	15.40	2015	UNESCO	7.8	2015	UNDP (HDI)
Brunei Darussalam	0.7480	96.4	2015	UNDP (HDI)	80.91	2015	UNESCO	14.74	2015	UNESCO	9	2015	UNDP (HDI)
Bulgaria	0.8106	98.4	2015	UNDP (HDI)	90.53	2015	UNESCO	14.94	2015	UNESCO	10.8	2015	UNDP (HDI)
Burkina Faso	0.2097	36	2015	UNDP (HDI)	46.54	2013	UNESCO	7.70	2013	UNESCO	1.4	2015	UNDP (HDI)
Burundi	0.5113	85.6	2015	UNDP (HDI)	64.23	2014	UNESCO	10.6	2015	UNDP (HDI)	3	2015	UNDP (HDI)
Cambodia	0.5626	77.2	2015	UNDP (HDI)	84.49	2010	UNESCO	10.9	2015	UNDP (HDI)	4.7	2015	UNDP (HDI)
Cameroon	0.5618	75	2015	UNDP (HDI)	71.95	2015	UNESCO	12.19	2015	UNESCO	6.1	2015	UNDP (HDI)
Canada	0.8744	99	2014	UNESCO	93.04	2000	UNESCO	16.3	2015	UNDP (HDI)	13.1	2015	UNDP (HDI)

Table 15. Human Capital Index (HCI) and its components (continued)

		Adult Literacy (%)			Gross Enrollment Ratio			Expected Year of Schooling			Mean Year of Schooling		
Country	HCI	Index Value	Year	Source	Index Value	Year	Source	Index Value	Year	Source	Index Value	Year	Source
Cabo Verde	0.6152	87.6	2015	UNDP (HDI)	75.77	2015	UNESCO	13.19	2015	UNESCO	4.8	2015	UNDP (HDI)
Central African Republic	0.2347	36.8	2015	UNDP (HDI)	42.49	2013	UNESCO	7.10	2012	UNESCO	4.2	2015	UNDP (HDI)
Chad	0.1644	22.31	2016	UNESCO	46.19	2011	UNESCO	7.30	2011	UNESCO	2.3	2015	UNDP (HDI)
Chile	0.8339	97.3	2015	UNDP (HDI)	97.17	2015	UNESCO	16.48	2015	UNESCO	9.9	2015	UNDP (HDI)
China	0.7088	95.12	2010	UNESCO	79.97	2015	UNESCO	14.01	2015	UNESCO	7.6	2015	UNDP (HDI)
Colombia	0.7382	94.7	2015	UNDP (HDI)	89.41	2015	UNESCO	14.42	2015	UNESCO	7.6	2015	UNDP (HDI)
Comoros	0.5166	77.8	2015	UNDP (HDI)	64.45	2014	UNESCO	11.09	2014	UNESCO	4.8	2015	UNDP (HDI)
Congo	0.5515	79.3	2015	UNDP (HDI)	67.02	2012	UNESCO	11.1	2015	UNDP (HDI)	6.3	2015	UNDP (HDI)
Costa Rica	0.7933	97.8	2015	UNDP (HDI)	95.07	2015	UNESCO	15.22	2015	UNESCO	8.7	2015	UNDP (HDI)
Côte d'Ivoire	0.3357	43.1	2015	UNDP (HDI)	55.25	2015	UNESCO	9.20	2015	UNESCO	5	2015	UNDP (HDI)
Croatia	0.8196	99.3	2015	UNDP (HDI)	89.24	2015	UNESCO	15.14	2015	UNESCO	11.2	2015	UNDP (HDI)
Cuba	0.7862	99.7	2015	UNDP (HDI)	80.22	2015	UNESCO	13.81	2015	UNESCO	11.8	2015	UNDP (HDI)
Cyprus	0.8083	99.1	2015	UNDP (HDI)	85.67	2015	UNESCO	14.57	2015	UNESCO	11.7	2015	UNDP (HDI)
Czech Republic	0.8752	99	2014	UNESCO	94.21	2015	UNESCO	16.94	2015	UNESCO	12.3	2015	UNDP (HDI)
Democratic People's Republic of Korea	0.6150	100	2015	UNDP (HDI)	66.94	2015	UNESCO	10.96	2015	UNESCO	5.47	2017	estimation
Democratic Republic of the Congo	0.5108	77.04	2016	UNESCO	59.45	2013	UNESCO	9.8	2015	UNDP (HDI)	6.8	2016	UNESCO
Denmark	0.9472	99.00	2014	UNESCO	105.71	2015	UNESCO	19.30	2015	UNESCO	12.7	2015	UNDP (HDI)
Djibouti	0.3325	70.30	2014	UNESCO	36.81	2011	UNESCO	6.29	2011	UNESCO	4.1	2015	UNDP (HDI)
Dominica	0.6497	88.00	2014	UNESCO	73.00	2014	UNESCO	12.8	2015	UNDP (HDI)	7.9	2015	UNDP (HDI)
Dominican Republic	0.6927	91.8	2015	UNDP (HDI)	79.54	2015	UNESCO	13.75	2015	UNESCO	7.7	2015	UNDP (HDI)
Ecuador	0.7395	94.35	2016	UNESCO	88.87	2013	UNESCO	14.0	2015	UNDP (HDI)	8.3	2015	UNDP (HDI)
Egypt	0.6072	75.2	2015	UNDP (HDI)	78.01	2014	UNESCO	13.10	2014	UNESCO	7.1	2015	UNDP (HDI)
El Salvador	0.6345	88.4	2015	UNDP (HDI)	74.17	2015	UNESCO	12.89	2015	UNESCO	6.5	2015	UNDP (HDI)
Equatioral Guinea	0.5397	95.3	2015	UNDP (HDI)	55.00	2014	UNESCO	9.2	2015	UNDP (HDI)	5.5	2015	UNDP (HDI)
Eritrea	0.3179	73.8	2015	UNDP (HDI)	32.76	2014	UNESCO	5.35	2014	UNESCO	3.9	2015	UNDP (HDI)
Estonia	0.8818	99.8	2015	UNDP (HDI)	97.83	2015	UNESCO	16.35	2015	UNESCO	12.5	2015	UNDP (HDI)
Eswatini	0.5939	87.5	2015	UNDP (HDI)	66.73	2011	UNESCO	11.41	2013	UNESCO	6.8	2015	UNDP (HDI)
Ethiopia	0.3094	49.1	2015	UNDP (HDI)	54.59	2012	UNESCO	8.44	2012	UNESCO	2.6	2015	UNDP (HDI)
Fiji	0.7899	94.40	2014	UNESCO	88.0		UNDP	15.3	2015	UNDP (HDI)	10.5	2015	UNDP (HDI)

Table 15. Human Capital Index (HCI) and its components (continued)

		Adult Literacy (%)			Gross Enrollment Ratio			Expected Year of Schooling			Mean Year of Schooling		
Country	HCI	Index Value	Year	Source	Index Value	Year	Source	Index Value	Year	Source	Index Value	Year	Source
Finland	0.9509	99.00	2014	UNESCO	115.41	2015	UNESCO	19.34	2015	UNESCO	11.2	2015	UNDP (HDI)
France	0.8598	99.00	2014	UNESCO	96.15	2014	UNESCO	16.27	2014	UNESCO	11.6	2015	UNDP (HDI)
Gabon	0.6398	83.2	2015	UNDP (HDI)	76.15	2001	UNESCO	12.6	2015	UNDP (HDI)	8.1	2015	UNDP (HDI)
Gambia	0.3539	55.5	2015	UNDP (HDI)	55.70	2010	UNESCO	8.9	2015	UNDP (HDI)	3.3	2015	UNDP (HDI)
Georgia	0.8333	99.8	2015	UNDP (HDI)	86.33	2015	UNESCO	15.44	2015	UNESCO	12.2	2015	UNDP (HDI)
Germany	0.9036	99.00	2014	UNESCO	97.87	2015	UNESCO	17.29	2015	UNESCO	13.2	2015	UNDP (HDI)
Ghana	0.5669	76.6	2015	UNDP (HDI)	68.60	2015	UNESCO	11.92	2015	UNESCO	6.9	2015	UNDP (HDI)
Greece	0.8867	97.7	2015	UNDP (HDI)	105.78	2014	UNESCO	17.78	2014	UNESCO	10.5	2015	UNDP (HDI)
Grenada	0.8202	96.00	2005	UNDP	99.79	2015	UNESCO	16.72	2015	UNESCO	8.6	2015	UNDP (HDI)
Guatemala	0.5524	79.3	2015	UNDP (HDI)	68.61	2013	UNESCO	10.88	2015	UNESCO	6.3	2015	UNDP (HDI)
Guinea	0.2406	30.4	2015	UNDP (HDI)	53.11	2014	UNESCO	8.82	2014	UNESCO	2.6	2015	UNDP (HDI)
Guinea-Bissau	0.3869	59.9	2015	UNDP (HDI)	62.46	2006	UNESCO	9.2	2015	UNDP (HDI)	2.9	2015	UNDP (HDI)
Guyana	0.6102	88.5	2015	UNDP (HDI)	68.54	2012	UNESCO	10.35	2012	UNESCO	8.4	2015	UNDP (HDI)
Haiti	0.3620	60.7	2015	UNDP (HDI)	39.40	2014	UNESCO	9.1	2015	UNDP (HDI)	5.2	2015	UNDP (HDI)
Honduras	0.6015	88.99	2016	UNESCO	70.23	2015	UNESCO	11.52	2015	UNESCO	6.2	2015	UNDP (HDI)
Hungary	0.8364	99	2015	UNDP (HDI)	90.17	2015	UNESCO	15.37	2015	UNESCO	12	2015	UNDP (HDI)
Iceland	0.9365	99.00	2014	UNESCO	102.56	2013	UNESCO	19.63	2013	UNESCO	12.2	2015	UNDP (HDI)
India	0.5484	72.1	2015	UNDP (HDI)	71.21	2015	UNESCO	11.96	2015	UNESCO	6.3	2015	UNDP (HDI)
Indonesia	0.6857	95.38	2016	UNESCO	76.26	2015	UNESCO	12.77	2015	UNESCO	7.9	2015	UNDP (HDI)
Iran (Islamic Republic of)	0.7364	86.8	2015	UNDP (HDI)	90.34	2015	UNESCO	14.93	2015	UNESCO	8.8	2015	UNDP (HDI)
Iraq	0.5094	79.7	2015	UNDP (HDI)	54.48	2000	UNESCO	10.1	2015	UNDP (HDI)	6.6	2015	UNDP (HDI)
Ireland	0.9626	99.2	2015	UNDP (HDI)	111.54	2015	UNESCO	19.65	2015	UNESCO	12.3	2015	UNDP (HDI)
Israel	0.8635	97.76	2011	UNESCO	94.07	2015	UNESCO	16.01	2015	UNESCO	12.8	2015	UNDP (HDI)
Italy	0.8341	98.85	2011	UNESCO	90.86	2015	UNESCO	16.22	2015	UNESCO	10.9	2015	UNDP (HDI)
Jamaica	0.6957	88.7	2015	UNDP (HDI)	79.86	2004	UNESCO	12.8	2015	UNDP (HDI)	9.6	2015	UNDP (HDI)

Table 15. Human Capital Index (HCI) and its components (continued)

Country	HCI	Adult Literacy (%)			Gross Enrollment Ratio			Expected Year of Schooling			Mean Year of Schooling		
		Index Value	Year	Source	Index Value	Year	Source	Index Value	Year	Source	Index Value	Year	Source
Japan	0.8428	99.00	2014	UNESCO	89.84	2014	UNESCO	15.36	2014	UNESCO	12.5	2015	UNDP (HDI)
Jordan	0.7387	96.7	2015	UNDP (HDI)	80.17	2012	UNESCO	13.1	2015	UNDP (HDI)	10.1	2015	UNDP (HDI)
Kazakhistan	0.8388	99.8	2015	UNDP (HDI)	93.73	2016	UNESCO	15.01	2016	UNESCO	11.7	2015	UNDP (HDI)
Kenya	0.5472	78	2015	UNDP (HDI)	67.22	2009	UNESCO	11.1	2015	UNDP (HDI)	6.3	2015	UNDP (HDI)
Kiribati	0.6591	93.00	2014	UN E-GOV Survey	75.14	2008	UNESCO	11.9	2015	UNDP (HDI)	7.8	2015	UNDP (HDI)
Kuwait	0.6852	96.2	2015	UNDP (HDI)	75.24	2013	UNESCO	13.3	2015	UNDP (HDI)	7.3	2015	UNDP (HDI)
Kyrgizistan	0.7628	99.5	2015	UNDP (HDI)	81.19	2015	UNESCO	13.13	2015	UNESCO	10.8	2015	UNDP (HDI)
Lao People's Democratic Republic	0.5254	79.9	2015	UNDP (HDI)	63.54	2015	UNESCO	10.91	2015	UNESCO	5.2	2015	UNDP (HDI)
Latvia	0.8131	99.9	2015	UNDP (HDI)	93.35	2014	UNESCO	13.36	2015	UNESCO	11.7	2015	UNDP (HDI)
Lebanon	0.6649	93.9	2015	UNDP (HDI)	63.43	2015	UNESCO	13.3	2015	UNDP (HDI)	8.6	2015	UNDP (HDI)
Lesotho	0.5324	79.4	2015	UNDP (HDI)	62.79	2014	UNESCO	10.74	2014	UNESCO	6.1	2015	UNDP (HDI)
Liberia	0.3772	47.6	2015	UNDP (HDI)	63.92	2000	UNESCO	9.9	2015	UNDP (HDI)	4.4	2015	UNDP (HDI)
Libya	0.7173	91	2015	UNDP (HDI)	94.38	2003	UNESCO	13.4	2015	UNDP (HDI)	7.3	2015	UNDP (HDI)
Liechtenstein	0.8237	99.00	2014	UN E-GOV Survey	86.91	2015	UNESCO	14.71	2015	UNESCO	12.4	2015	UNDP (HDI)
Lithuania	0.8323	99.8	2015	UNDP (HDI)	94.82	2014	UNESCO	13.41	2015	UNESCO	12.7	2015	UNDP (HDI)
Luxembourg	0.7803	99.00	2014	UNESCO	77.31	2012	UNESCO	13.9	2015	UNDP (HDI)	12	2015	UNDP (HDI)
Madagascar	0.4822	64.7	2015	UNDP (HDI)	66.20	2014	UNESCO	10.50	2014	UNESCO	6.1	2015	UNDP (HDI)
Malawi	0.4720	65.8	2015	UNDP (HDI)	69.12	2011	UNESCO	10.72	2011	UNESCO	4.4	2015	UNDP (HDI)
Malaysia	0.6987	94.6	2015	UNDP (HDI)	68.93	2015	UNESCO	12.93	2015	UNESCO	10.1	2015	UNDP (HDI)
Maldives	0.6754	99.3	2015	UNDP (HDI)	76.76	2003	UNESCO	12.7	2015	UNDP (HDI)	6.2	2015	UNDP (HDI)
Mali	0.2558	38.7	2015	UNDP (HDI)	51.08	2011	UNESCO	8.4	2015	UNDP (HDI)	2.3	2015	UNDP (HDI)
Malta	0.7973	94.1	2015	UNDP (HDI)	85.04	2015	UNESCO	15.59	2015	UNESCO	11.3	2015	UNDP (HDI)
Marshall Islands	0.7301	98.27	2011	UNESCO	74.62	2002	UNESCO	12.32	2002	UNESCO	10.9	2011	UNESCO
Mauritania	0.3467	52.1	2015	UNDP (HDI)	52.55	2015	UNESCO	8.84	2015	UNESCO	4.3	2015	UNDP (HDI)
Mauritius	0.7308	90.6	2015	UNDP (HDI)	81.28	2015	UNESCO	14.89	2015	UNESCO	9.1	2015	UNDP (HDI)
Mexico	0.7044	94.4	2015	UNDP (HDI)	77.76	2014	UNESCO	13.30	2014	UNESCO	8.6	2015	UNDP (HDI)
Micronesia	0.6889	94.00	2014	UNESCO	75.43	2004	UNESCO	11.7	2015	UNDP (HDI)	9.7	2015	UNDP (HDI)

Table 15. Human Capital Index (HCI) and its components (continued)

		Adult Literacy (%)			Gross Enrollment Ratio			Expected Year of Schooling			Mean Year of Schooling		
Country	HCI	Index Value	Year	Source	Index Value	Year	Source	Index Value	Year	Source	Index Value	Year	Source
Monaco	0.7901	99.00	2014	UN E-GOV Survey	99.00	2014	UNDP	11.8	2015	UNDP (HDI)	11.27	2017	estimation
Mongolia	0.7899	98.4	2015	UNDP (HDI)	87.90	2015	UNESCO	15.01	2015	UNESCO	9.8	2015	UNDP (HDI)
Montenegro	0.8172	98.7	2015	UNDP (HDI)	88.66	2010	UNESCO	15.13	2010	UNESCO	11.3	2015	UNDP (HDI)
Morocco	0.5278	72.4	2015	UNDP (HDI)	69.77	2012	UNESCO	12.05	2012	UNESCO	5	2015	UNDP (HDI)
Mozambique	0.3951	58.8	2015	UNDP (HDI)	61.52	2015	UNESCO	9.59	2015	UNESCO	3.5	2015	UNDP (HDI)
Myanmar	0.5127	93.1	2015	UNDP (HDI)	53.00	2007	UNESCO	9.1	2015	UNDP (HDI)	4.7	2015	UNDP (HDI)
Namibia	0.5850	81.9	2015	UNDP (HDI)	70.28	2006	UNESCO	11.7	2015	UNDP (HDI)	6.7	2015	UNDP (HDI)
Nauru	0.5619	92.00	2014	UN E-GOV Survey	56.13	2008	UNESCO	9.7	2015	UNDP (HDI)	7.12	2017	estimation
Nepal	0.4957	64.7	2015	UNDP (HDI)	72.93	2015	UNESCO	12.19	2015	UNESCO	4.1	2015	UNDP (HDI)
Netherlands	0.9206	99.00	2014	UNESCO	106.92	2012	UNESCO	18.12	2012	UNESCO	11.9	2015	UNDP (HDI)
New Zealand	0.9450	99.00	2014	UNESCO	105.67	2015	UNESCO	19.36	2015	UNESCO	12.5	2015	UNDP (HDI)
Nicaragua	0.5847	82.8	2015	UNDP (HDI)	70.00	2014	UNESCO	11.7	2015	UNDP (HDI)	6.5	2015	UNDP (HDI)
Niger	0.0894	19.1	2015	UNDP (HDI)	36.63	2012	UNESCO	5.4	2015	UNDP (HDI)	1.7	2015	UNDP (HDI)
Nigeria	0.4261	59.6	2015	UNDP (HDI)	55.64	2011	UNESCO	10.0	2015	UNDP (HDI)	6	2015	UNDP (HDI)
Norway	0.9025	99.00	2014		98.06	2015	UNESCO	17.68	2015	UNESCO	12.7	2015	UNDP (HDI)
Oman	0.7013	94.8	2015	UNDP (HDI)	76.54	2011	UNESCO	13.7	2015	UNDP (HDI)	8.1	2015	UNDP (HDI)
Pakistan	0.3682	58.7	2015	UNDP (HDI)	50.17	2015	UNESCO	8.24	2015	UNESCO	5.1	2015	UNDP (HDI)
Palau	0.8462	99.5	2015	UNDP (HDI)	97.67	2013	UNESCO	14.3	2015	UNDP (HDI)	12.3	2015	UNDP (HDI)
Panama	0.7137	95	2015	UNDP (HDI)	75.97	2013	UNESCO	12.80	2013	UNESCO	9.9	2015	UNDP (HDI)
Papua New Guinea	0.4778	64.2	2015	UNDP (HDI)	78.93	2012	UNESCO	9.9	2015	UNDP (HDI)	4.3	2015	UNDP (HDI)
Paraguay	0.6701	95.6	2015	UNDP (HDI)	71.59	2010	UNESCO	12.3	2015	UNDP (HDI)	8.1	2015	UNDP (HDI)
Peru	0.7274	94.5	2015	UNDP (HDI)	83.62	2010	UNESCO	13.4	2015	UNDP (HDI)	9	2015	UNDP (HDI)

Table 15. Human Capital Index (HCI) and its components (continued)

		Adult Literacy (%)			Gross Enrollment Ratio			Expected Year of Schooling			Mean Year of Schooling		
Country	HCI	Index Value	Year	Source	Index Value	Year	Source	Index Value	Year	Source	Index Value	Year	Source
Philippines	0.7170	96.3	2015	UNDP (HDI)	85.13	2013	UNESCO	11.7	2015	UNDP (HDI)	9.3	2015	UNDP (HDI)
Poland	0.8668	99.8	2015	UNDP (HDI)	95.23	2014	UNESCO	16.4	2015	UNDP (HDI)	11.9	2015	UNDP (HDI)
Portugal	0.8167	95.7	2015	UNDP (HDI)	98.58	2015	UNESCO	16.50	2015	UNESCO	8.9	2015	UNDP (HDI)
Qatar	0.6683	97.8	2015	UNDP (HDI)	60.02	2015	UNESCO	11.97	2015	UNESCO	9.8	2015	UNDP (HDI)
Republic of Korea	0.8743	99.00	2014	UNESCO	96.85	2015	UNESCO	16.52	2015	UNESCO	12.2	2015	UNDP (HDI)
Republic of Moldova	0.7274	99.4	2015	UNDP (HDI)	70.27	2015	UNESCO	11.63	2015	UNESCO	11.9	2015	UNDP (HDI)
Romania	0.7944	98.8	2015	UNDP (HDI)	83.82	2015	UNESCO	14.93	2015	UNESCO	10.8	2015	UNDP (HDI)
Russian Federation	0.8522	99.7	2015	UNDP (HDI)	95.15	2015	UNESCO	15.38	2015	UNESCO	12	2015	UNDP (HDI)
Rwanda	0.4815	70.5	2015	UNDP (HDI)	70.34	2015	UNESCO	10.55	2015	UNESCO	3.8	2015	UNDP (HDI)
Saint Kittis and Nevis	0.7491	97.80	2014	UNESCO	84.73	2015	UNESCO	14.39	2015	UNESCO	8.4	2015	UNDP (HDI)
Saint Lucia	0.7022	94.80	2014	UNESCO	73.53	2007	UNESCO	13.1	2015	UNDP (HDI)	9.3	2015	UNDP (HDI)
Saint Vincent and the Grenadines	0.6820	88.10	2014	UNESCO	78.28	2004	UNESCO	13.3	2015	UNDP (HDI)	8.6	2015	UNDP (HDI)
Samoa	0.7241	99	2015	UNDP (HDI)	71.32	2000	UNESCO	12.9	2015	UNDP (HDI)	10.3	2015	UNDP (HDI)
San Marino	0.8102	99.00	2014	UN E-Gov Survey	85.33	2012	UNESCO	15.11	2012	UNESCO	11.36	2017	estimation
Sao Tome and Principe	0.5830	74.9	2015	UNDP (HDI)	80.27	2015	UNESCO	12.96	2015	UNESCO	5.3	2015	UNDP (HDI)
Saudi Arabia	0.8100	94.7	2015	UNDP (HDI)	95.68	2014	UNESCO	16.11	2014	UNESCO	9.6	2015	UNDP (HDI)
Senegal	0.3427	55.7	2015	UNDP (HDI)	53.51	2015	UNESCO	8.98	2015	UNESCO	2.8	2015	UNDP (HDI)
Serbia	0.7896	98.1	2015	UNDP (HDI)	85.21	2015	UNESCO	14.55	2015	UNESCO	10.8	2015	UNDP (HDI)
Seychelles	0.7299	95.2	2015	UNDP (HDI)	77.23	2015	UNESCO	14.09	2015	UNESCO	9.4	2015	UNDP (HDI)
Sierra Leone	0.3081	48.1	2015	UNDP (HDI)	45.43	2001	UNESCO	9.5	2015	UNDP (HDI)	3.3	2015	UNDP (HDI)
Singapore	0.8557	96.8	2015	UNDP (HDI)	102.80	2014	UNESCO	15.40	2015	UNDP (HDI)	11.6	2015	UNDP (HDI)
Slovakia	0.8141	99.6	2015	UNDP (HDI)	81.85	2014	UNESCO	15.0	2015	UNDP (HDI)	12.2	2015	UNDP (HDI)
Slovenia	0.8923	99.7	2015	UNDP (HDI)	98.46	2014	UNESCO	17.35	2014	UNESCO	12.1	2015	UNDP (HDI)
Solomon Islands	0.4732	76.6	1999	UNESCO	55.42	2007	UNESCO	9.6	2015	UNDP (HDI)	5.3	2015	UNDP (HDI)
Somalia	0	24.00	2014	UN E-Gov Survey	17.00	2014	UNDP	2.40	2013	UNDP (HDI)	0.97	2017	estimation
South Africa	0.7291	94.3	2015	UNDP (HDI)	77.43	2014	UNESCO	13.34	2014	UNESCO	10.3	2015	UNDP (HDI)
South Sudan	0.2269	31.9	2015	UNDP (HDI)	38.00	2014	UNESCO	8.00	2014	UNESCO	4.8	2015	UNDP (HDI)
Spain	0.8884	98.1	2015	UNDP (HDI)	109.29	2015	UNESCO	17.88	2015	UNESCO	9.8	2015	UNDP (HDI)

Table 15. Human Capital Index (HCI) and its components (continued)

		Adult Literacy (%)			Gross Enrollment Ratio			Expected Year of Schooling			Mean Year of Schooling		
Country	HCI	Index Value	Year	Source	Index Value	Year	Source	Index Value	Year	Source	Index Value	Year	Source
Sri Lanka	0.7451	92.6	2015	UNDP (HDI)	78.84	2013	UNESCO	13.99	2013	UNESCO	10.9	2015	UNDP (HDI)
Sudan	0.3873	75.9	2015	UNDP (HDI)	47.70	2013	UNESCO	7.21	2013	UNESCO	3.5	2015	UNDP (HDI)
Suriname	0.6808	95.6	2015	UNDP (HDI)	72.21	2002	UNESCO	12.7	2015	UNDP (HDI)	8.3	2015	UNDP (HDI)
Sweden	0.9366	99.00	2014	UNESCO	107.99	2015	UNESCO	18.60	2015	UNESCO	12.3	2015	UNDP (HDI)
Switzerland	0.8660	99.00	2014	UNESCO	88.89	2014	UNESCO	16.17	2015	UNESCO	13.4	2015	UNDP (HDI)
Syrian Arab Republic	0.4860	86.4	2015	UNDP (HDI)	50.60	2013	UNESCO	9.03	2013	UNESCO	5.1	2015	UNDP (HDI)
Tajikistan	0.7002	99.8	2015	UNDP (HDI)	69.73	2012	UNESCO	11.3	2015	UNDP (HDI)	10.4	2015	UNDP (HDI)
Thailand	0.7903	96.7	2015	UNDP (HDI)	95.35	2015	UNESCO	16.03	2015	http://hdr.undp.org/sites/default/files/reports/14/hdr2013_en_complete.pdf	7.9	2015	UNDP (HDI)
The former Yugoslav Republic of Macedonia	0.6924	97.8	2015	UNDP (HDI)	71.03	2015	UNESCO	13.12	2015	UNESCO	8.3	2016	UNESCO
Timor-Leste	0.5387	67.5	2015	UNDP (HDI)	81.79	2010	UNESCO	12.5	2015	UNDP (HDI)	4.4	2015	UNDP (HDI)
Togo	0.5058	66.5	2015	UNDP (HDI)	71.89	2011	UNESCO	12.0	2015	UNDP (HDI)	4.7	2015	UNDP (HDI)
Tonga	0.8038	99.4	2015	UNDP (HDI)	88.50	2003	UNESCO	14.3	2015	UNDP (HDI)	11.1	2015	UNDP (HDI)
Trinidad and Tobago	0.7195	99	2015	UNDP (HDI)	67.31	2004	UNESCO	12.7	2015	UNDP (HDI)	10.9	2015	UNDP (HDI)
Tunisia	0.6640	81.8	2015	UNDP (HDI)	80.63	2015	UNESCO	14.75	2015	UNESCO	7.1	2015	UNDP (HDI)
Turkey	0.8148	95	2015	UNDP (HDI)	100.27	2015	UNESCO	17.22	2015	UNESCO	7.9	2015	UNDP (HDI)
Turkmenistan	0.6626	99.7	2015	UNDP (HDI)	61.28	2014	UNESCO	10.80	2014	UNESCO	9.9	2015	UNDP (HDI)
Tuvalu	0.6422	98.00	2014	UN E-Gov Survey	72.33	2001	UNESCO	10.96	2001	UNESCO	6.93	2017	estimation
Uganda	0.4906	73.9	2015	UNDP (HDI)	61.32	2011	UNESCO	10.0	2015	UNDP (HDI)	5.7	2015	UNDP (HDI)
Ukraine	0.8436	99.8	2015	UNDP (HDI)	96.11	2014	UNESCO	15.31	2014	UNESCO	11.3	2015	UNDP (HDI)
United Arab Emirates	0.6877	93.8	2015	UNDP (HDI)	67.00	2014	UNESCO	13.33	2012	UNDP (HDI)	9.5	2015	UNDP (HDI)
United Kingoom of Great Britain and Northern Ireland	0.9200	99.00	2014	UNESCO	99.81	2014	UNESCO	17.94	2014	UNESCO	13.3	2015	UNDP (HDI)
United Republic of Tanzania	0.4759	80.3	2015	UNDP (HDI)	52.30	2013	UNESCO	8.9	2015	UNDP (HDI)	5.8	2015	UNDP (HDI)

Table 15. Human Capital Index (HCI) and its components (continued)

Country	HCI	Adult Literacy (%)			Gross Enrollment Ratio			Expected Year of Schooling			Mean Year of Schooling		
		Index Value	Year	Source	Index Value	Year	Source	Index Value	Year	Source	Index Value	Year	Source
United States of America	0.8883	99.00	2014	UNESCO	96.39	2014	UNESCO	16.54	2014	UNESCO	13.2	2015	UNDP (HDI)
Uruguay	0.7719	98.4	2015	UNDP (HDI)	87.91	2014	UNESCO	15.00	2014	UNESCO	8.6	2015	UNDP (HDI)
Uzbekistan	0.7396	99.6	2015	UNDP (HDI)	70.24	2016	UNESCO	12.29	2016	UNESCO	12	2015	UNDP (HDI)
Vanuatu	0.5675	85.2	2015	UNDP (HDI)	63.51	2004	UNESCO	10.8	2015	UNDP (HDI)	6.8	2015	UNDP (HDI)
Venuzuela (Bolivian Republic of)	0.7615	95.4	2015	UNDP (HDI)	87.78	2009	UNESCO	14.3	2015	UNESCO	9.4	2015	UNDP (HDI)
Viet Nam	0.6543	94.5	2015	UNDP (HDI)	66.00	2014	UNESCO	12.6	2015	UNDP (HDI)	8	2015	UNDP (HDI)
Yemen	0.4037	70.1	2015	UNDP (HDI)	54.78	2011	UNESCO	9.0	2015	UNDP (HDI)	3	2015	UNDP (HDI)
Zambia	0.5689	63.4	2015	UNDP (HDI)	85.0		UNDP	12.5	2015	UNDP (HDI)	6.9	2015	UNDP (HDI)
Zimbabwe	0.5668	86.5	2015	UNDP (HDI)	59.15	2013	UNESCO	10.3	2015	UNDP (HDI)	7.7	2015	UNDP (HDI)

Note: Last accessed December 2017

Sources: UNESCO Institute of Statistics http://data.uis.unesco.org/

http://hdr.undp.org/en/data

Table 16. Regional and Economic grouping for E-Government Development Index (EGDI)

Country	Region	Sub-Region	EGDI Level	Level of Income	GNI Per Capitas (US dollars)
Afghanistan	Asia	Southern Asia	Middle EGDI	Low Income	1970
Albania	Europe	Southern Europe	High EGDI	Upper Middle Income	11350
Algeria	Africa	Northern Africa	Middle EGDI	Upper Middle Income	14390
Andorra	Europe	Southern Europe	High EGDI	High Income	43270***
Angola	Africa	Middle Africa	Middle EGDI	Upper Middle Income	6090
Antigua and Barbuda	Americas	Caribbean	High EGDI	High Income	22090
Argentina	Americas	South America	High EGDI	High Income	19500
Armenia	Asia	Western Asia	High EGDI	Lower Middle Income	9020
Australia	Oceania	Australia and New Zealand	Very High EGDI	High Income	45210
Austria	Europe	Western Europe	Very High EGDI	High Income	50530
Azerbaijan	Asia	Western Asia	High EGDI	Upper Middle Income	16130
Bahamas	Americas	Caribbean	High EGDI	High Income	21640
Bahrain	Asia	Western Asia	Very High EGDI	High Income	44170*
Bangladesh	Asia	Southern Asia	Middle EGDI	Lower Middle Income	3790
Barbados	Americas	Caribbean	High EGDI	High Income	17180
Belarus	Europe	Eastern Europe	Very High EGDI	Upper Middle Income	17220
Belgium	Europe	Western Europe	Very High EGDI	High Income	45900
Belize	Americas	Central America	Middle EGDI	Upper Middle Income	7930
Benin	Africa	Western Africa	Middle EGDI	Low Income	2170
Bhutan	Asia	Southern Asia	Middle EGDI	Lower Middle Income	8160
Bolivia(Plurinational State of)	Americas	South America	High EGDI	Lower Middle Income	7100
Bosnia and Herzegovina	Europe	Southern Europe	High EGDI	Upper Middle Income	12190
Botswana	Africa	Southern Africa	Middle EGDI	Upper Middle Income	16680
Brazil	Americas	South America	High EGDI	Upper Middle Income	14810
Brunei Darussalam	Asia	South-Eastern Asia	High EGDI	High Income	83010
Bulgaria	Europe	Eastern Europe	High EGDI	Upper Middle Income	19190
Burkina Faso	Africa	Western Africa	Middle EGDI	Low Income	1730
Burundi	Africa	Eastern Africa	Middle EGDI	Low Income	770
Cambodia	Asia	South-Eastern Asia	Middle EGDI	Low Income	3510
Cameroon	Africa	Middle Africa	Very High EGDI	Lower Middle Income	3540
Canada	Americas	Northern America	Middle EGDI	High Income	44020
Cabo Verde	Africa	Western Africa	Middle EGDI	Lower Middle Income	6220
Central African Republic	Africa	Middle Africa	Low EGDI	Low Income	700
Chad	Africa	Middle Africa	Low EGDI	Low Income	1950
Chile	Americas	South America	High EGDI	High Income	22540
China	Asia	Eastern Asia	High EGDI	Upper Middle Income	15470
Colombia	Americas	South America	High EGDI	Upper Middle Income	13900
Comoros	Africa	Eastern Africa	Low EGDI	Low Income	1540
Congo	Africa	Middle Africa	Middle EGDI	Lower Middle Income	5380
Costa Rica	Americas	Central America	High EGDI	Upper Middle Income	15750
Côte d'Ivoire	Africa	Western Africa	Middle EGDI	Lower Middle Income	3590
Croatia	Europe	Southern Europe	High EGDI	High Income	22630

Table 16. Regional and Economic grouping for E-Government Development Index (EGDI) (continued)

Country	Region	Sub-Region	EGDI Level	Level of Income	GNI Per Capitas (US dollars)
Cuba	Americas	Caribbean	Middle EGDI	Upper Middle Income	5880^
Cyprus	Asia	Western Asia	Very High EGDI	High Income	32200
Czech Republic	Europe	Eastern Europe	High EGDI	High Income	32350
Democratic People's Republic of Korea	Asia	Eastern Asia	Low EGDI	Low Income	506~
Democratic Republic of the Congo	Africa	Middle Africa	Middle EGDI	Low Income	780
Denmark	Europe	Northern Europe	Very High EGDI	High Income	50290
Djibouti	Africa	Eastern Africa	Low EGDI	Lower Middle Income	2200&&
Dominica	Americas	Caribbean	High EGDI	Upper Middle Income	10620
Dominican Republic	Americas	Caribbean	High EGDI	Upper Middle Income	14480
Ecuador	Americas	South America	High EGDI	Upper Middle Income	11030
Egypt	Africa	Northern Africa	Middle EGDI	Lower Middle Income	10980
El Salvador	Americas	Central America	High EGDI	Lower Middle Income	8220
Equatioral Guinea	Africa	Middle Africa	Low EGDI	High Income	18290
Eritrea	Africa	Eastern Africa	Low EGDI	Low Income	1500^
Estonia	Europe	Northern Europe	Very High EGDI	High Income	29040
Eswatini	Africa	Southern Africa	Middle EGDI	Lower Middle Income	8310
Ethiopia	Africa	Eastern Africa	Middle EGDI	Low Income	1730
Fiji	Oceania	Melanesia	Middle EGDI	Upper Middle Income	8710
Finland	Europe	Northern Europe	High EGDI	High Income	43780
France	Europe	Western Europe	Very High EGDI	High Income	42000
Gabon	Africa	Middle Africa	Very High EGDI	Upper Middle Income	16720
Gambia	Africa	Western Africa	Middle EGDI	Low Income	1630
Georgia	Asia	Western Asia	Middle EGDI	Lower Middle Income	9510
Germany	Europe	Western Europe	High EGDI	High Income	49690
Ghana	Africa	Western Africa	Very High EGDI	Lower Middle Income	4150
Greece	Europe	Southern Europe	High EGDI	High Income	27150
Grenada	Americas	Caribbean	Very High EGDI	Upper Middle Income	13720
Guatemala	Americas	Central America	High EGDI	Lower Middle Income	7750
Guinea	Africa	Western Africa	Middle EGDI	Low Income	1840
Guinea-Bissau	Africa	Western Africa	Low EGDI	Low Income	1550
Guyana	Americas	South America	Low EGDI	Lower Middle Income	7800
Haiti	Americas	Caribbean	Middle EGDI	Low Income	1790
Honduras	Americas	Central America	Middle EGDI	Lower Middle Income	4410
Hungary	Europe	Eastern Europe	Middle EGDI	High Income	25360
Iceland	Europe	Northern Europe	High EGDI	High Income	51170
India	Asia	Southern Asia	Very High EGDI	Lower Middle Income	6490
Indonesia	Asia	South-Eastern Asia	High EGDI	Lower Middle Income	11220
Iran (Islamic Republic of)	Asia	Southern Asia	High EGDI	Upper Middle Income	20010
Iraq	Asia	Western Asia	High EGDI	Upper Middle Income	17210
Ireland	Europe	Northern Europe	Middle EGDI	High Income	56920
Israel	Asia	Western Asia	Very High EGDI	High Income	36810

Table 16. Regional and Economic grouping for E-Government Development Index (EGDI) (continued)

Country	Region	Sub-Region	EGDI Level	Level of Income	GNI Per Capitas (US dollars)
Italy	Europe	Southern Europe	Very High EGDI	High Income	38460
Jamaica	Americas	Caribbean	Very High EGDI	Upper Middle Income	8450
Japan	Asia	Eastern Asia	Middle EGDI	High Income	43540
Jordan	Asia	Western Asia	Very High EGDI	Upper Middle Income	8980
Kazakhistan	Asia	Central Asia	High EGDI	Upper Middle Income	22930
Kenya	Africa	Eastern Africa	Very High EGDI	Lower Middle Income	3120
Kiribati	Oceania	Micronesia	Middle EGDI	Lower Middle Income	3050
Kuwait	Asia	Western Asia	Middle EGDI	High Income	83150
Kyrgizistan	Asia	Central Asia	High EGDI	Lower Middle income	3410
Lao People's Democratic Republic	Asia	South-Eastern Asia	High EGDI	Lower Middle Income	6270
Latvia	Europe	Northern Europe	Middle EGDI	High Income	25530
Lebanon	Asia	Western Asia	High EGDI	Upper Middle Income	14070
Lesotho	Africa	Southern Africa	High EGDI	Lower Middle Income	3340
Liberia	Africa	Western Africa	Middle EGDI	Low Income	700
Libya	Africa	Northern Africa	Middle EGDI	Upper Middle Income	11210
Liechtenstein	Europe	Western Europe	Middle EGDI	High Income	115530
Lithuania	Europe	Northern Europe	Very High EGDI	High Income	28680
Luxembourg	Europe	Western Europe	Very High EGDI	High Income	69640
Madagascar	Africa	Eastern Africa	Very High EGDI	Low Income	1440
Malawi	Africa	Eastern Africa	Middle EGDI	Low Income	1140
Malaysia	Asia	South-Eastern Asia	Middle EGDI	Upper Middle Income	26900
Maldives	Asia	Southern Asia	High EGDI	Upper Middle Income	16710
Mali	Africa	Western Africa	High EGDI	Low Income	2050
Malta	Europe	Southern Europe	Low EGDI	High Income	35710
Marshall Islands	Oceania	Micronesia	Very High EGDI	Upper Middle Income	5370
Mauritania	Africa	Western Africa	Middle EGDI	Lower Middle Income	3760
Mauritius	Africa	Eastern Africa	Low EGDI	Upper Middle Income	20990
Mexico	Americas	Central America	High EGDI	Upper Middle Income	17160
Micronesia	Oceania	Micronesia	High EGDI	Lower Middle Income	4090
Monaco	Europe	Western Europe	Middle EGDI	High Income	186710^^^
Mongolia	Asia	Eastern Asia	Very High EGDI	Upper Middle Income	11420
Montenegro	Europe	Southern Europe	High EGDI	Upper Middle Income	17870
Morocco	Africa	Northern Africa	High EGDI	Lower Middle Income	7710
Mozambique	Africa	Eastern Africa	High EGDI	Low Income	1190
Myanmar	Asia	South-Eastern Asia	Middle EGDI	Lower Middle Income	5530
Namibia	Africa	Southern Africa	Middle EGDI	Upper Middle Income	10380
Nauru	Oceania	Micronesia	Middle EGDI	Upper Middle Income	17510
Nepal	Asia	Southern Asia	Middle EGDI	Low Income	2520
Netherlands	Europe	Western Europe	Middle EGDI	High Income	49930
New Zealand	Oceania	Australia and New Zealand	Very High EGDI	High Income	37190
Nicaragua	Americas	Central America	Very High EGDI	Lower Middle Income	5530
Niger	Africa	Western Africa	Middle EGDI	Low Income	970

Table 16. Regional and Economic grouping for E-Government Development Index (EGDI) (continued)

Country	Region	Sub-Region	EGDI Level	Level of Income	GNI Per Capitas (US dollars)
Nigeria	Africa	Western Africa	Low EGDI	Lower Middle Income	5740
Norway	Europe	Northern Europe	Middle EGDI	High Income	61920
Oman	Asia	Western Asia	Very High EGDI	High Income	0
Pakistan	Asia	Southern Asia	High EGDI	Lower Middle Income	5560
Palau	Oceania	Micronesia	Middle EGDI	Upper Middle Income	14840
Panama	Americas	Central America	High EGDI	Upper Middle Income	20980
Papua New Guinea	Oceania	Melanesia	High EGDI	Lower Middle Income	4140
Paraguay	Americas	South America	Middle EGDI	Upper Middle Income	9050
Peru	Americas	South America	High EGDI	Upper Middle Income	12480
Philippines	Asia	South-Eastern Asia	High EGDI	Lower Middle Income	9390
Poland	Europe	Eastern Europe	High EGDI	High Income	26300
Portugal	Europe	Southern Europe	Very High EGDI	High Income	29940
Qatar	Asia	Western Asia	Very High EGDI	High Income	124760*
Republic of Korea	Asia	Eastern Asia	High EGDI	High Income	36570
Republic of Moldova	Europe	Eastern Europe	Very High EGDI	Lower Middle Income	5670
Romania	Europe	Eastern Europe	High EGDI	Upper Middle Income	22370
Russian Federation	Europe	Eastern Europe	High EGDI	High Income	24120
Rwanda	Africa	Eastern Africa	Very High EGDI	Low Income	1860
Saint Kittis and Nevis	Americas	Caribbean	Middle EGDI	High Income	25640
Saint Lucia	Americas	Caribbean	High EGDI	Upper Middle Income	12030
Saint Vincent and the Grenadines	Americas	Caribbean	Middle EGDI	Upper Middle Income	11380
Samoa	Oceania	Polynesia	High EGDI	Lower Middle Income	6230
San Marino	Europe	Southern Europe	Middle EGDI	High Income	52140^^^
Sao Tome and Principe	Africa	Middle Africa	High EGDI	Lower Middle Income	3250
Saudi Arabia	Asia	Western Asia	Middle EGDI	High Income	55750
Senegal	Africa	Western Africa	High EGDI	Lower Middle Income	2480
Serbia	Europe	Southern Europe	Middle EGDI	Upper Middle Income	13700
Seychelles	Africa	Eastern Africa	High EGDI	High Income	28380
Sierra Leone	Africa	Western Africa	High EGDI	Low Income	1320
Singapore	Asia	South-Eastern Asia	Middle EGDI	High Income	85020
Slovakia	Europe	Eastern Europe	Very High EGDI	High Income	29670
Slovenia	Europe	Southern Europe	High EGDI	High Income	31690
Solomon Islands	Oceania	Melanesia	Very High EGDI	Lower Middle Income	2140
Somalia	Africa	Eastern Africa	Middle EGDI	Low Income	107~
South Africa	Africa	Southern Africa	Low EGDI	Upper Middle Income	12830
South Sudan	Africa	Eastern Africa	High EGDI	Low Income	1700
Spain	Europe	Southern Europe	Very High EGDI	High Income	36300
Sri Lanka	Asia	Southern Asia	Very High EGDI	Lower Middle Income	12200
Sudan	Africa	Northern Africa	High EGDI	Lower Middle Income	4290
Suriname	Americas	South America	Low EGDI	Upper Middle Income	14460
Sweden	Europe	Northern Europe	Very High EGDI	High Income	49420
Switzerland	Europe	Western Europe	Very High EGDI	High Income	63810

Table 16. Regional and Economic grouping for E-Government Development Index (EGDI) (continued)

Country	Region	Sub-Region	EGDI Level	Level of Income	GNI Per Capitas (US dollars)
Syrian Arab Republic	Asia	Western Asia	Middle EGDI	Lower Middle Income	1860&
Tajikistan	Asia	Central Asia	Middle EGDI	Lower Middle Income	3500
Thailand	Asia	South-Eastern Asia	High EGDI	Upper Middle Income	16070
The former Yugoslav Republic of Macedonia	Europe	Southern Europe	High EGDI	Upper Middle Income	14310
Timor-Leste	Asia	South-Eastern Asia	Middle EGDI	Lower Middle Income	3380
Togo	Africa	Western Africa	Middle EGDI	Low Income	1370
Tonga	Oceania	Polynesia	High EGDI	Upper Middle Income	5780
Trinidad and Tobago	Americas	Caribbean	High EGDI	High Income	31770
Tunisia	Africa	Northern Africa	High EGDI	Upper Middle Income	11150
Turkey	Asia	Western Asia	High EGDI	Upper Middle Income	24980
Turkmenistan	Asia	Central Asia	Middle EGDI	Upper Middle Income	16060
Tuvalu	Oceania	Polynesia	Middle EGDI	Upper Middle Income	5920
Uganda	Africa	Eastern Africa	Middle EGDI	Low Income	1790
Ukraine	Europe	Eastern Europe	High EGDI	Lower Middle Income	8190
United Arab Emirates	Asia	Western Asia	Very High EGDI	High Income	72830
United Kingoom of Great Britain and Northern Ireland	Europe	Northern Europe	Very High EGDI	High Income	41640
United Republic of Tanzania	Africa	Eastern Africa	Middle EGDI	Low Income	2740
United States of America	Americas	Northern America	Very High EGDI	High Income	58700
Uruguay	Americas	South America	Very High EGDI	High Income	21090
Uzbekistan	Asia	Central Asia	High EGDI	Lower Middle Income	6640
Vanuatu	Oceania	Melanesia	Middle EGDI	Lower Middle Income	3040**
Venuzuela (Bolivian Republic of)	Americas	South America	High EGDI	High Income	17410**
Viet Nam	Asia	South-Eastern Asia	High EGDI	Lower Middle Income	6040
Yemen	Asia	Western Asia	Low EGDI	Lower Middle Income	2490
Zambia	Africa	Eastern Africa	Middle EGDI	Lower Middle Income	3850
Zimbabwe	Africa	Eastern Africa	Middle EGDI	Low Income	1810

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1 ITU (2014) Manual for Measuring ICT Access and Use by Households and Individuals. Available at: http://www.itu.int/dms_pub/itu-d/opb/ind/D-IND-ITCMEAS-2014-PDF-E.pdf

2 Note: The Internet is a worldwide public computer network. It provides access to a number of communication services including the World Wide Web and carries e-mail, news, entertainment and data files, irrespective of the device used (not assumed to be only via a computer – it may also be by mobile telephone, tablet, PDA, games machine, digital TV etc.). Access can be via a fixed or mobile network. (Ibid)

3 ITU (2017). Measuring the Information Society Report 2017. Volume 2. ICT country profiles. p. 249. Available at: https://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2017/MISR2017_Volume2.pdf

4 2014 E Government Survey

5 The World Bank. World Bank Country and Lending Groups. Available at: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519 (Accessed on 22 February 2018)

The United Nations E-Government Survey presents a systematic assessment of the use of information and communication technologies (ICTs) to transform the public sector by enhancing its efficiency, effectiveness, accountability, inclusiveness, trustworthiness and supporting people's participation and engagement. The Survey examines emerging e-government issues and trends, and innovative practices that are relevant to the international community.

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