Advancing online services and bridging divides

4.1. Introduction

Governments are increasingly utilizing digital technologies to deliver advanced electronic and mobile services aimed at bringing benefits to all people. All sectors have seen an increase in the provision of such services, albeit to varying degrees. A major trend is the increase in mobile technologies and applications. It entails new development opportunities for the poorest and the most vulnerable, and it is driving initiatives to promote sustainable development and new ways of providing services.

As is the case for other aspects of e-government, the major challenge for the future will be to bridge the digital divides between countries and people. This requires policies in the social and economic areas, mobilizing technologies and providing services to the poorest and most vulnerable; while ensuring adequate attention to environmental aspects.

This chapter describes and analyses global trends in electronic and mobile public service delivery and sheds light on the distribution of online services by income level and sectors. It also looks at the accessibility and availability of broadband, which is a vital enabler of economic, social, and environmental progress. Furthermore, the chapter presents an integrated approach to overcoming the digital divides and looks at the trends of online government services for vulnerable groups. It also examines the concept of the Internet of Things (IoT) and the use of Geographic Information Systems (GIS) for better service delivery.

4.2. Progress in online service delivery

4.2.1. Global trends

The online services component of the E-Government Development Index (EGDI) is a composite indicator measuring the use of ICT by governments to deliver public services at national level. It is based on a comprehensive survey of the online presence of all 193 United Nations 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 for delivery of services. The results are tabulated and presented as a set of standardized index values on a scale from zero to one, 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 one another 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 last edition in 2012, does not mean there has been no progress in e-government development. The distance between scores conveys the gap in online service delivery *(2014 UN E-Government Survey)*.

Photo credit: nmedia/Shutterstock.com

In this chapter:

As all nations of the world had an online presence during the assessment, the 2016 *Survey* provides 100 per cent global coverage. In the 2016 *Survey*, 32 countries (17%) have a very high Online Service Index (OSI) (more than 0.75). This is 10 additional countries compared to 2014. Likewise, there is an increase from 43 to 56 countries with high-OSI values (between 0.50 to 0.75). The positive trend continues as more countries reach higher levels of online services (see Figure 4.1).

Figure 4.1.   Number of countries grouped by Online Service Index (OSI) levels in 2014 and 2016

2014 Survey

- 11% Very High OSI: 22 countries
- 22% High OSI: 43 countries
- 30% Middle OSI: 57 countries
- 37% Low OSI: 71 countries

2016 Survey

- 17% Very High OSI: 32 countries
- 29% High OSI: 56 countries
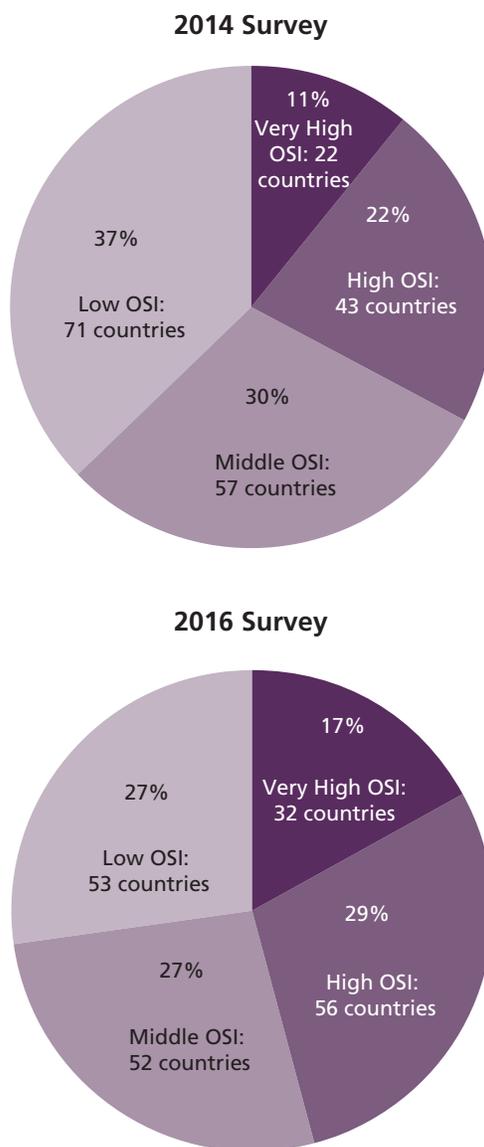- 27% Middle OSI: 52 countries
- 27% Low OSI: 53 countries

Table 4.1 provides a list of 193 countries in alphabetical order and their respective range on the OSI scale from very high (0.75 to 1) on the left of the table to low OSI on the right (less than 0.25).

Table 4.1. Countries grouped by level of Online Service Index (OSI) in alphabetical order

Very High OSI (More than 0.75)	High OSI (Between 0.50 and 0.75)	Middle OSI (Between 0.25 and 0.50)	low OSI (Less than 0.25)
Australia	Albania	Afghanistan	Algeria
Austria	Andorra	Angola	Antigua and Barbuda
Bahrain	Argentina	Armenia	Benin
Canada	Azerbaijan	Bahamas	Burkina Faso
Chile	Bangladesh	Barbados	Burundi
China	Belgium	Belarus	Cambodia
Colombia	Brazil	Belize	Cameroon
Denmark	Brunei Darussalam	Bhutan	Central African Republic
Estonia	Bulgaria	Bolivia	Chad
Finland	Costa Rica	Bosnia- Hercegovina	Comoros
France	Croatia	Botswana	Congo
Germany	Cyprus	Cape Verde	Cote D'Ivoire
Israel	Dominican Republic	Czech Republic	Cuba
Italy	Ecuador	Dominica	Democratic People's Republic of Korea
Japan	Ethiopia	Egypt	Democratic Republic of the Congo
Kazakhstan	Georgia	El Salvador	Djibouti
Lithuania	Greece	Fiji	Equatorial Guinea
Malta	Guatemala	Ghana	Eritrea
Mexico	Hungary	Granada	Gabon
Netherlands	Iceland	Guyana	Gambia
New Zealand	India	Honduras	Guinea
Norway	Ireland	Indonesia	Guinea-Bissau
Republic of Korea	Kenya	Iran (Islamic Republic of)	Haiti
Serbia	Kuwait	Iraq	Kiribati
Singapore	Latvia	Jamaica	Lesotho
Slovenia	Lebanon	Jordan	Liberia
Spain	Liechtenstein	Kyrgyzstan	Libya
Sweden	Luxembourg	Lao People's Democratic Republic	Madagascar
United Arab Emirates	Malaysia	Monaco	Malawi
United Kingdom of Great Britain and Northern Ireland	Mauritius	Namibia	Maldives
United States of America	Mongolia	Nepal	Mali
Uruguay	Montenegro	Nicaragua	Marshall Islands
	Morocco	Nigeria	Mauritania
	Oman	Pakistan	Micronesia (Federated States of)
	Paraguay	Panama	Mozambique
	Peru	Romania	Myanmar
	Philippines	Rwanda	Nauru
	Poland	Saint Kitts and Nevis	Niger
	Portugal	Saint Lucia	Palau
	Qatar	Saint Vincent and the Grenadines	Papua New Guinea

Very High OSI (More than 0.75)	High OSI (Between 0.50 and 0.75)		Middle OSI (Between 0.25 and 0.50)
	Republic of Moldova	Samoa	San Marino
	Russian Federation	Senegal	Sao Tome and Principe
	Saudi Arabia	Seychelles	Sierra Leone
	South Africa	Slovakia	Solomon Islands
	Sri Lanka	Suriname	Somalia
	Switzerland	Swaziland	South Sudan
	Thailand	Syrian Arab Republic	Sudan
	The Former Yugoslav Republic of Macedonia	Togo	Tajikistan
	Trinidad and Tobago	Tonga	Timor Este
	Tunisia	Venezuela	Turkmenistan
	Turkey	Zambia	Tubalu
	Uganda	Zimbabwe	Vanuatu
	Ukraine		Yemen
	United Republic of Tanzania		
	Uzbekistan		
	Vietnam		

The highest performing countries in OSI include 15 countries from Europe, 8 from Asia and 6 from the Americas. These countries stand out, among other reasons, for adopting innovative approaches to transform public sector and the delivery of services. Highlighted in Table 4.2 below, among the 32 top performing countries (OSI from 0.75 to 1), the United Kingdom of Great Britain and Northern Ireland ranks first in online service delivery in 2016, followed closely by Australia. As illustrated in Box 4.1, a number of reforms over the years have put the United Kingdom of Great Britain and Northern Ireland in the leading position in the 2016 OSI.

Box 4.1.   United Kingdom of Great Britain and Northern Ireland: progress in online public service delivery

Source: http://ww-w.e-service-expert.com/e-Government-UK.html

The United Kingdom of Great Britain and Northern Ireland takes the top place in the 2016 Online Service Index, as the country scored well in all areas and stages of online service delivery. Its early adoption of e-government and the considerable evolution since, including many course corrections to integrate lessons learned, contributed to this achievement. In the last decade, the government worked continuously to establish the needed infrastructure; and secure government gateways, interoperability standards, authentication and broadband availability, while also deregulating the telecommunications sector.

With the basic infrastructure in place, attention was turned to ensuring faster and more innovative adoption of new technologies for online service delivery. The e-government service progression went from simply publishing information to offering basic interactions, (e.g., e-forms), to full transactional capability (e.g., filing and processing tax returns, welfare benefits, passports, etc.) and to a more complete transformation and reform of public sector online operations and public service delivery.

The governance of online public service delivery was changed with the introduction of Chief Information Officers (CIOs) Council and between the e-Government Unit of the Cabinet Office and the Office of Government Commerce. This team was set to transform online service delivery and make it citizens centred, self-service, accessible and enabling.

This marked a Whole-of-Government approach in online service delivery, where services are available in a more integrated fashion from various departments; local and central governments. Digital authentications, as well as secure access to the full spectrum of services are being ensured along with efforts to promote digital inclusion.

The European Union has established a very solid record for delivering consistent and trusted public services to its businesses. Its Single Market strategy aims to design and deliver public services to better serve citizens and businesses, while reducing costs, opening up digital opportunities, and enhancing Europe's position as one of the world leaders in the digital economy.

Table 4.2. Top performing countries in Online Service Index (OSI), 2016

Country	Online Service Index OSI
United Kingdom of Great Britain and Northern Ireland	1
Australia	0.9783
Singapore	0.9710
Canada	0.9565
Republic of Korea	0.9420
Finland	0.9420
New Zealand	0.9420
France	0.9420
Netherlands	0.9275
United States of America	0.9275
Austria	0.9130
Spain	0.9130
Estonia	0.8913
United Arab Emirates	0.8913
Sweden	0.8768
Japan	0.8768
Italy	0.8696
Israel	0.8623
Slovenia	0.8478
Mexico	0.8478
Germany	0.8406
Lithuania	0.8261
Bahrain	0.8261
Serbia	0.8188
Norway	0.8043
Malta	0.7971
Colombia	0.7899
Denmark	0.7754
Uruguay	0.7754
Chile	0.7754
China	0.7681
Kazakhstan	0.7681

In Asia, Singapore and the Republic of Korea are among the top five countries globally. The Republic of Korea continues to implement its new vision for government operations, called "Government 3.0," placing emphasis on openness, sharing, communication and collaboration (see Chapter 1). Under this new vision the government is undergoing a paradigm shift to move away from a government-led approach to a more people-oriented approach. The holistic Government Portal integrates all major administrative services provided by individual government institutions to facilitate more effective delivery of e-government services. From one portal, people can conveniently find all the services provided by the Korean government. Efforts are continuously being made to improve operational and managerial capabilities of the portal and to provide services, such as integrated searches and individually customized services, in order to create more efficient service delivery.

The Government of the People's Republic of China has made special efforts to leverage the Internet and online services for public service delivery, bearing in mind that China has the largest number of Internet users in the world. Innovative measures in China underscore the prominence of ICT as a national priority, including the government's goal of growing e-commerce and the use of social media in citizen engagement. For example, the "WeChat" tool can be used as a means for anti-corruption or whistle-blowing purposes, while microblogging for social inclusion has become increasingly sophisticated.

Kazakhstan has been working to improve its public administration in recent years. The "100 Concrete Steps to Implement Five Institutional Reforms" was launched by the President during the 2015 Astana Economic Forum. With its innovative, holistic and Whole-of-Government approach, this initiative has the potential to support the establishment of a modern, professional and independent public service that ensures high-quality implementation of economic programmes and delivery of public services.

In North America, Canada and the United States have experienced a transformational change by providing customized services to people through greater service integration, Whole-of-Government approaches, and by continuing to release open government data and develop policies that advance co-production and co-creation of online public services.

In Latin America, Chile, Colombia, Mexico and Uruguay have adopted e-government systems for enhanced service delivery. These countries' online presence features a strategic design, aspects of open government, as well as efforts to improve institutional coordination, transparency, and ease of access.

## 4.2.2. Distribution of Online Service Index (OSI) values by income group

A country's level of technological advancement is positively correlated to income levels. However, a considerable variation is present within income groups (World Bank 2010). According to a number of studies such variation reflects the nature of technology, the characteristics of overall institutional and policy frameworks, and the extent to which the government has prioritized and successfully implemented delivery of public services with a strong technological component.

- **High income countries:**

    As shown in Figure 4.2.a., out of the 59 high income countries, 27 have very high OSI values (see Table 4.1). However, there are still 11 high income countries that remain with OSI values below 0.5, with the majority of those (7 out of 11 countries) being small islands states, including Barbados, Bahamas, Seychelles, Saint Kitts and Nevis, Antigua and Barbuda and Equatorial Guinea.

    The *Survey* shows that since 2014 there is a positive trend in the online service delivery of high income countries: in 2016, the number of countries with low OSI values dropped from 4 to 3; the number of countries with middle OSI values dropped from 15 to 8 whereas there was an increase in the number of countries with high OSI values from 13 to 22. Only one country joined the countries with very high OSI values.

Figure 4.2.a. Distribution of OSI values in high income countries
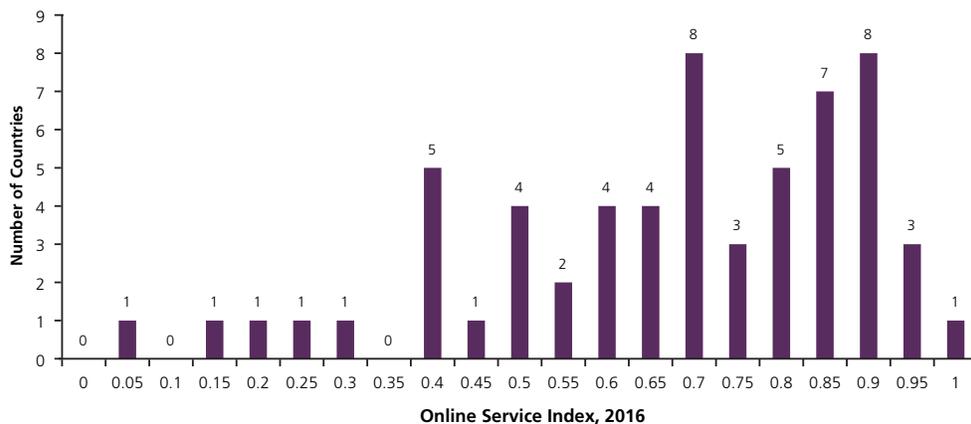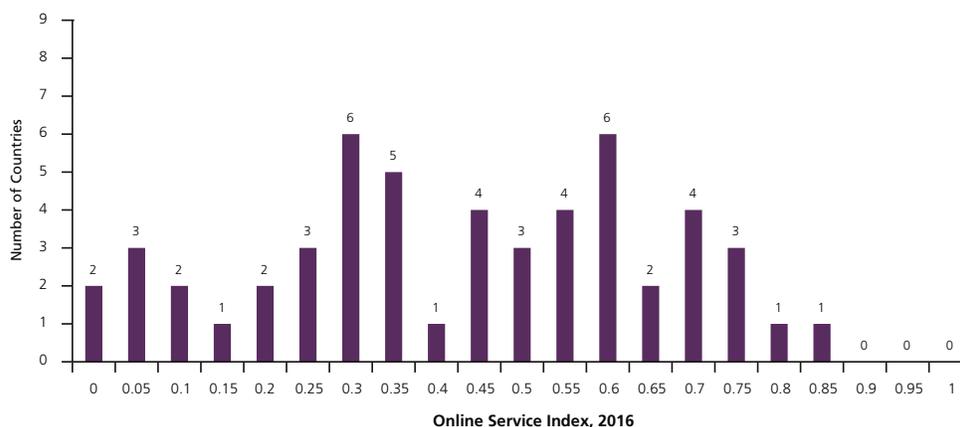

- **Upper middle income countries:**

    As shown in Figure 4.2.b, 5 upper middle income countries have very high OSI values whereas there are 10 countries at the lower end of OSI values from 0.0-0.25, amongst which a number of small islands states such Maldives, Palau, Nauru, Tuvalu and Marshall Islands.

    Overall, the upper middle income countries have experienced substantial improvements in their OSI values. The *Survey* shows that since 2014 there is a positive trend in the online service delivery: in 2016, the number of countries with low OSI values dropped from 16 to 13; the number of countries with middle OSI values dropped from 23 to 19 whereas there was an increase in the number of countries with high OSI values from 14 to 19. For the very high OSI values, there was an increase of 3 countries, from 2 to 5.

Figure 4.2.b. Distribution of OSI values in upper middle income countries

• **Lower middle income countries:**

As shown in Figure 4.2.c, no lower middle income country has very high OSI values whereas there are 17 countries at the lower end of OSI values from 0.0-0.25, amongst which a number of Small Island Developing States (SIDS) including Timor-Leste, Kiribati, Vanuatu, Papua New Guinea, Solomon Islands and São Tomé and Príncipe, along with a number of African countries. The lower middle income countries have also experienced a moderate improvement in their OSI values. The *Survey* shows that since 2014, the number of lower middle income countries with middle OSI values increased from 14 to 20 and the number of countries with high OSI values moved from 9 to 12.

Figure 4.2.c. Distribution of OSI values in lower middle income countries
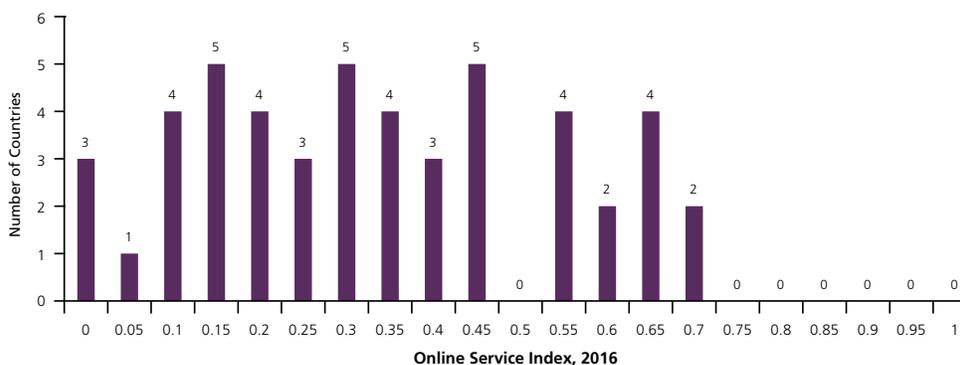
• **Lower income countries:**

As shown in Figure 4.2.d, no lower income country has very high OSI values whereas there are still 23 countries at the lower end of OSI values, most of which are either countries in conflict or countries at the early stages of post conflict reconstruction, such as Liberia, Haiti, Burundi, Chad, South Sudan, Mali, Congo, Somalia and Central African Republic, among others. The lower income countries have experienced a very slight improvement in their OSI values. The *Survey* shows that since 2014, the number of lower income countries with middle OSI values dropped from 6 to 5 and the number of countries with high OSI values moved from 1 to 3.

Figure 4.2.d. Distribution of OSI values in lower income countries
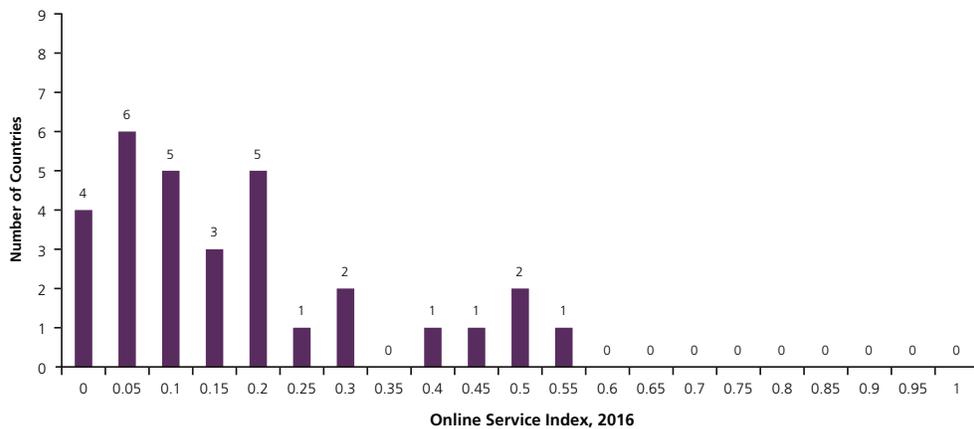
The above trends confirm that there is an empirical correlation between income levels and the OSI. However, an empirical analysis within each income group and the respective country composition shows that the size of country, geographic location, stability and stages of overall development could also highly influence the OSI.

4.2.3. Trends of transactional services online

By 2014, all the 193 Member States of the United Nations had national portals. The 2016 *Survey* shows continued effort by most countries to build and maintain national portals and back-end systems to automate core administrative tasks, to improve the delivery of public services and promote transparency and accountability. When compared with the 2014 data, transactional online services[1] have seen variable improvements across different types of services. Figure 4.3 provides a comprehensive breakdown of typical transactional services and the number of countries for which these services could be readily identified through the national website.

Figure 4.3. Trends of transactional services online, 2014 and 2016

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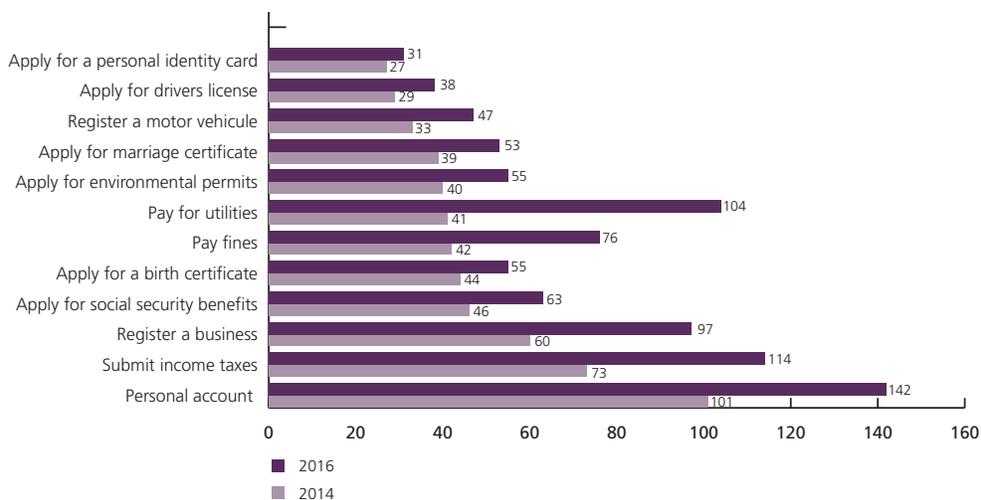
[1]   Transactional services on Government websites engage in two-way communication with their citizens, including requesting and receiving inputs on government policies, programmes, regulations, etc. Some form of electronic authentication of the citizen's identity is required to successfully complete the exchange. Government websites process non-financial transactions, e.g. filing taxes online or applying for certificates, licenses and permits. They also handle financial transactions, i.e. where money is transferred on a secure network. Transactional services, such as making payments online, are substantially more complicated than simply providing information. Increasing online provision of transactional services such as payments indicates maturity as well as greater integration because payments made through a single site may need to be routed to any number of accounts held by various branches of the government.

According to the *2016 Survey*, the most commonly used online service was the setup of personal accounts for the purpose of accessing personalized online services, followed by payments of utilities (see Chapters 1 and 3).

The opening of a personal account is considered a pre-condition for more advanced, transactional public services online. Almost two-thirds of the 193 countries provided for the establishment or opening of a personal account online, which represents an increase from 101 countries in 2014 to 142 countries in 2016. If the rate of growth continues at the same or similar levels, full global coverage of this online service might be reached by 2020, with all 193 countries providing online personal accounts; reflecting an important step forward in the delivery of more integrated and personalised services, as well as more efficient and transparent public service delivery overall.

Whether it is done manually or digitally, tax filing is an important service for most income earners and business entities. In order to improve tax payers' services, governments are leveraging ICTs to provide online tax services to their citizens (Kaliannan, Murali & Magiswary 2010). According to the 2016 *Survey*, the number of countries providing income tax services online increased from 73 countries in 2014 to 114 in 2016. However, low usage by end-users is still one of the major hurdles to the expansion of e-government projects (Sahu & Gupta, 2010), including filing income taxes online. Streamlining registration processes and reducing the need for in-person visits minimizes transaction time and costs for both businesses and government, often reducing registration time from weeks to a few hours. Greater ease in starting a business and better governance are associated with increased entrepreneurial activity (World Bank, 2008).

Based on the 2016 *Survey*, the registration of businesses online has increased by 19%, bringing the number of countries that offer online users such service from 60 countries in 2014 to 97 countries in 2016. High transactions costs are particularly detrimental to small businesses and small investors with limited resources (Nagy Hanna, 2010). The fact that less than half of all countries – and almost no developing countries - currently offer online business registration globally clearly hampers market entry for new businesses and access to much needed financing for new start-ups and small and medium size enterprises.

As part of the effort to promote health and well-being, and extending life expectancy for all, national systems of identity registration should be implemented to verify social security claims and benefits. This facilitates the effective functioning of a nationwide social security system contributing to economic and social development.

Identity registration at birth is also a UN proclaimed human right and a specific target of the 2030 Agenda (Target 16.9 – A/RES/70/1). However, it is still not available in many of the world's poorer countries today. In absolute terms, as of 2016 there are only 55 countries offering online application for birth certificate, 53 countries offering online application for marriage certificate, and 63 countries offering online application for social security benefits.

The online application for a personal identity card is still the transactional service provided by the lowest number of countries. 31 out of 193 countries provide this service as of 2016, with only 4 countries introducing it since 2014. Concerns over privacy and security have hampered the efforts of countries to fully adopt the online application for identity card.

Compared to 2014, the online payments for both utilities and fines have substantially increased in 2016: an additional 34 countries offer online payment of fines and an additional 63 countries provide online payment of utilities. This represents an overall increase respectively of about 18% and 33% in the number of countries providing these services out of 193 member states.

In 2016, an additional 8 countries offer online applications for environmental permits with an increase of about 8% in the number of countries out of 193 member states, bringing the number of countries that offer this service via their webpage to a total of 55 countries.

4.2.4. Distribution of services online by sector

When considering e-government development in different government sectors, there is additional evidence that digital technologies—the Internet, mobile phones, and all the other tools to collect, store, analyze, and share information digitally—have spread quickly.

The availability of archived information, downloadable forms, emails or feed updates, and mobile apps/SMS services has continued to grow in most of the countries around the world. The *Survey* shows that since 2014 in all sectors surveyed—education, health, finance, social welfare, labour and environment—the number of countries providing such services has increased.
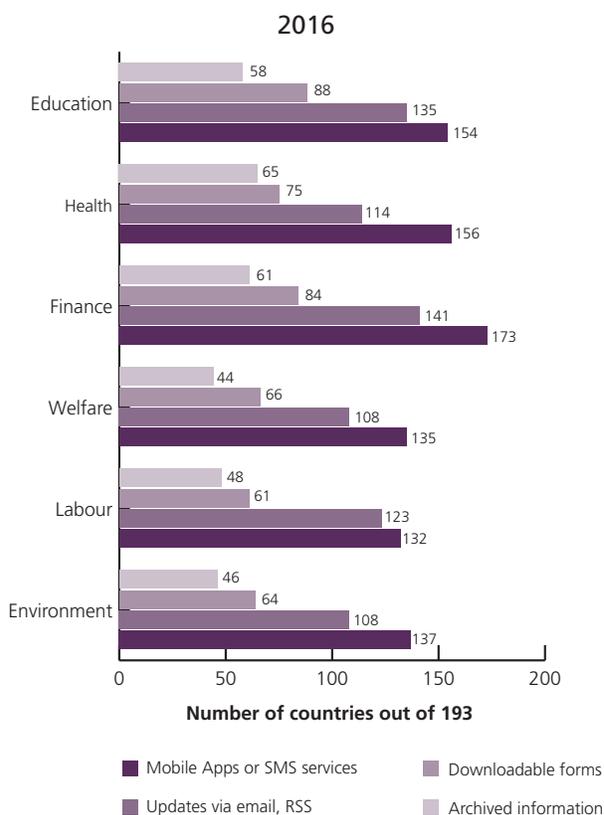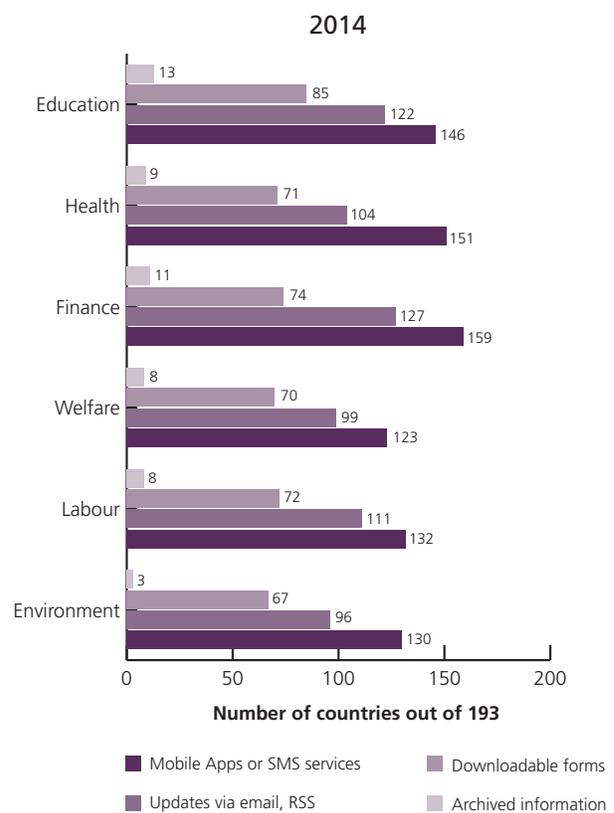
Figure 4.3.a. Types of services online, 2016

Figure 4.3.b. Types of services online, 2014

2016

Sector	Archived information	Downloadable forms	Updates via email, RSS	Mobile Apps or SMS services
Education	58	88	135	154
Health	65	75	114	156
Finance	61	84	141	173
Welfare	44	66	108	135
Labour	48	61	123	132
Environment	46	64	108	137

Number of countries out of 193

- Mobile Apps or SMS services
- Updates via email, RSS
- Downloadable forms
- Archived information

2014

Sector	Archived information	Downloadable forms	Updates via email, RSS	Mobile Apps or SMS services
Education	13	85	122	146
Health	9	71	104	151
Finance	11	74	127	159
Welfare	8	70	99	123
Labour	8	72	111	132
Environment	3	67	96	130

Number of countries out of 193

- Mobile Apps or SMS services
- Updates via email, RSS
- Downloadable forms
- Archived information

The online availability of downloadable forms and archived information is reaching a maturation stage, and a very small number of countries lag behind. The embracement of open government data initiatives by many countries around the world might be one of the driving factors for such an increase, especially as the leading sectors of finance, health and education are the main focus areas of most open government data initiatives.

As in 2014, there appears to be substantial underutilized potential and a continued decrease of the use of the features of update via email and use of Really Simple Syndication (RSS). RSS is still a valid Internet technology that allows users to keep up to date with new content from their favourite sites and has been available almost as long as the web. The reason of this constant decrease can be identified with the massive proliferation and availability of new

performing user-friendly social media based –tools that make these update features almost obsolete.

In all sectors reviewed, the trends of mobile apps and SMS services have experienced a large and significant growth and further information is provided in section 4.2.5.

The environment sector experienced a significant increase with 43 countries introducing mobile apps and SMS services from 2014 to 2016, bringing the overall number to 46 countries out of 193. Box 4.2 shows that we are not only seeing more mobile apps and SMS services, but also an increased capacity of public institutions to improve both their interactions and partnerships with people, and channel the data for improved public policies (see Chapter 1).

**Box 4.2. European Environment Agency (EEA): Mobile apps on environment –
Marine Litter Watch**

Source: http://www.
eea.europa.eu/themes/
coast_sea/marine-litter-
watch

Huge amounts of plastic and other debris are increasingly found in the world's seas, harming marine wildlife and potentially threatening human health. However, the composition, movement and origins of the rubbish that litters beaches are still not widely understood. To help tackle this issue, the European Environment Agency (EEA) launched Marine Litter Watch, a mobile app that utilises modern technology to help resolve the problem of marine litter by tracking it. This science-based app aims to help fill data gaps in beach litter monitoring by involving the people who visit beaches. It employs a two-tiered approach: monitoring to support official processes and voluntary clean-ups. This mobile app allows the person who finds the beach litter to choose from a master list of commonly found marine litter items, such as cigarette butts, bottles, fishing materials, etc. The data is then submitted through the app to the EEA hosted Marine Litter Watch database where it can be extracted, viewed on the EEA website, or embedded in other web pages or applications. The data is ultimately used to provide a better understanding of the problem and formulate a policy response.

4.2.5. Trends in mobile service delivery

Online services are increasingly being provided through innovative mobile government applications and customized to individual needs. Mobile broadband is the most dynamic market segment; globally, mobile broadband penetration reached 47% in 2015, a value that increased since 2007[2]. Investments in affordable broadband connectivity will therefore be crucial. Governments around the world have begun to respond to this trend by adapting e-government services for the mobile platform, providing public sector field workers[3] access to mobile technologies and applications, enabling smart/flexible working[4] and delivering citizen services anytime, anywhere. Governments are also using mobile applications and social media channels to reach out and provide timely services to remote and vulnerable groups, particularly the young, older persons, women, persons with disabilities, and indigenous people. Thus, there are substantive shifts both from fixed into mobile broadband as well as from fixed to mobile cellular telephones per 100 inhabitants. The 2016 *Survey* shows that the shift of devices from fixed to mobile has unleashed a new era of government mobile services.

E-mail remains a critical communication tool for governments across the world, ensuring timely access to beneficiaries (i.e. citizens, businesses and overall constituencies). Email is almost a mark of identity, and has become quite pervasive. According the Radicati Group's "Email statistics report 2015-2019", there were 4.35 billion e-mail accounts globally in 2015 and the number is expected to grow to 4.2 billion by 2016 and 5.6 billion by 2019 with one-third of the worldwide population using email by year-end 2019.

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2   ICT Facts and Figures, 2015, ITU
3   Public sector field workers are public servants who are in contact with people and provide face-to-face services and/or provide services 24/7 through mobile platforms, including in the field of health and education.
4   "Flexible working is a way of working that suits an employee's needs, e.g. having flexible start and finish times, or working from home" (https://www.gov.uk/flexible-working).

The percentage of countries providing updates via email or RSS in 2016 was the highest for education with 90 countries (46%), followed by finance provided by 85 countries (44%) and health services provided by 75 countries (39%) with 65, 63, and 61 countries respectively providing such services for welfare, environment, and labour. However, in all six sectors there is potential for growth with more than half of the governments around the world expected to initiate such government services in the coming years.

The expected increase in the availability and affordability of mobile devices, especially the ones with email capabilities, will drastically change the landscape of government services and related use of email and RSS. This change will be beneficial, especially in developing countries where the growth of these services in the social sector is expected to drastically accelerate as the affordability and availability of mobile devices increases. This not only will serve to bridge digital divide amongst regions as pertaining to the online services in social sectors, but will also contribute to sustainable development

Figure 4.4.b. Trends in mobile apps and SMS services usage by sectors, in 2014 and 2016

Number of countries out of 193 offering the services (in per cent)
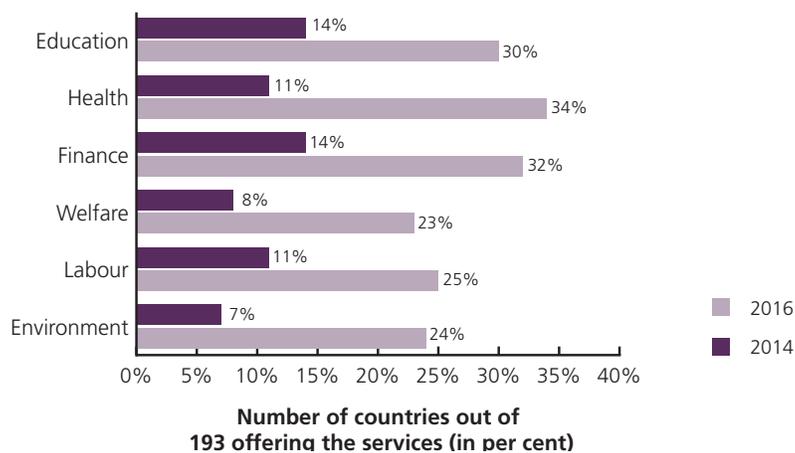
As indicated in Figure 4.4.b, mobile apps and SMS services show tremendous increases in almost all sectors. The highest growth in the mobile apps and SMS services was in the health sector, with an increase from 11 to 34% from 2014 to 2016, followed by the finance sector with an increase from 14 to 32%. Other sectors also experienced high levels of increase, respectively 7 to 24% for the environment, 14 to 30% for education, 8 to 23% for welfare, and 11 to 25% for labour. Figure 4.10 provides an overall picture of mobile services by sector for 2016. Updates via email or RSS experienced the highest number across the sectors as compared to mobile apps or SMS services. Mobile apps and SMS services have both been increasing in the last two years (Figure 4.4.b and Figure 4.4.c), and the gap between the two online services is narrowing. However, the difference is still high in education (30 countries), finance (23 countries), welfare (22 countries), environment (22 countries), and labour (13 countries).

Figure 4.4.c.   Mobile services, by sector
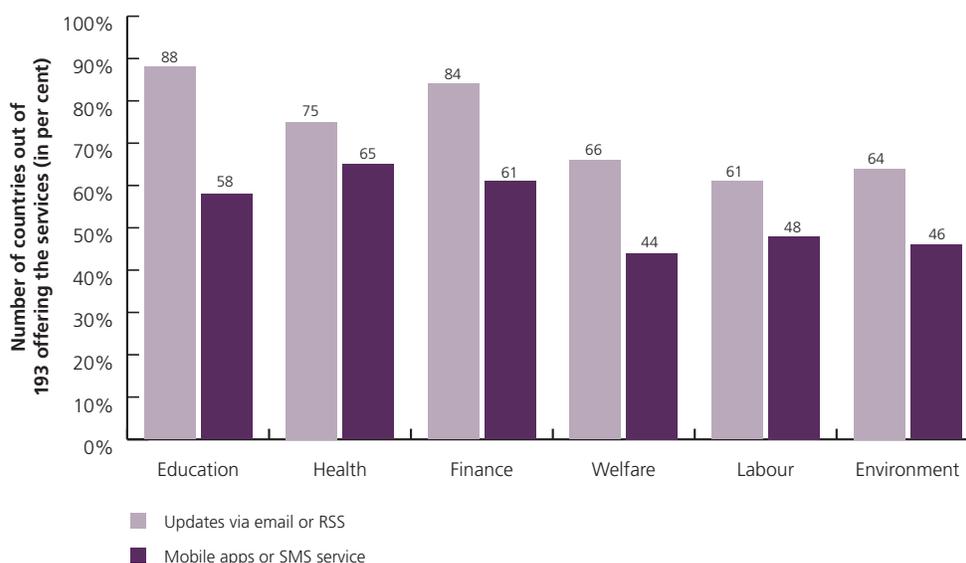
The 2016 *Survey* highlights two important phenomena. First, the social sectors such as health and education experienced an increase, which represents a strong commitment from governments around the world to utilise technology for the benefits of all and in support of sustainable development. Second, given the trends highlighted by the 2014 and 2016 *Surveys*, it is expected that increases will occur in both services – updates via both email/RSS and mobile apps/SMS services – across sectors. Such increases will be determined by the availability and affordability of mobile devices.

4.3.   Advancement of mobile service delivery

Increased connectivity, innovation and access to the Internet have helped achieve progress of the Millennium Development Goals. The 2030 Agenda Targets 9.a and 9.c encourage Member States to facilitate sustainable and resilient infrastructure development in developing countries, and significantly increase access to ICT and strive to provide universal and affordable access to the Internet in least developed countries by 2020 (A/RES/70/1). As highlighted in the General Assembly Resolution A/70/125, the expansion and use of ICTs must continue to be a core priority for all Member States in order to achieve the 2030 Agenda. The outcome document also highlights the cross-cutting contribution of ICTs to the Sustainable Development Goals and poverty eradication, and notes that access to ICTs has also become a development indicator and aspiration in and of itself.

The number of mobile phone subscriptions is estimated to have risen from 2.2 billion in 2005 to 7.1 billion in 2015, and by the end of 2015, 3.2 billion people are expected to be online. This increase would represent over 43 per cent of the total world population, of which 2 billion are from developing countries.

Further, fixed broadband subscriptions have increased, reaching a penetration rate of almost 10%, as compared with 3.4% in 2005. Meanwhile, mobile broadband remains the fastest growing market segment, with continuous double-digit growth rates reaching 47% in 2015, a value that increased 12 times since 2007. Mobile phones, reaching almost four-fifth of the world's people, provide the main form of Internet access in developing countries. 2 billion people however still do not own a mobile phone (World Bank, 2016).

4.3.1. Accessibility and availability of broadband

A brief regional analysis of the data shows that fixed broadband subscriptions increased across regions (Figure 4.5) from 2014 to 2016, growing from 0.6 users per 100 inhabitants to 3.5 users per 100 inhabitants. The increase has been uneven across regions. Africa is at the lower end with an increase of 0.6/100 inhabitants, and an overall fixed broadband subscription of 1.2/100 inhabitants. Asia and Oceania experienced an increase of nearly 1.5 and 2.1 users per 100 inhabitants, respectively, in the last two years. The Americas had an increase of 1.9 additional fixed broadband users per 100 inhabitants, with Europe at the highest levels with an increase of 3.5 users per 100 inhabitants.

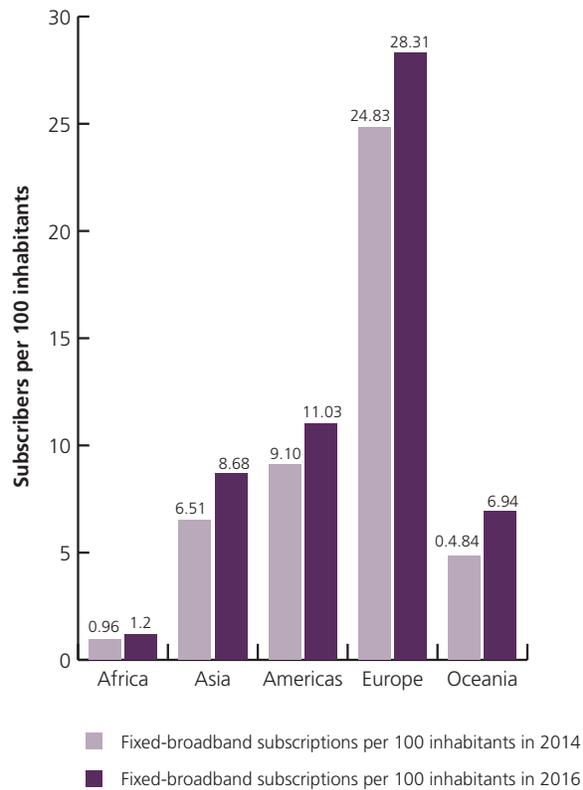**Figure 4.5.   Trends in fixed broadband subscription in 2014 and 2016**

Figure 4.6 indicates the trends in wireless broadband subscription across the regions. Increases in subscription in wireless broadband took place across regions. The number of subscriptions per 100 inhabitants in Africa went from 7 in 2014 to 12 in 2016, with the region still remaining in the lower end. Despite being the second lowest region in absolute number of wireless broadband subscriptions per 100 inhabitants with 22 subscriptions in 2016, the Americas experienced the highest jump with an increase of 9 subscriptions per 100 inhabitants, compared with 13 subscriptions in 2014. Oceania experienced an increase from 21 subscriptions in 2014 to 28 subscriptions in 2016, and Asia saw an increase from 30 subscriptions in 2014 to 35 subscriptions in 2016. Europe remains the highest in absolute terms with an overall subscriptions rate of 56 in 2016, up from 48 in 2014, which puts the region gradually on a path towards market maturation.

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Figure 4.6.   Trends in wireless broadband subscriptions in 2014 and 2016

Fixed-broadband subscriptions per 100 inhabitants in 2014
Fixed-broadband subscriptions per 100 inhabitants in 2016
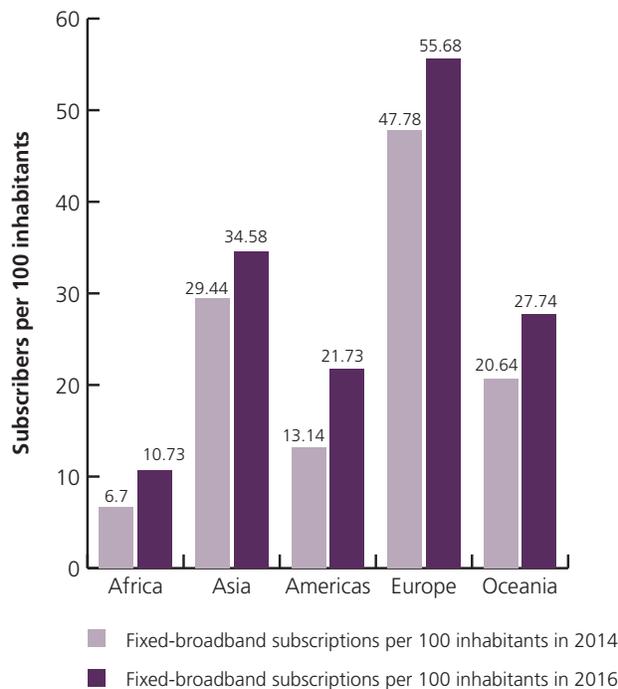
Overall, the mobile industry is growing strongly. According to the ITU, by the end of 2015 the total number of mobile cellular subscriptions nearly rivalled the total global population. There will be 7.1 billion mobile cellular subscriptions (not subscribers) by end of 2015 – the equivalent of a global penetration rate of 97 mobile subscriptions per 100 inhabitants (ITU, 2015). This sign of maturation is also reflected in the trends of mobile phone subscriptions for the last two years, as shown in Figure 4.7 which shows market maturation in Europe and a reverse trend of slight reduction in the Americas, alongside steady substantive growth in Africa and Asia.

Figure 4.7.   Trends in mobile phone subscription in 2014 and 2016

Mobile-cellular telephone subscriptions per 100 inhabitants in 2014
Mobile-cellular telephone subscriptions per 100 inhabitants in 2016
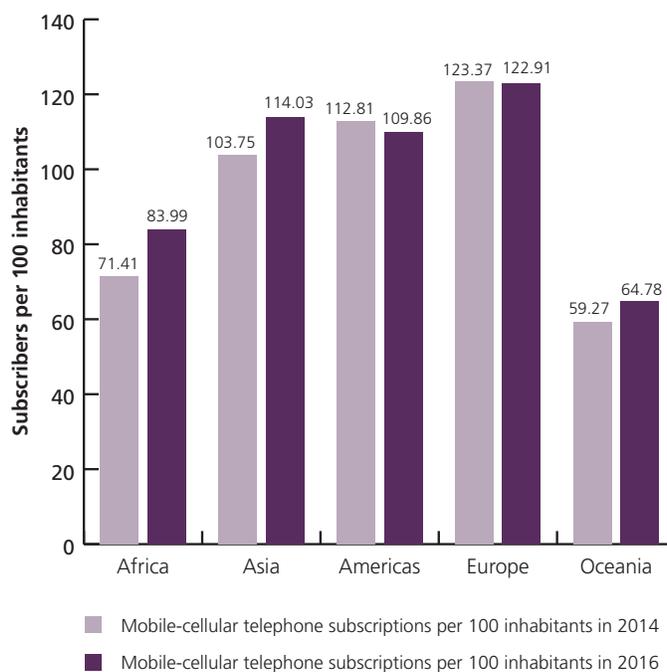
This growth, if sustained, can help improve the lives of many people in developing countries. Governments, international organizations and Non-Governmental Organizations (NGOs) are launching initiatives to improve health, education, enhance access to finance, or information related to agriculture or disasters. Many innovations are coming from entrepreneurs and people themselves. It is important that the business, scientific, and relevant public institutions are mobilized to develop the kind of mobile phones and mobile apps that are most attuned to developing countries' needs.

The accessibility and availability of broadband has remained a priority for countries around the world. UNDESA, in close cooperation with the ITU, continues to report the trends of fixed and mobile broadband, along with wireless and mobile phones subscriptions, as they pertain to the access and utilisation of well-designed vital public services.[5]

4.3.3. Availability and affordability of mobile devices

The availability and affordability of mobile devices remains an important factor and driver of change in the migration from electronic to mobile public service delivery. The Report of Ofcom 2015 of the United Kingdom regulatory agency highlights the dominance of mobile, and indicates that the change has been brought about not by improvements in fixed broadband, but by the availability of larger, more capable phones and faster 4G mobile networks. Phones and 4G are in turn facilitating communication through a variety of channels, especially social media. An ever increasing number of users are switching from computers to smartphones – a shift which is driven by larger size screens and prolonged battery life of smartphones enables people to comfortably carry out the tasks that would have normally been reserved for a desktop, laptop or tablet.

According to the ITU and UNESCO Report on the State of Broadband 2015, the availability and affordability of a multitude of devices has unleashed a new era of innovation. This technological shift allows countries to develop and adopt more mobile public services, going beyond SMS and into a full range of service offerings.

Today several countries have already adopted "Responsive Web Design" (RWD) technology to implement on-line services in their governmental portals. RWD creates dynamic changes to the appearance of a website, depending on the screen size and orientation of the device being used to view. Instead of having to build a special mobile version of a website, which often requires writing a new code from scratch, this technique solves the problem of designing for the multitude of devices available to customers.

This innovative technology emerged as a way to provide equal access to information regardless of the device (fixed or mobile). In 2014, only 48 countries had adopted this technology. In 2016, the *Survey* shows a significant increment, with 99 countries using RWD technology for their national portals (22 from Africa, 21 from the Americas, 26 from Asia, 24 from Europe and 6 from Oceania).

The shift towards mobile services and devices can help improve health, education, and productivity. It can help break the barriers between formal and informal education, health and other basic important public services. Today, mobile technologies are available, even where basic infrastructures and utilities are scarce. As the price of mobile phone ownership continues to fall, many more people, including in extremely impoverished areas, are likely to own and use a mobile device. As people have their devices wherever they go, the provisions of services and learning can happen in places previously non-conducive to education. As health workers adopt mobile devices to a large scale, the health services provided are no longer associated with just the physical institution providing them. The result is that countries are better able to overcome

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5   More information on the telecommunication index and overall EGDI is provided in chapter 5.

physical barriers to health, education and accessing public services, and reshape their delivery not only towards improved services, but towards people-centred, public services, especially ones that utilise mobile broadband and mobile devices to bridge digital divides. Mobile devices and mobile apps have the potential to improve living conditions of the poorest in important ways. It is important to concomitantly adopt policies to, for example, teach people how to use such services, especially the poorest and most vulnerable.

However, discrepancies in availability and affordability persist. According to the most recent data from ITU[6], fixed broadband services remain expensive, costing an average of US$ 74.5 Purchasing Power Parity (compared with just US$ 22.5 in developed countries, less than a third of the developing country equivalent). This implies a disadvantage for the developing world, especially LDCs.

According to the World Bank, only around 15 per cent of the world's people can afford access to broadband Internet, and nearly 2 billion people do not own a mobile phone (World Development Report 2016). "4 billion people from developing countries remain offline, representing two thirds of the population residing in developing countries. Of the 940 million people living in the least developed countries (LDCs), only 89 million use the Internet, corresponding to a 9.5 per cent penetration rate" (ITU, ICT Facts and Figures, 2015). The world's offline population is mainly in India and in China but more than 120 million people are still offline in North America (World Bank Data 2016).

4.4.   Digital divides

At the early stages of technology, the digital divide was simply defined as the troubling gap between those who use computers and the Internet and those who do not (Wilhelm, 2004). A broader definition of the digital divide goes beyond infrastructure deployment to include the creation of an enabling environment, with a focus on institutional strengthening and capacity building, the creation of content in local language and increased online presence, and continuous improvements in legal and regulatory frameworks, etc.

Looking at a different perspective (Helbig, Gil-Garcia and Ferro, 2005), we can identify three commonly used approaches to the digital divide, such as (i) access divide; (ii) multi-dimensional digital divide; and (iii) multi perspective digital divide.

The "access divide" focuses on the division between individuals and groups that do or do not have access to technologies, simplifying therefore the divide as a gap that exists solely as a technological problem. Based on this technological determination, information technologies can solve social, political, economic and organizational problems. Therefore ICTs have the potential to improve government actions (e-government) and to eliminate the digital divide.

The 'multi-dimensional" digital divide implies that the digital divide is not just about access, but more about other social, political, educational and economic issues. This definition (Norris, Pipa, 2002) sees the digital divide as a mirror of social inequality: as a global divide, as a social divide and as a democratic divide. The public policy response thus aims to address social, political, educational, and economic factors.

The 'multi-perspective digital divide" builds upon the "multi-dimensional digital divide" and focuses on the interrelationships of technology with race, gender and culture. According to this approach (Servon, 2002), the intersection between an individual's race, gender, and culture affects the use of digital technology. There are other factors as well, such as age. Public sector intervention is needed to address the perspective and challenges of each group in closing the digital divide over time. E-government intervention has to address the complex interaction of these factors in order to ensure the success of its projects (Siau, Chiang, Hargrave, 2011).

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[6]   ITU and UNESCO Report on State of Broadband 2015

According to the ITU Report 2013 on Measuring the Information Society, "the digital divide refers to the gap among individuals, households and businesses at different socio-economic levels with regard to both their opportunities to access ICTs, and their use of the Internet for a wide variety of activities. It also refers to disparities among different geographic areas. The digital divide includes imbalances both in physical access to technology, as well as in the resources and skills needed to effectively use such technology. A knowledge divide reflects the access of various social groupings to information and knowledge, typically by gender, income, race and location".

The digital divide also exists between developed and developing countries, as well as within and among groups in a country, especially countries with greater rural populations. The digital divide within countries can be as high as that between the countries as the digital divide goes beyond technological availability and affordability. "Leaving no one behind" requires enhancing digital inclusion by improving access to high-speed broadband connection to all through reliable and high-quality infrastructure, and by building a more holistic approach that encompasses the social, economic and environmental factors to advance digital inclusion.

To bridge the divides in terms of capabilities at the individual, government and enterprise levels, ICT usage and other complementary skills are needed. Policy actions include creating alternate spaces for learning, involving community centres, creating better metrics of ICT usage, making efficient use of digital platforms, engaging in continuous experimentation, exploring strategic collaborations, popularizing open government data models, developing comprehensive citizen engagement strategy, and adopting participatory e-governance models for the 'shared economy. (Draft Global Sustainable Development Report, 2016, chapter 3).

Efforts are also needed to provide improved online services targeted to specific vulnerable groups, as well as by offering user-friendly features and language content that help promote inclusion.

4.4.1. Targeted services for vulnerable groups

The 2016 *Survey* provides a global assessment of online government services targeted to vulnerable groups by region. Figure 4.8 reflects country efforts to reach out to vulnerable groups via online services. It shows that the number of countries providing such services has increased compared to 2014. The number of countries offering online services to youth increased from 66 countries in 2014 to 88 in 2016. Possibly due to increased advocacy efforts, the number of countries offering tailored online government services to women has almost doubled from 36 countries in 2014 to 61 in 2016. The number of countries that provide targeted online government services to immigrants also increased from 49 countries in 2014 countries to 76 in 2016. While there was a small increase in online services to older persons and persons with disabilities, only 13 countries introduced such services between 2014 and 2016. As a result, the total number of countries offering such service is less than one-third of all countries.

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Figure 4.8. Online government services for vulnerable groups in 2014, and 2016
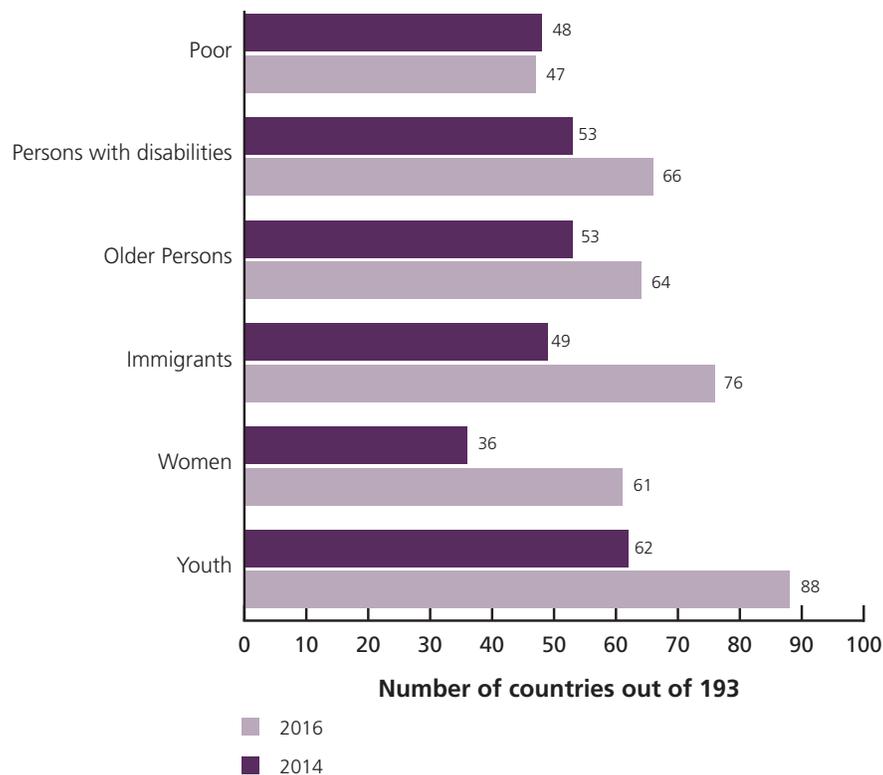
The 2016 *Survey* shows that an increasing number of countries are providing online services in more than one official language and more have increased the availability of online guidance/tutorials on how to use services, compared to 2014. In fact, Figure 4.9 highlights that in 2016, 166 countries are now offering online services in more than one official language compared to 142 in 2014. The number of guidance/tutorials increased from 58 to 91 countries. There was no increase in the availability of audio content over the past two years, and only 7 new countries compared to 2014 are now providing configuration of size/font.

In line with the need to continue and improve the targeted services to vulnerable groups, United Nations Member States have underscored that there is a "need for further development of local content and services in a variety of languages and formats that are accessible to all people, who also need the capabilities and capacities, including media, information and digital literacy skills to make use of and further develop information and communications technologies (United Nations, para. 24, 2015). It is of "vital importance to recognize the principles of multilingualism in the information society to ensure the linguistic, cultural and historical diversity of all nations" (ibid.).Locally relevant content can be promoted by establishing local innovation centres and technology hubs, promoting local internet exchange points, increasing support for open data initiatives and organizing contests and challenges. Above all, an ecosystem approach to digital policy can help bridging the existing gaps (Draft Global Sustainable Development Report, 2016, chapter 3).

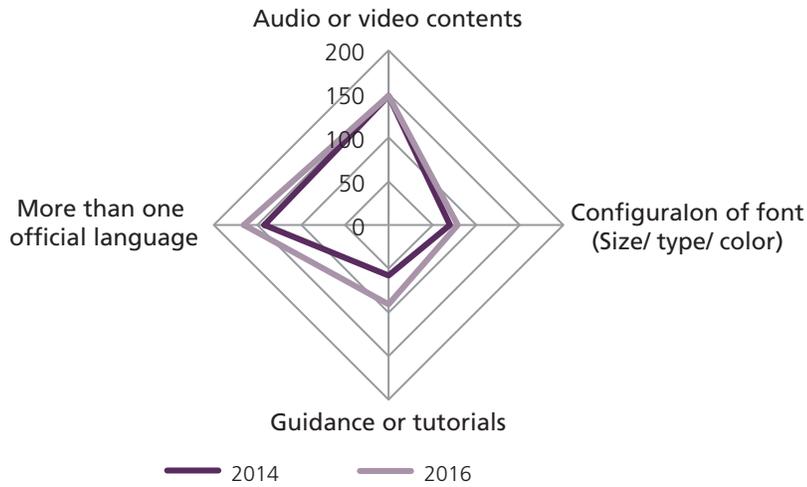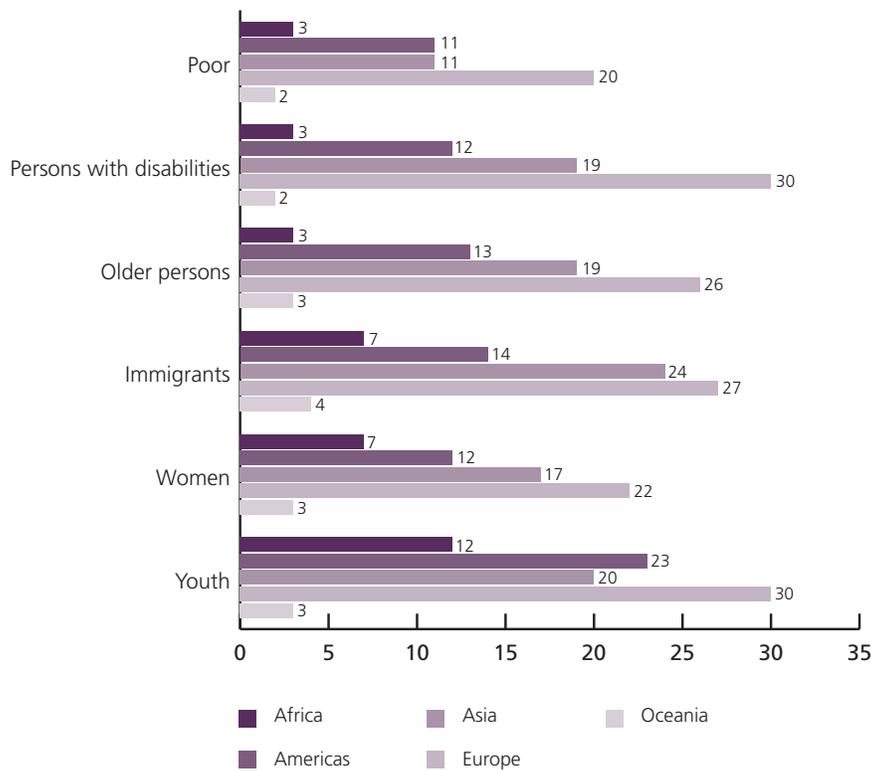Figure 4.9.   Number of countries with available features for vulnerable groups

Figure 4.10 shows that, according to the 2016 *Survey*, more countries provide online services to youth and persons with disabilities.

Figure 4.10. Services to vulnerable groups, by region

	Poor	Persons with disabilities	Older persons	Immigrants	Women	Youth
Africa	3	3	3	7	7	12
Americas	11	12	13	14	12	23
Asia	11	19	19	24	17	20
Europe	20	30	26	27	22	30
Oceania	2	2	3	4	3	3
	47	66	64	76	61	88

Figure 4.11. Services for at least one vulnerable group, by region

Number of countries out of 193

■ Alert via email or SMS subscription
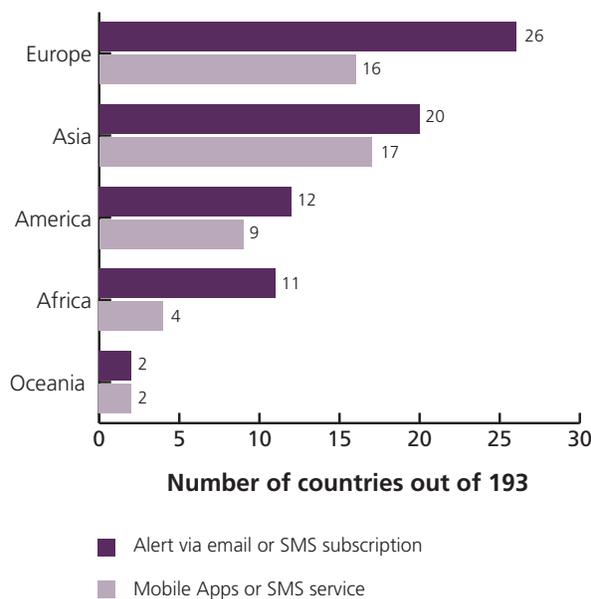
■ Mobile Apps or SMS service

Figure 4.11 indicates that in 2016, Europe leads the online services to vulnerable groups with an increase of 20%. More than 60% of the overall number of European countries (26 out of 43) provides emails or SMS subscription to at least one vulnerable group. However, the biggest leap was undertaken by Africa, which had 7 new countries introducing targeted services to vulnerable groups.

In addition to developing infrastructure and access to the Internet, improvements in basic services targeted to vulnerable groups have led to more inclusive public services at the national level and have contributed to efforts to bridge the digital divide. Overall, the digital divide persists among nations and regions and between men and women, younger and older generations, educated and less educated people, and people of various groups of the population.

4.5. Key trends in online service delivery

With the considerable increases in connectivity, use, creation of online and mobile services, and innovation, new tools have emerged to drive poverty eradication and economic, social and environmental betterment. For example, fixed and wired broadband, smartphones and tablets, cloud computing, open data, social media, and Big Data were only in their early states at the time of the adoption of the Tunis Agenda on the world information society. They are now understood to be significant enablers of sustainable development.[7]

4.5.1. The use of Geographic Information Systems (GIS) for public service delivery

The use of Geographic Information Systems (GIS) in public service delivery has unleashed a tremendous number of innovations and improved processes and outcomes for public service. Geographic Information Systems (GIS) is a computer system that allows one to map, model, query, and analyse large quantities of data within a single and structured database according to location. GIS gives a person the power to: create maps, integrate information, visualize scenarios, present powerful ideas and develop effective solutions (EPA.GOV).

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[7]   United Nations Information and Communications Technologies for Development, (December 2015), Pg13.

The adoption of GIS in public service delivery goes far beyond the traditional mapping tool usage. Rather, it is integrated throughout processes and systems to substantially improve public policies and public services in key social sectors such as health, education, energy, agriculture, transport and so on. Because GIS has become more common and easier to use, governments are using it to analyse financial decisions, improve service delivery and engage people in monitoring and evaluating government performance. Further, GIS has unique promises to enhance government accountability and transparency. Web-based GIS platforms can also provide specific and timely information that is especially useful for emergency and disaster management.

The use of GIS technologies allows users to integrate and analyse large, disparate data sets that involve geospatial information like population density or customer preferences (McKinsey, Inc. - Grant, Rozdan & Shan, 2014). Recent changes and developments have introduced quite a revolution in the use of geospatial data; particularly in location-based services. These include: (i) the increase of geospatial information available through smart-phones, credit cards, social media, GPS devices and other sources; (ii) greater standardization of data and databases; and (iii) increased accuracy of geospatial data due to better hardware and software applications.

These changes have been increasingly applied in new and innovative ways by all stakeholders in society. However, this has been especially true for public administration institutions, which seek to further utilise technology for improved policy and decision-making processes, and public service delivery.

The use of GIS can help tackle some of the most challenging problems in policy-making and public service delivery. It can help provide high quality services to all segments of society especially when servicing large and demographically diverse areas. Coupled with optimized resource allocations, GIS supports policymakers in designing public policies that address pressing issues at both local and central levels (see Box 4.3). Both governments and the public can use GIS technology and geospatial analysis to improve and monitor service delivery; and governments can strategically plan to integrate GIS technology and geospatial data throughout public policy processes and public service delivery (see Box 4.4).

Box 4.3. South Africa: Use of GIS for improving public policy and public service delivery

The government of South Africa was facing a number of challenges that required enhanced use of data and GIS information, in order to: (i) provide more services to semi-urban and informal settlements within urban centres; (ii) provide services to the most vulnerable especially in rural areas; (iii) optimally locate service points closer to the people, especially in areas of changing human settlement patterns and demographics; and (iii) develop road infrastructure and transport services to improve access to services and encourage economic development. In order to tackle these challenges, the government prepared a step-by-step strategy, which required the formulation of a national vision on how to improve GIS infrastructure and data collection. Once the first stage was implemented, the government followed two paths: (i) using GIS data for public policy formulation, implementation and monitoring, both group and sector oriented, and (ii) incorporating GIS application and data into basic public service delivery in social welfare, health, safety and transportation among others. This strategic approach was formulated and implemented with the participation of all stakeholders. It has introduced an innovative method wherein the benefits of technological advancements in GIS are integrated into the processes of developing public policy and delivering public services.

Source: http://www. dpsa.gov.za/pro-grammes.php?id=23

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Box 4.4. Australia: GIS use for public health prevention

Historically, public health information (surveillance) systems, based in local, state and commonwealth governments, have collected and tabulated data on illness, disabilities, causes of death, injuries, environmental risk factors, health costs and other health issues. Improvements of both spatial analysis tools (sophisticated software and fast personal computers) and the quality and accessibility of the information itself (unique identifiers, digital census data, rapid internet), have led to the increasing use of GIS.

In Queensland (Australia), GIS provides an environment in which the biophysical, social, behavioural, and cultural worlds can be combined for a systemic understanding of health and disease. GIS has been successfully applied in many areas of population health. For example, it was used to inform the placement of water pumps in Queensland villages that were most infected by Guinea Worm to ensure a safe water supply. GIS applications were also used to enhance community-based child welfare services, as well as to identify distribution points for culturally-appropriate promotion materials about diabetes in a multicultural community.

Some other GIS applications used by local Queensland governments include: quantifying major hazards in a neighbourhood, predicting injuries of pedestrian children, and analysing disease policy and planning. These applications have been integrated into targeted interventions. This led to: (i) reduced prevalence of guinea worm disease in villages where pumps were introduced, (ii) children in high child poverty areas receiving subsidized meals while at family day care, (iii) a targeted and culturally-sensitive diabetes program; (iv) the direction of finite vector-control resources to the highest priority response areas during dengue fever outbreaks; (v) screening programs to assess hazards in high-risk neighbourhoods, which also reduced overall costs; and (vi) locating clusters in space and time of child pedestrian injuries and suggesting interventions.

Source: https://www.health.qld.gov.au/epidemiology/documents/gis-ph-spatial-app.pdf

The number of good practices and case studies involving GIS and geospatial data is increasing every day, as more and more public services at all levels incorporate its use into their work processes. This confirms that the renewed use of GIS is yet another means to address development challenges at the local, national, and regional levels, while countries work towards achievements of development goals as outlined in the 2030 Agenda for Sustainable Development. It is clear that GIS technology on its own does not usually deliver better health outcomes. Rather, by informing epidemiologists, policy and decision-makers, and health workers of the location and geographic relationship between datasets, GIS is an enabling integrator that helps target existing interventions to improve the efficacy of the service delivered and/or reduce associated costs.

The 2030 Agenda for Sustainable Development recognises the important role of technological innovation in the implementation of the Sustainable Development Goals (SDGs) and contains specific references to the need for high quality, timely, reliable and disaggregated data, including earth observation and geospatial information. The UNDESA Statistical Division has been supporting the work on the improvement and harmonization of GIS data and its use. This work takes place through the United Nations Committee of experts on Global Geospatial Information Management (UN-GGIM). An intergovernmental Committee, UN-GGIM is tasked with making joint decisions and setting directions on the production and use of geospatial information within national, regional and global policy frameworks, and takes a leading role in setting the agenda for the development of global geospatial information to address key global challenges. At its third High Level Forum, the UN-GGIM issued the 2014 Beijing Declaration on Sustainable Development with Geospatial Information. This Declaration called for "a greater use of geospatial information for timely, evidence-based and authoritative decision-making, and policy formulation on local-based development issues, including disasters and humanitarian needs." The Declaration urged Member States to develop more effective communication mechanisms to demonstrate how geospatial information can contribute to sustainable development.

4.5.2. Internet of Things

Even though the term Internet of Things (IoT) was initially introduced in 1999, it is only in the last few years that the term has found its way into public discourse. According to the ITU (Internet of things, Global Standards Initiative, ITU 2012) IoT is "the network of physical objects or 'things' embedded with electronics, software, sensors and network connectivity, which enables these objects to collect and exchange data." IoT allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration between the physical world and computer-based systems leading to improved efficiency, accuracy and economic benefit. Since its introduction, IoT has been used in many aspects of our daily lives from home security, to remote health follow-up, remote computer access and so on; however, most of its benefits are still to be revealed.

IoT is considered part of the global infrastructure for the information society. It enhances services by interconnecting (physical and virtual) "things" based on existing and evolving interoperable information and communication technologies (ITU Recommendation 06/2012). Through the exploitation of identification, data capture, processing and communication capabilities, IoT makes full use of "things" to offer services to all kinds of applications. At the same time, it is important to ensure that security and privacy are safeguarded.

According to a number of research centers and institutions, the number of devices that will be connected wirelessly on the Internet of Things will be between 26 billion (according to Gartner, Inc. based in the US) to 30 billion by 2020 (according to ABI Research also based in the US). There is a growing belief that the IoT will have widespread and beneficial effects by 2025 or earlier (Anderson & Rainie, 2015). It is expected to change and enhance a number of important areas in our lives, such as how education is delivered, environmental monitoring, infrastructure management, and health monitoring and energy management among others. Box 4.5 provides a relevant example.

Box 4.5. Detecting early-stage dementia using mobile devices

Dementia is characterized as a global health epidemic and a public health priority. Although there is currently no cure for dementia, it is possible to get an earlier, more accurate diagnosis as well as better, personalized treatment through the use of Information Communication Technology (ICT).

The EU funded project Dem@Care has developed a system based on smart mobile sensors that can monitor health parameters, activity levels and even emotional and cognitive status of users. With this new technological innovation, hospitals and other public health institutions are able to offer more timely diagnosis of early state dementia and provide optimized personal care solutions for those living with dementia. The Dem@care project consists of 11 academic and industrial partners from all over Europe. Since 2012, they have been working to improve differential diagnosis and develop effective interventions for people with dementia in a variety of settings.

European Commission

Source: http://www.dpsa.gov.za/programmes.php?id=23

A number of IoT applications are being developed and implemented in every field. Examples relate to environmental monitoring (e.g., monitoring of air and water quality, atmospheric and soil conditions, movements of wildlife, and tsunami and earthquake early warning systems). IoT can be combined with other efforts to provide better emergency responses and related services. Similarly, IoT can support transportation and infrastructure. By continually monitoring changes in structural conditions that can compromise safety, proper and timely repair and maintenance activities can be ensured.

IoT allows for better coordination between different service providers and users, providing more efficiency and public satisfaction. In the energy and water sectors, IoT offers the opportunity to remotely monitor and control all electronic devices, and powering them on and

off as and when needed. Increasing the sustainability and efficiency of energy distribution and water management has not only improved service, but also can save time and even lives. In the medical and healthcare arena, IoT has enabled remote health monitoring and emergency notification systems, in areas such as blood pressure and heart monitoring. The result has been improved efficiency in service and a decrease in hospital expenses.

While IoT introduces new and exciting opportunities, it also raises new questions on the interaction between people and businesses operating in the digital world. Some of these questions involve the capture, processing and ownership of people's data. Other questions are about the possible need to create new legislative or technical frameworks to manage such a large and complex environment, while at the same time avoiding unnecessary constraints on IoT market development. Issues, such as governance, security, and privacy need to be addressed (European Union Research Cluster on Internet of Things, 2015).

The Mauritius Declaration on the Internet of Things and the Resolution on Big Data (both adopted in 2014) set out principles and recommendations designed to reduce risks associated with the collection and use of data in connected devices and Big Data ecosystems. Both documents begin by acknowledging that connected devices and Big Data have the capacity to make our lives easier. Among many trends in advancing e-government, such as co-creation, co-production, crowd-sourcing and crowd-funding (addressed in previous chapters), the extensive use of GIS and the IoT stand out for the ways they are revolutionising overall governance processes. They are also affecting the way societies operate and interact with eco-systems. They hold great opportunities to address key development challenges in health, education, climate change, disaster management, agriculture and so on. These trends are allowing governments around the world to move towards more advanced electronic and mobile services. They are leading towards higher level of interconnectivity and interdependency among people, nature, technology and overall development.

4.6. Conclusion

The lessons learned from this chapter can be summarized as follows:

- Countries around the world have experienced substantial progress in the online service delivery, as it pertains to the provision of basic services, e-participation, multichannel service delivery, mobile services, and a Whole-of-Government approach. Progress in income levels is generally related to higher levels of OSI. However, despite considerable progress, online service delivery remains a challenge for LDCs and SIDS. The regional distribution shows an increasing divide, with most of the African countries remaining at the lowest levels of OSI.

- Several types of transactional services online have increased. The transactional services related to finance, personal accounts, and payment of utilities continue to experience linear progression, reconfirming the commitment of countries to increase uptake of public services online as well as improve transparency in public finance. The improvement of the business environment has remained a priority for the period 2014-2016, with 37 countries introducing the online business registration. However, the application for a number of registration and licenses still remains at low levels, while concerns over privacy and security have hampered efforts of countries to fully adopt the online application for identity cards.

- The availability of information has increased in the areas of education, health, finance, welfare, labour, and environment. Environmental information and mobile apps and SMS services experienced the highest increases.

- The efforts of countries to increase accessibility and availability of broadband have led to increased levels of fixed-and mobile broadband subscriptions per 100 inhabitants, while the rate of increase has been lower in mobile phone subscriptions per 100 inhabitants.

These improvements in access and availability have provided for better utilisation of well-designed public services online. The increase in mobile service delivery continues in the 2016 *Survey*, with the health, finance and education sectors experiencing the largest increases. The accessibility and availability of mobile devices has had a tremendous impact on the shift from fixed to mobile public services, especially in developing countries.

- There are increased efforts to bridge the digital divide through national and multilateral efforts. The services to vulnerable groups have experienced tremendous increases throughout regions and groups, with services to youth remaining at the highest levels, followed by services for the poor, persons with disabilities, older persons and immigrants; services to women are also high. The adoption of GIS in policy processes is resulting in increased levels of efficiency, transparency, accountability and participation. The Internet of Things, through increased levels of interconnectivity, is allowing for more targeted and specialised public service delivery with lower costs and higher transparency. These key trends are opening the door to great opportunities, but also great challenges that need to be addressed.

- Bridging the digital divide between countries and people is a key objective of the international community. It requires international cooperation and support. It also requires mobilizing the public and private sectors and societies at large to develop the kind of devices, applications, technologies, and safeguards that can enable and mobilize ICT for addressing poverty, illiteracy, and disease. Progress has to be accompanied by policies to equip people to use online and mobile services, and develop the necessary enabling environment and safeguards.