

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.



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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 Simpás, 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 uptake, 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 online¹. 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 2003-2016². 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 discontinuity 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-attacks, 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 EGD 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 EGD 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-EGD 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-EGD levels. The number of African countries in the High-EGD-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.