

Electronic Government around the World: Key Information and Communication Technology Indicators

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Abstract—Governments around the world are adopting Information and Communication Technologies (ICTs) because of the important opportunities it provides through E-government (EG) to modernize government public administration processes and delivery of quality and efficient public services. Almost every country in the world is adopting ICT in its public sector administration (EG) to modernize and change the traditional process of government, increase citizen engagement and participation in governance, as well as the provision of timely information to citizens. This paper, therefore, seeks to present the adoption, development and implementation of EG in regions globally, as well as the ICT indicators around the world, which are making EG initiatives successful. Europe leads the world in its EG adoption and development index, followed by the Americas, Asia, Oceania and Africa. There is a gradual growth in ICT indicators in terms of the increase in Internet access and usage, increase in broadband penetration, an increase of individuals using the Internet at home and a decline in fixed telephone use, while the mobile cellular phone has been on the increase year-on-year. Though the lack of ICT infrastructure is a major challenge to EG adoption and implementation around the world, in Africa it is very pervasive, hampering the expansion of Internet access and provision of broadband, and hence is a barrier to the successful adoption, development, and implementation of EG initiatives in countries on the continent. But with the general improvement and increase in ICT indicators around the world, it provides countries in Europe, Americas, Asia, Arab States, Oceania and Africa with the huge opportunity to enhance public service delivery through the adoption of EG. Countries within these regions cannot fail their citizens who desire to enjoy an enhanced and efficient public service delivery from government and its many state institutions.

Keywords—E-government development index, e-government, indicators, information and communication technologies.

I. INTRODUCTION

THE objective of this paper is to present a global perspective on EG adoption, development, and implementation in countries around the world and to also provide the key ICT indicators development which is making EG thrive. The constant, growing demand and aspiration of citizens, stakeholders, the general public and private business to enjoy efficient and quality service from governments has necessitated the need for the adoption and implementation EG as a tool, not only to modernize the operations of government business but to also meet the demand of citizens for improved public service delivery both in developed and developing

nations. The adoption of EG has enabled governments to design and deliver public services with increased efficiency and transparency in engaging with citizens, as well as stakeholders, in a bid to foster richer interactions with the populace [1]. EG has the potential to improve the efficiency and effectiveness of government functions, operations, and standardization of its business [1] within key sectors of the economy. It can further facilitate the development of more accessible government services, greater public access to information, and most importantly make governments more accountable to their citizens and business within its jurisdiction [1]. EG has become a critical avenue for governments to provide better services by transforming itself into a more adaptable organization with a capacity of responding to varying circumstances and discovering new and better ways to fulfill its mandate to the general population [1]. ICT offers a new approach to increase transparency and promote anti-corruption by improving the access and openness, as well as the accountability of functions and activities of public sector organizations [2]. It also enables the government to expand their critical role as a provider of services for citizens, which is the essence and foundational development of EG initiatives [2].

EG is the adoption and application of appropriate ICTs by the government and its ministries, departments and agencies to enhance the delivery and provision of quality and efficient public service to its citizens. It has two dimensions of change; the first is the internal change of government operations and the second is an external change in terms of public service delivery and interaction with the public. EG is the online supply of government information and services through the power of the Internet [3]. Reference [4] considers EG as a function with a purpose to restructure the organization of public services, adopting mechanisms that promote and simplify communication processes among different organs of government. There are different multiple definitions of EG by researchers, but broadly, electronic government is the government use of ICTs to offer citizens and businesses the opportunity to interact and conduct business with the state through its agencies by using different electronic media such as mobile phones, touch pad, smart cards, self-service kiosks, and email/the Internet [5].

The application of ICTs through EG initiatives have major multiple positive outcomes that include improved service delivery to citizens, interaction with business and industry, increased public accessibility to information, more efficient

government management, a fall in corruption, increased transparency and reduced costs [2]. EG could be used to facilitate and support the fundamental organizational functions of government, and enhance the bureaucratic process of state and public sector organizations [6]. The application of ICT in government public administration can be used to support and enable bureaucratic practices in favor of government reforms and improvement of service delivery [6]. The loss of or low trust in public administration could be regained through the adoption of EG to, for instance, fight against corruption in state institutions, invest in e-service quality and in public administration communication. These initiatives could ultimately recover and increase the levels of trustworthiness among citizens in public administration [7].

This study was prepared using secondary sources of data from online journals, articles, and web sources. Qualitative-type of research method was applied to the study.

II. COUNTRIES LEADING IN EG DEVELOPMENT

The adoption and development of EG by countries is strongly linked to a specific country's level of income. Nations with high-income level status make more efforts to achieve effective implementation of EG to enhance interaction, dissemination of government information and ultimately provide efficient and improved public service delivery to its citizens. The United Nations EG Survey 2014 indicates that 25 top countries in the world belong to high-income nations [8]. Out of these countries, the majority are European with 16 countries (64%), five from Asia (20%), and two countries (8%) each from the Americas and from Oceania [8]. Citizens in these leading EG developed countries enjoy the benefits such as access to improved public service delivery and modernizing of public administration in civil or state institutions. Fig. 1 illustrates the top 25 ranked high in the EG Development Index (EGDI) in 2014 and their previous EG rankings for 2012, 2010 and 2008, respectively.

Table I shows that no African country was included in the top performing EGDI, while countries of other continents; Asia, Oceania, Europe and the Americas were fully represented. African countries should be encouraged to enhance the adoption and implementation of EG if they are to be recognized among the top most performing countries in respect of the world EGDI. South Korea has maintained the top position in the index over three consecutive years, with the highest EG development index rating of 0.9462 in 2014. This is quite an impressive performance for South Korea, which rose from its ranking of 6th in 2008 to become a leader in terms of the adoption and development of EG as a tool to modernize and transform public administration to bring better and more efficient public service to its citizens. Australia and Singapore, who were second and third respectively, have made considerable improvements in their rankings from 2008 through to 2012. The top 25 countries with the highest EGDI combined have an EGDI average of 0.8368, which is far above the EGDI world average. This could be attributed to the fact that these nations fall into the list of high-income group countries, and hence can afford the huge financial investment

in ICT infrastructure which is a base for effective and successful EG adoption and development.

TABLE I
 COUNTRIES LEADING IN EG DEVELOPMENT INDEX [8]-[11]

Country	Region	2014 EGDI	2014 Rank	2012 Rank	2010 Rank	2008 Rank
Republic of Korea	Asia	0.9462	1	1	1	6
Australia	Oceania	0.9103	2	12	8	8
Singapore	Asia	0.9076	3	10	11	23
France	Europe	0.8938	4	6	10	9
Netherlands	Europe	0.8897	5	2	5	5
Japan	Asia	0.8874	6	18	17	11
USA	Americas	0.8748	7	5	2	4
United Kingdom	Europe	0.8695	8	3	4	10
New Zealand	Oceania	0.8644	9	13	14	18
Finland	Europe	0.8449	10	9	19	15
Canada	Americas	0.8418	11	11	3	7
Spain	Europe	0.841	12	23	9	20
Norway	Europe	0.8357	13	8	6	3
Sweden	Europe	0.8225	14	7	12	1
Estonia	Europe	0.818	15	20	20	13
Denmark	Europe	0.8162	16	4	7	2
Israel	Asia	0.8162	17	16	26	17
Bahrain	Asia	0.8089	18	36	13	42
Iceland	Europe	0.797	19	22	22	21
Austria	Europe	0.7912	20	21	24	16
Germany	Europe	0.7864	21	17	15	22
Ireland	Europe	0.781	22	34	21	19
Italy	Europe	0.7593	23	32	38	27
Luxembourg	Europe	0.7591	24	19	25	14
Belgium	Europe	0.7564	25	24	16	24
EGDI Average		0.8368				
World Average		0.4712				

III. CONTINENTAL AVERAGES OF EG DEVELOPMENT INDEX

The United Nations Survey [8] depicted in the diagram indicates that Africa and Oceania, with 0.2661 and 0.4086 EG development indexes, respectively, are below the world average of 0.4712. Europe (0.6936), Americas (0.5074) and Asia (0.4951) have enhanced their EGDI, which is way above the world average of 0.4712. Globally, Europe is the leading region when it comes to the adoption and implementation of EG; this is followed by the Americas, Asia, and Oceania regions, and lastly by Africa as the least developed region.

Africa's poor performance in the adoption and implementation of EG could be due to several reasons and factors such as poor ICT infrastructure, lack of financial resources to invest in infrastructure, the absence of political will and support, frequent instability in national affairs of African countries and the language barrier of citizens. These challenges notwithstanding, Africa and other best-performing regions in Fig. 1 is making efforts through policy formation and adoption of EG to transform and modernize public administration, as well as the traditional business of governments with a focus on improved and efficient public service delivery to citizens through its state institutions, ministries, departments, and agencies.

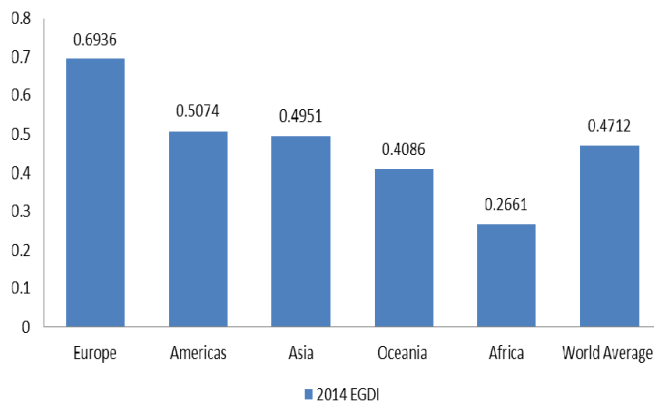


Fig. 1 Continental Averages of EG Development Index [8]

IV. EG DEVELOPMENT IN AFRICA

Africa is considered the largest continent on the planet with approximately 11.7 million square miles. It is divided into five regions, West Africa, South Africa, North Africa, East Africa and Central Africa. Over the years, the rapid democratic transitions in Africa has led to a more responsive and accountable government to the people [12]. According to the United Nations Development Programme [12], the population of Africa stands at 910.4 million, with a poverty rate of 48.5%. Its per capita income is \$1,966 and a Human Development Index of 0.463. Africa's GDP is estimated to reach 4.4% and 4.8% in 2016 and 2017, respectively. Mobile phone subscriptions in Africa have seen an increase of 2,500% between 2000 and 2012 [12], while Internet penetration in Africa is 28.6%. The percentage of Internet users is 9.8% [13].

Africa, like other regions around the world, is harnessing the powerful tool of ICTs to engineer economic growth and bring efficacy to government public service delivery through EG adoption and implementation. According to the 2014 United Nations EG Survey, Africa was ranked 5th in the EGDI with a regional average of 0.2661, which is below the world average of 0.4712. The top EG development country is Tunisia with EGDI of 0.5390 ranked 75 in the world, but in Africa is the number one in relation to EG adoption and implementation. Mauritius, Egypt, and Seychelles are second, third and fourth, respectively. Tunisia, Mauritius, Egypt, Seychelles, Morocco and South Africa have EGDI figures which are above the world average of 0.712 and according to [8], this placed these countries among the top 50 percent of the world. Table II below presents the best-performing countries with EGDI in Africa in 2014 and respective previous EGDI rankings for 2012, 2010 and 2008.

Africa countries' EG adoption and development has seen slow progress over the years. To enhance EG development in Africa, countries on the continent must improve ICT literacy, do more to bridge the infrastructure gap, create stable political and economic environments to provide enabling environments for EG development and to also put in place visionary strategies and practical implementation for the effective deployment of sustainable online services [12]

The African regional bloc EG development index [9] in Fig.

7, indicates that South Africa (0.3934) has the highest EGDI, followed by North Africa (0.3159), East Africa (0.3011), Middle Africa (0.2492) and West Africa (0.2171). No region was able to go beyond the world EGDI average of 0.4882.

TABLE II
 TOP 20 AFRICAN COUNTRIES WITH HIGH EGDI [8]-[11]

Country	2014 EGDI	2014 Rank	2012 Rank	2010 Rank	2008 Rank
Tunisia	0.5390	75	103	66	124
Mauritius	0.5338	76	93	77	63
Egypt	0.5129	80	107	86	79
Seychelles	0.5113	81	84	104	69
Morocco	0.5060	82	120	126	140
South Africa	0.4869	93	101	97	61
Botswana	0.4198	112	121	117	118
Namibia	0.388	117	123	125	126
Kenya	0.3805	119	119	124	122
Libya	0.3753	121	191	114	120
Ghana	0.3735	123	145	147	138
Rwanda	0.3589	125	140	148	143
Zimbabwe	0.3585	126	133	129	137
Cape Verde	0.3551	127	118	108	104
Gabon	0.3294	131	129	123	129
Algeria	0.3106	136	132	131	121
Swaziland	0.3056	138	144	145	125
Angola	0.2970	140	142	132	127
Nigeria	0.2929	141	162	150	136
Cameroon	0.2782	144	147	149	149
Regional Average	0.2661				
World Average	0.4712				

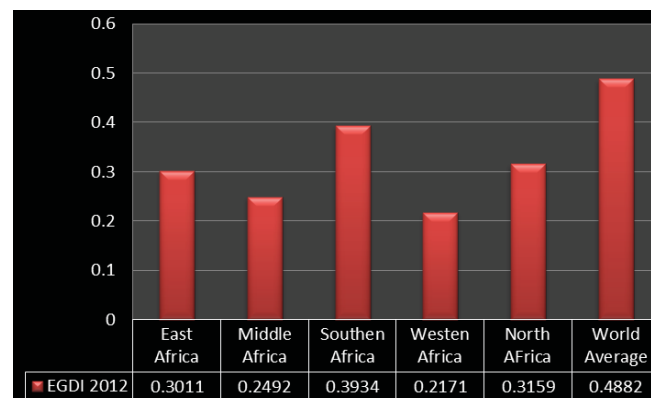


Fig. 2 Africa Regional EG Development Index 2012 [9]

V. EG DEVELOPMENT IN THE AMERICA

The Americas regional blocs are Central America, South America, North America and the Caribbean. The United States of America is the leader in EG development in the Americas ranked 7th in the World EG development rankings with 0.8748 value on the EGDI. Followed by Canada (0.8418), Uruguay (0.7420), Chile (0.7122) and Argentina (0.6306) ranked in 2014, 11th, 26th, 33rd and 46th, respectively in the world. The Americas has a regional average of 0.5074 which is above the world average of 0.4712. The top performing countries in EG development indexes in 2014 and their respective previous EG rankings for 2012, 2010 and 2008 are illustrated in Table III.

In Fig. 3, the leading region of the Americas is North America, with an EGDI rating of 0.8559, which is far above the world average. This is followed by South America, Central America and the Caribbean with 0.5507, 0.5133 and 0.4895 values, respectively. All these regional blocs have an EGDI which is above the world average of 0.4882 according to the 2012 United Nations EG Survey.

TABLE III
EG DEVELOPMENT INDEX IN THE AMERICAS [8]-[11]

Country	2014 EGDI	2014 Rank	2012 Rank	2010 Rank	2008 Rank
United States of America	0.8748	7	5	2	4
Canada	0.8418	11	11	3	7
Uruguay	0.7420	26	50	36	48
Chile	0.7122	33	39	34	40
Argentina	0.6306	46	56	48	39
Colombia	0.6073	50	43	31	52
Costa Rica	0.6061	54	77	71	59
Brazil	0.6008	57	59	61	45
Barbados	0.5933	59	44	40	46
Antigua & Barbuda	0.5927	60	49	55	96
Mexico	0.5733	63	55	56	37
Venezuela	0.5564	67	71	70	62
Peru	0.5435	72	82	63	55
Panama	0.5242	77	66	79	83
Grenada	0.522	78	75	99	92
Ecuador	0.5053	83	102	95	75
El Salvador	0.4989	88	74	73	67
Saint Kitts & Nevis	0.4980	90	81	75	76
Trinidad & Tobago	0.4932	91	67	67	54
Bahamas	0.4900	92	65	65	71
Regional Average	0.5074				
World Average	0.4712				

VI. EG DEVELOPMENT IN ASIA

Asia is the largest and most populous continent in the world, home to about 3.8 billion people. The percentage of Internet users in Asia, as at November 2015, was 48.2% of the world's population, while the rest of the world is 51.8% [14]. The Internet penetration rate in Asia is 40.2%. Asia has a regional average EGDI of 0.4951, which is above the world average of 0.4712. The Republic of South Korea is the leader in both Asia and the world for EG adoption, development and implementation with the highest EGDI of 0.9462, which is above the world average of 0.4712. Singapore is ranked third in the with an index rating of 0.9076, making it the second country in Asia. The regional bloc average for Asia is 0.495, which is above the world average and also, all the best performing 20 countries in Asia depicted in Table IV have EGDI indexes above the world EGDI of 0.4712.

The regional bloc of Asia regions, Eastern Asia (0.6344) is the leading region in EG development, followed by Western Asia (0.5547), Central Asia (0.4941) and South Eastern Asia (0.4793) and all these regions have regional index which is above the world average except Southern Asia with 0.3464 indexes below the world average. The regional bloc EGDI is represented in Fig. 4.

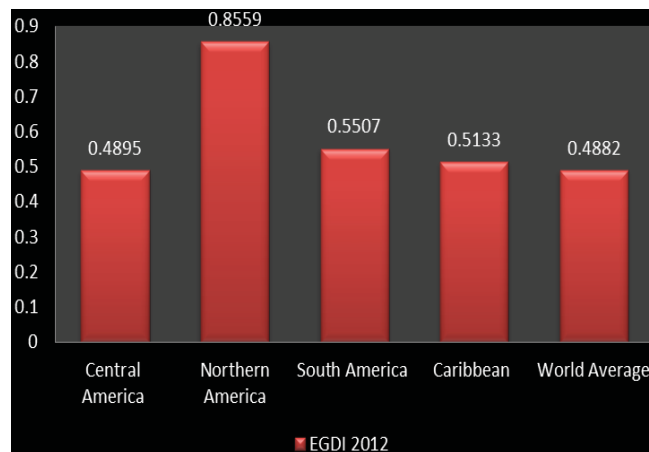


Fig. 3 Americas Regional EG Development Index 2012 [9]

TABLE IV
BEST-PERFORMING 20 EG DEVELOPMENT COUNTRIES [8]-[11]

Country	2014 EGDI	2014 Rank	2012 Rank	2010 Rank	2008 Rank
South Korea	0.9462	1	1	1	6
Singapore	0.9076	3	10	11	23
Japan	0.8874	6	18	17	11
Israel	0.8162	17	16	26	17
Bahrain	0.8089	18	36	13	42
Kazakhstan	0.7383	28	38	46	81
United Arab Emirates	0.7136	32	28	49	32
Saudi Arabia	0.6900	36	41	58	70
Qatar	0.6362	44	48	62	53
Oman	0.6273	48	68	82	84
Kuwait	0.6268	49	63	50	57
Malaysia	0.6115	52	40	32	34
Georgia	0.6047	56	72	100	90
Cyprus	0.5958	58	45	42	35
Armenia	0.5897	61	94	110	103
Mongolia	0.5581	65	76	53	82
Azerbaijan	0.5472	68	96	83	89
China	0.5450	70	78	72	65
Turkey	0.5441	71	78	69	76
Sri Lanka	0.5418	74	115	111	101
Regional Average	0.4951				
World Average	0.4712				

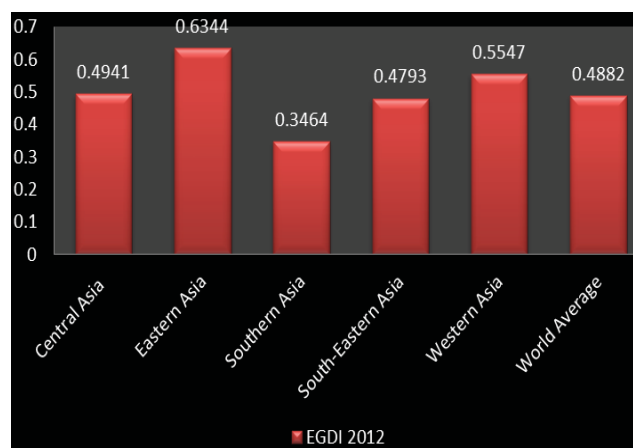


Fig. 4 Asia EG Development Index 2012 [9]

TABLE V
 TOP 20 COUNTRIES IN EUROPE WITH HIGH EGDI [8]-[11]

Country	2014 EGDI	2014 Rank	2012 Rank	2010 Rank	2008 Rank
France	0.8938	4	6	10	9
Netherlands	0.8897	5	2	5	5
United Kingdom	0.8695	8	3	4	10
Finland	0.8449	10	9	19	15
Spain	0.8410	12	23	9	20
Norway	0.8357	13	8	6	3
Sweden	0.8225	14	7	12	1
Estonia	0.8180	15	20	20	13
Denmark	0.8162	16	14	7	2
Iceland	0.7970	19	22	22	21
Austria	0.7912	20	21	24	16
Germany	0.7864	21	17	15	22
Ireland	0.7810	22	34	21	19
Italy	0.7593	23	32	38	27
Luxembourg	0.7591	24	19	25	14
Belgium	0.7564	25	19	16	24
Russian Federation	0.7296	27	27	59	60
Lithuania	0.7271	29	29	28	28
Switzerland	0.7267	30	15	15	12
Latvia	0.7176	31	42	37	36
Regional Average	0.6936				
World Average	0.4712				

VII. EG DEVELOPMENT IN EUROPE

The percentage of Internet users in Europe is 17.9%, with an Internet penetration rate of 73.5% as at November 2015 [15], while the percentage of Internet users in the European Union is 12.0% and the Internet penetration rate is 79.3% [16]. Two-thirds of all European citizens (65%) use the Internet every day, while almost half of the population (51%) uses the Internet on the go through portable computers and handheld devices [17]. The number of individual citizens in the EU who have never used the Internet dropped to 18% in 2014, and for the same period, the proportion of the population without experience in using the Internet (whether at home, work or elsewhere) was noted to be high in member countries such as Romania (39%), Bulgaria (37%), Greece (33%), Italy (32%) and Portugal (30%), and was lowest in Denmark (3%), Luxembourg (4%) and the Netherlands (5%) [17]. According to the United Nations EGDI, France is the leading EG adoption and development country in Europe with 0.8938, ranking it 4th in the whole world. This is followed by the Netherlands (0.8897), United Kingdom (0.8695), Finland (0.8449) and Spain (0.8410) ranked in the 2014 EGDI 5th, 8th, 10th and 12th, respectively in the world EG rankings. The top 20 best EG development countries in Europe in 2014 and their respective rankings for 2012, 2010 and 2008 are shown in Table VI.

The European Commission in 2010 developed the European EG Action Plan 2011-2015 [18] under the theme “Harnessing ICT to promote smart, sustainable & innovative Government” for all European countries. The EG Action plan for Europe was within a comprehensive measure aimed at exploiting the benefits of ICTs across Europe to enable the public sector to

develop innovative approaches to delivering public services to citizens while increasing efficiencies and a reduction of costs [18]. The 2010 European EG Action plan was the second after the implementation of the first European EG Action Plan adopted in 2006 [18].

The second five-year European EG Action Plan had a focused and determined vision that by 2015 European public administrations in all member states will be “recognized as being open, flexible and collaborative in their relations with citizens and businesses. They used EG to increase their efficiency and effectiveness and to constantly improve public services in a way that caters to user’s different needs and maximizes public value, thus supporting the transition of Europe to a leading knowledge-based economy.” [19]. The Action Plan [19] outlined four priority areas for all European public administrations over the next five years:

1. Citizens and businesses are empowered by EG services designed around user’s needs and developed in collaboration with third parties, as well as by increased access to public information, strengthened transparency and effective means for involvement of stakeholders in the policy process.
2. Mobility in the Single Market is reinforced by seamless EG services for the setting up and running of a business and for studying, working, residing and retiring anywhere in the European Union.
3. Efficiency and effectiveness are enabled by a constant effort to use EG to reduce the administrative burden, improve organizational processes and promote a sustainable low-carbon economy.
4. The implementation of the policy priorities is made possible by creating the appropriate key enablers and by establishing the necessary legal and technical preconditions.

The action plan further had some key targets such as by 2015, a number of keyboarder services will be available online, 50% of EU citizens will have used EG services, and that 80% of enterprises/businesses will have used EG. In 2013, the number of citizens who interacted with public authorities and public services over the Internet was 41%. One in every five EU citizens filed and submitted web application forms with the highest emanating from Denmark (66%), followed by the Netherlands (57%), Sweden (46%), Finland (45%), Ireland (36), Belgium and France (32%), respectively. While less than one in every 10 citizens in Bulgaria (8%), the Czech Republic (7%) and Romania (2%) submitted forms online [20].

The motivations and reasons of EU citizens [20] for usage of EG services varies; however, almost 44% of EG users used it to declare income tax, followed by requests for personal documents (passport, ID card or driver’s license, birth certificates, marriage and death certificates) (20%), claims for social security benefits (16%), searching public libraries (16%), enrolment in higher education or university (9%) and notification of change of address (6%). In terms of experience with EG services, four in 10 users (41%) had experienced problems with EG websites, 24% had technical problems with government websites, 23% found the information on the EG

websites to be insufficient, unclear or out of date, while 13% did not find the online or offline support they need to obtain the right information and forms to fill out or send. On user satisfaction, [21] indicates that 16% of EG users in the EU were dissatisfied with the ease of using services on EG websites, how easy to find information (16%), not satisfied with the usefulness of the information available (13%), while 21% were also dissatisfied with the extent to which they were able to track how their request through EG websites was handled. Currently, there is a public consultation on the next European EG Action Plan 2016-2020 [21].

In the United Nations EGOV 2012 Survey [9], the regional blocs in Europe, Northern Europe (0.8046) is the leader in Europe in EG adoption and implementation, followed by Western Europe (0.81420), Southern Europe (0.6574) and Eastern Europe (0.6333), having an EGDI above the global EG development average of 0.4882.

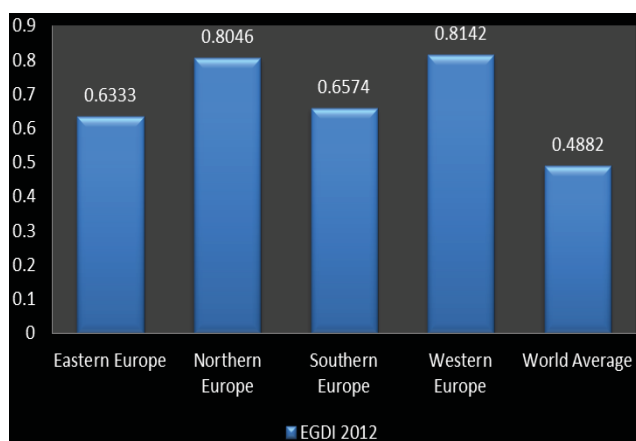


Fig. 5 Europe Regional Bloc EG Development Index 2012 [9]

TABLE VI
 OCEANIA LEADING COUNTRIES IN EG DEVELOPMENT INDEX [8]-[11]

Country	2014 EGDI	2014 Rank	2012 Rank	2010 Rank	2008 Rank
Australia	0.9103	2	12	8	8
New Zealand	0.8644	9	13	14	18
Fiji	0.5044	85	105	113	105
Tonga	0.4706	98	111	116	112
Palau	0.4415	108	113	103	N/A
Samoa	0.4204	111	114	115	115
Micronesia	0.3337	130	127	N/A	N/A
Kiribati	0.3201	132	149	N/A	N/A
Tuvalu	0.3059	137	134	N/A	N/A
Marshall Islands	0.2851	142	146	N/A	N/A
Nauru	0.2776	145	141	N/A	N/A
Vanuatu	0.2571	159	135	155	154
Solomon Islands	0.2087	170	168	156	147
Papua New Guinea	0.1203	188	177	171	166
Regional Average	0.4086				
World Average	0.4712				

VIII. EG DEVELOPMENT IN OCEANIA

The percentage of Internet users in Oceania countries is 0.8%, while the penetration rate is 73.2 % [22]. Australia is

the leading country in EG adoption and implementation in the Oceania region according to the United Nations EG Survey 2014 [8], with an EGDI index of 0.9103, making it the second-ranked country in the world EG rankings. This is followed by New Zealand with an EGDI value of 0.8644 ranked 9th in the world. Australia, New Zealand, and Fiji are the only countries in Oceania who had EGDI values above the world average of 0.4712, while other countries shown in Table VI have EGDI values below the world average. The region as a whole has an EGDI average which also below the world average.

Australia is the country with the most Internet users with 21.2 million in the Oceania region, followed by New Zealand with 4.2 million Internet users, while all other countries in Oceania have less than five million Internet users [22].

IX. WORLD ICT DEVELOPMENT TRENDS AND INDICATORS

A. Summary of ICT World Indicators

The adoption and usage of ICT technologies around the world from 2001 to 2015 [23] of key indicators, such as mobile-cellular telephone subscriptions, individuals using the Internet, fixed telephone subscriptions, active mobile broadband subscriptions and fixed broadband subscriptions are illustrated in Fig. 6. In Fig. 6, the global trend of mobile-cellular telephone subscriptions has been on the increase from 2001 with 15.5 million to 96.8% subscribers in 2015. The individual usage of the Internet has also been on the increase from a low figure of 0.8% in 2001 to 43.4 million in 2015, while fixed telephone subscriptions around the world have been increasing over the years from 2001 to 2017, but started to decline gradually from 2008 to 18.5% to 14.5% in 2015. This decline could be due to the increase in mobile telephone subscriptions and the active penetration of broadband subscriptions as well. Active mobile broadband subscriptions, which started with a low subscription 4.0% in 2007 has seen a faster increase from 2007 to 47.2% in 2015, compared to the fixed (wired) broadband subscriptions has seen an increase over the years from 0.6% in 2001 to 10.8% in 2015.

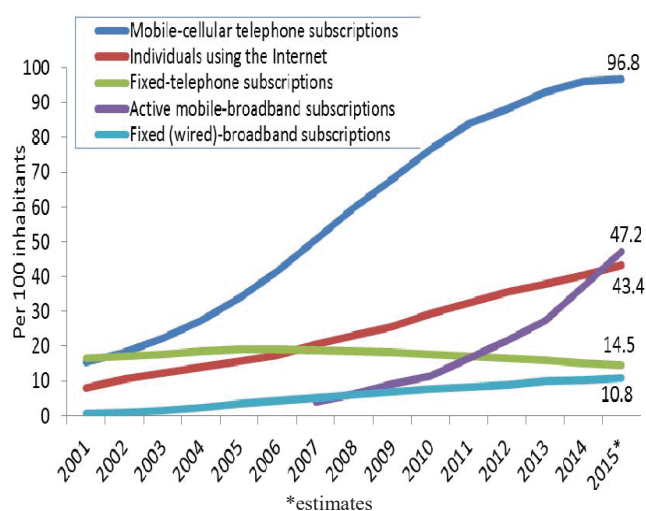


Fig. 6 Global ICT development Indicators 2001-2015 [23]

B. Fixed-Telephone Subscriptions per 100 Inhabitants (Global)

The global fixed telephone subscriptions depicted in the Fig. 7 show that all over global usage of fixed telephone lines is on the decrease in both developed and developing nations, and other parts of the world. Fixed telephone subscriptions in developed nations has seen a steady decline from 48.7 million subscribers from 2001 to 39 million in 2015, while in developing nations it has also seen a slight increase from 9 million in 2001 to 9.4 million in 2015. There was an increase in the world average of fixed telephone subscription from 16.6 million in 2001 to 19.2 million in 2006, but from 2007, it started to decrease from 18.8 million to 14.5 million in 2015.

Again, the decrease in fixed telephone subscriptions could be due to the huge availability of mobile phone telephone and broadband subscriptions among citizens in the world.

C. Fixed Telephone Subscriptions per 100 Inhabitants (Regional)

Europe leads the world with 37.3 million of fixed telephone subscription per 100 inhabitants. This is followed by the Americas with 25.4 million and the Commonwealth of Independent states with 23.1 million subscribers. Asia and Pacific has 11.3 million and the Arab states have 7.3 million subscribers, while the rest of the world has 14.5 million. Africa is the only region with low fixed telephone subscriptions, recording 1.2 million in 2015.

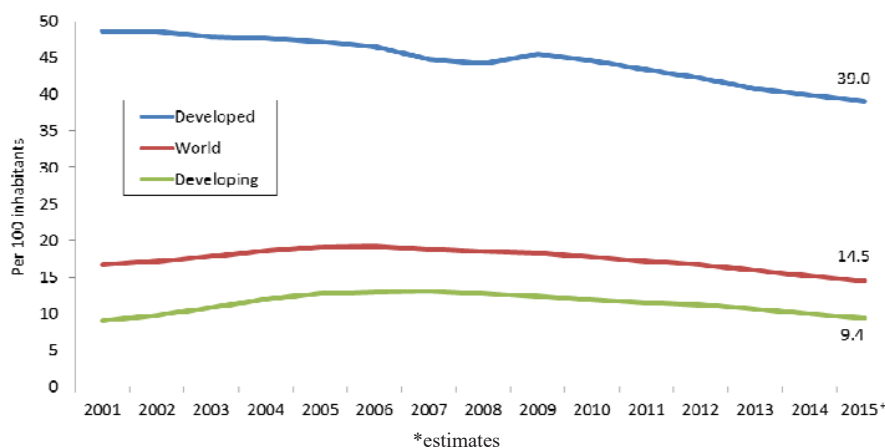


Fig. 7 Fixed telephone subscriptions per 100 inhabitants, 2001-20015(Global) [23]

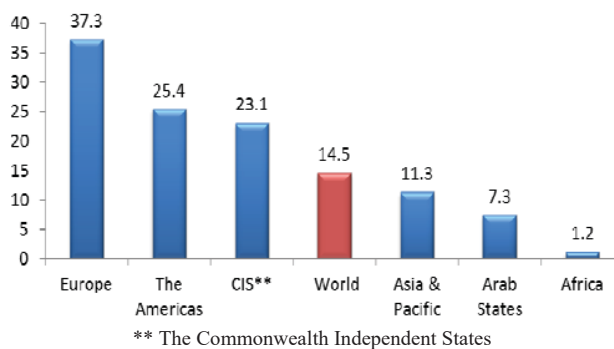


Fig. 8 Fixed Telephone Subscriptions per 100 Inhabitants (Regional) 2015 [23]

X. MOBILE CELLULAR DEVELOPMENT TRENDS

A. Global Mobile-Cellular Subscriptions (Total and per 100 Inhabitants), 2001-2015.

Mobile cellular subscriptions globally have seen a continuous increase from 962 million in 2011 to 7.085 billion subscribers in 2015, while the per 100 inhabitants of mobile subscribers also increased from 15.5% in 2001 to 96.8% in 2015.

B. Mobile Cellular Subscriptions per 100 Inhabitants (2001-2015)

Mobile cellular subscriptions per 100 inhabitants from 2001 to 2015 have been on the increase in developed nations, developing nations and other parts of the world. In the developed regions, mobile cellular subscription per 100 inhabitants increased from 47.1 in 2001 to 120.6% in 2015, and in the rest of the world it has also been increasing from 15.5 to 96.8 in 2015. Developing regions also saw a gradual increase from 7.9% to 91.8 % in 2015.

C. Mobile Cellular Subscriptions per 100 Inhabitants (2015) Regional

In terms of mobile phone subscription by regional blocs, the Commonwealth of Independent States leads with 138.1%, followed by Europe with 120.6 %, the Arab States at 108.2% and the Americas at 108.1%, while the world average is 96.8%. Asia & Pacific has 91.6 %, and finally, Africa, which had 73.5%, recorded the lowest mobile phone subscriptions per 100 inhabitants in 2015 as shown in Fig. 11.

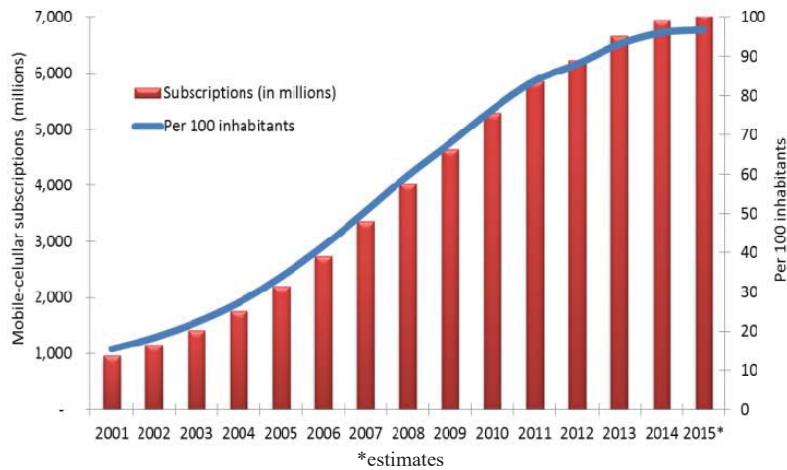


Fig. 9 Global mobile cellular subscriptions [23]

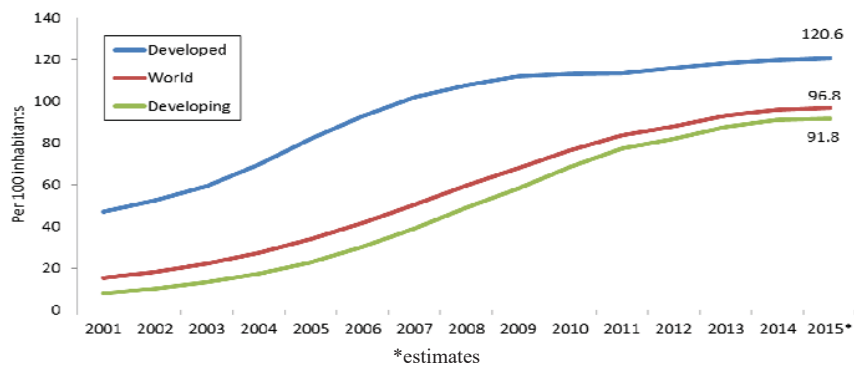


Fig. 10 Mobile cellular subscriptions per 100 inhabitants [23]

XI. MOBILE BROADBAND DEVELOPMENT TRENDS

A. Active Mobile-Broadband Subscriptions per 100 Inhabitants, 2007-2015(Global)

Active mobile-broadband subscriptions per 100 inhabitants in developed nations have increased from 18.5% in 2007 to 86.7% in 2015, while the rest of the world has also seen a steady increase from 4% in 2007 to 47.2% in 2015. Developing regions active mobile-broadband subscriptions per 100 inhabitants also increased from 0.8% in 2007 to 39.1% in 2015.

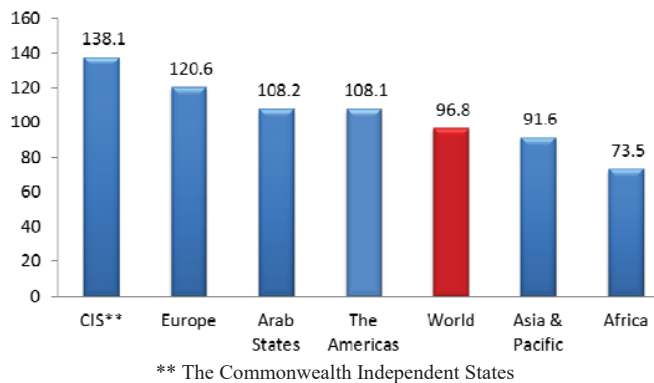


Fig. 11 Mobile cellular subscription per 100 inhabitants 2015 (Regional) [23]

B. Active Mobile-Broadband Subscriptions per 100 Inhabitants, 2015(Regional)

Europe is leading in active mobile-broadband subscriptions per 100 inhabitants with 78.2%, followed by the Americas 77.6%, Commonwealth Independent States 49.1%, which is above the world average of 47.2%. Asia & Pacific and the Arab States subscriptions per 100 populations are 42.3% and 40.6%, respectively. Africa has the lowest active mobile-broadband subscriptions per 100 inhabitants of 17.4%.

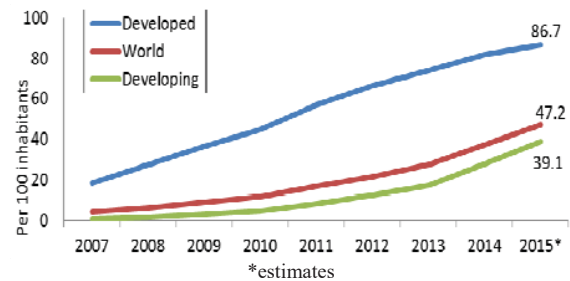


Fig. 12 Active mobile-broadband subscriptions per 100 inhabitants (Global) [23]

C. Fixed Broadband Subscriptions per 100 Inhabitants, 2001-2015(Global)

The fixed broadband subscriptions per 100 inhabitants from 2001 to 2015 have increased over the years. In the developed

countries, from the low subscription of 2.2% in 2001, it has increased to 29% by 2015, while the rest of the world also saw a similar increase from 0.6% to 10.8% in 2015. Developing countries have also seen an increase from 0.2% in 2001 to 7.1% in 2015.

D. Fixed Broadband Subscriptions per 100 Inhabitants, 2015 (Regional)

The 2015 fixed broadband subscriptions per 100 inhabitants indicated in Fig. 15, shows that Europe leads with 29.6%, the Americas 18%, the Commonwealth Independent States 13.6%, while the world average is 10.8%. Asia & Pacific and the Arab States had 8.9% and 3.7%, respectively. Meanwhile, Africa recorded 0.5% fixed broadband subscription per 100 inhabitants.

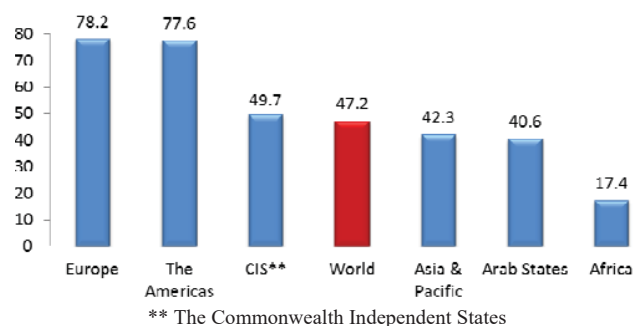


Fig. 13 Active mobile broadband subscriptions per 100 inhabitants (Regional) [23]

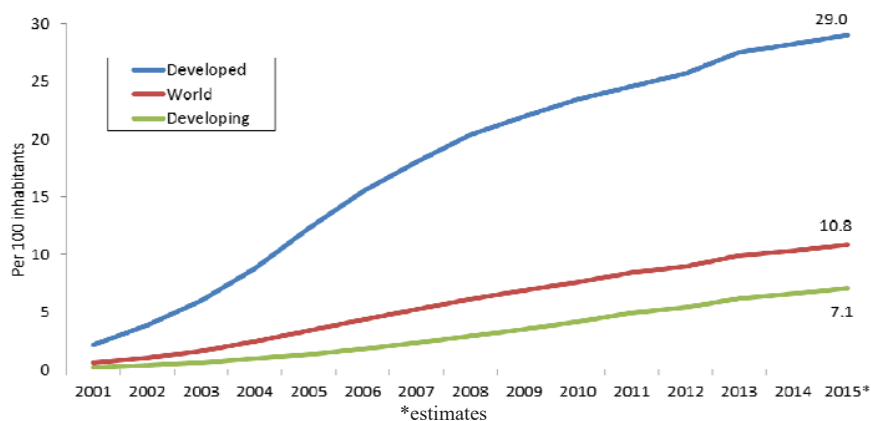


Fig. 14 Fixed broadband subscriptions per 100 inhabitants [23]

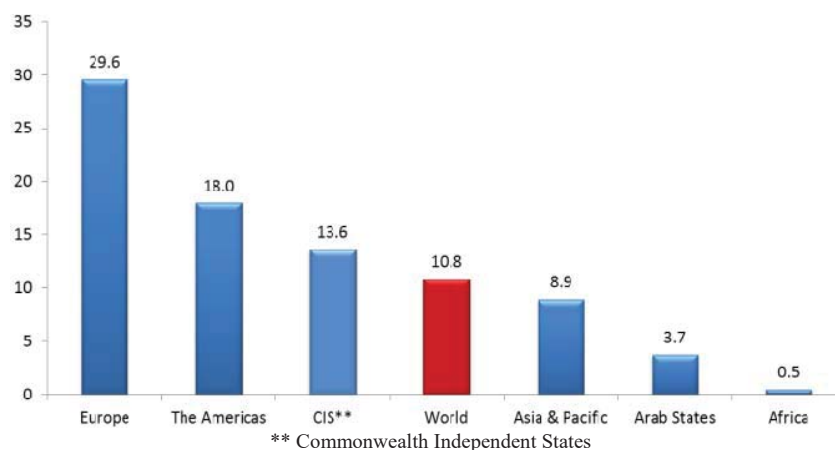


Fig. 15 Fixed broadband subscriptions per 100 inhabitants, 2015 Regional [23]

XII. HOUSEHOLDS AND INDIVIDUAL USING THE INTERNET

A. Percentage of Households with Internet Access by Level of Development, 2002-2015(Global)

The percentage of households with Internet access in developed nations has continuous increase from 35% in 2002 to 81.3% in 2015, while the rest of the world average also saw increase from 13.4% in 2002 to 46.4% in 2015. Developing nations have also seen an increase over the years from 4.6% in 2002 to 34.1% in 2015.

B. Percentage of Households with Internet Access, by Region, 2015

The region with the highest percentage of households with Internet access is Europe with 82.1%, followed by the Commonwealth Independent States 60.1%, the Americas 60%, while the world average is 46.4%. The Arab States and Asia & Pacific have 40.3% and 39%, respectively, of households with Internet access. Africa has the lowest percent of households with Internet access at 10.7%.

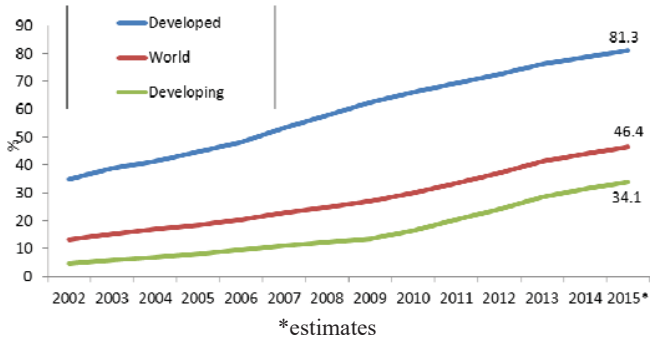


Fig. 16 Percentage of households with Internet access by level of development, 2002-2015(Global) [23]

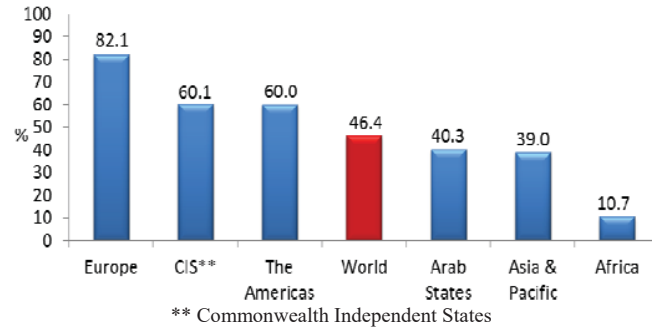


Fig. 17 Percentage of households with Internet access, by Region, 2015 [23]

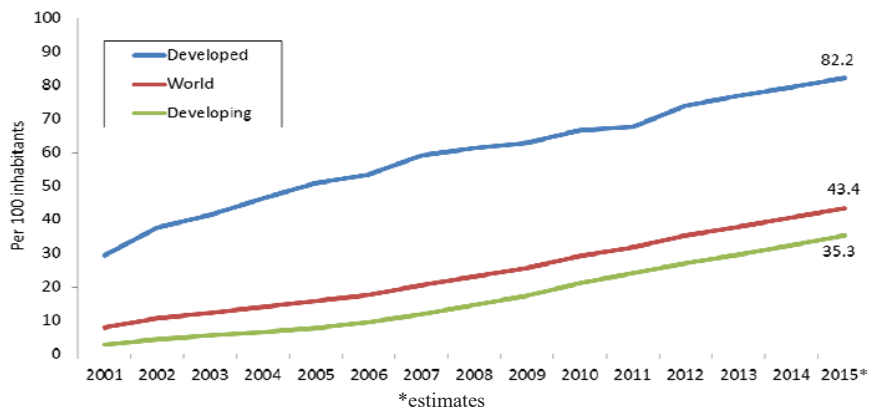


Fig. 18 Individuals using the Internet per 100 inhabitants, 2001-2015 (Global) [23]

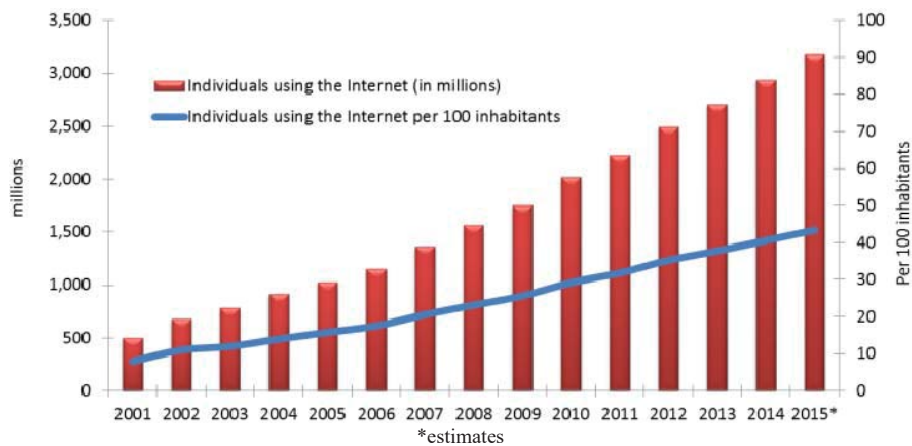


Fig. 19 Global numbers of individuals using the Internet, total and per 100 inhabitants, 2001-2015 [23]

C. Individuals Using the Internet per 100 Inhabitants, 2001-2015 (Global)

Individual Internet usage per 100 inhabitants has seen a tremendous increase over the years from 2001 to 2015, which means that more people are increasingly using the Internet around the globe. In developed nations, the percentage of Internet users increased from 29.4% in 2001 to 82.2% in 2015, while the world average also saw an increase in individuals using the Internet from 8.8% in 2001 to 43.4% in 2015. The same could be said of the developing nations which saw an increase in usage from 0.8% in 2001 to 35.3% in 2015.

D. Global Numbers of Individuals Using the Internet, Total and per 100 Inhabitants, 2001-2015

Fig. 20 shows the total number of individuals using the Internet and per 100 inhabitants from 2001 to 2015. It indicates a speedy increase in the number of individuals using the Internet in the world.

E. Individuals Using the Internet per 100 Inhabitants, 2015(Regional)

In Fig. 20, Europe leads with the number of individuals using the Internet per 100 inhabitants with 77.6%, followed by

the Americas 66%, Commonwealth of Independent States 59.9% and the Arab States 37%, while the world average of Internet users per 100 populations is 43.4%. Asia & Pacific recorded 36.9%, while Africa revealed the least number of individuals using the Internet at 20.7%.

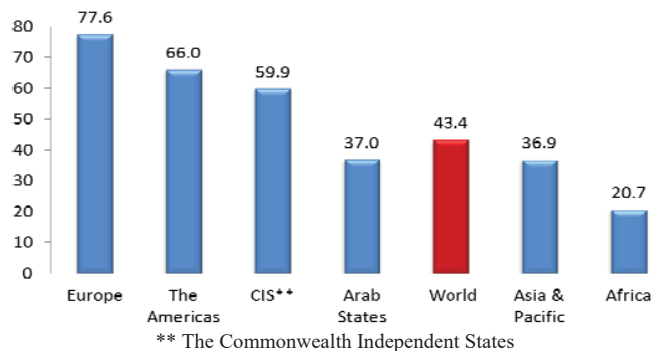


Fig. 20 Individuals using the Internet per 100 inhabitants, 2015 Regional [23]

XIII. DISCUSSION

The rapid improvement and advancement of the world's ICTs in countries globally presents a unique opportunity to governments and its state institutions to deliver efficient and quality public service to its citizens. Increased usage of mobile cellular phones and broadband, the high number of individuals with Internet connection indicates the desire of citizens to embrace technology in order to simplify activities and enhance their daily lives. Governments, therefore, must use EG as a tool to meet the demands of citizens for quality and efficient public service delivery by encouraging its state and public institutions to adopt the appropriate technologies to modernize their operations to enhance service delivery to all citizenry. The adoption and implementation of EG by governments in countries all over the world, as indicated in the United Nations EG surveys, shows that governments understand the need to modernize public administration, but there should be a greater commitment to achieving that through the allocation of resources by governments in specific regions of the globe to invest in ICT infrastructure.

Regions like Europe, Asia, and the Americas have made huge investment in ICT infrastructure in their specific countries which is impacting positively on their EG development indexes and the world rankings, with the exception of Africa which is still struggling to attract the huge financial capital needed for its ICT infrastructure development. This lack of ICT infrastructure is a key barrier to effective implementation of EG in Africa, hence the low EG development indexes and being ranked the last continent when it comes to adoption and implementation of EG. The availability of broadband, mobile telephones, as well as the availability of Internet in individual homes is a critical factor for the success of EG Internet-based services in Africa. All countries in Africa should, therefore, put in place the right measures to attract investment for expansion in ICT infrastructure if they are to meet the demands of its citizens for

efficient and quality public service delivery. Also, EG success anywhere in the world, particularly Africa, would be dependent on an increase in Internet access among all citizens, human capital development both in terms of users and designers, putting in the requisite regulatory framework, a conducive and enabling the political environment and the integration and reorganization of government processes.

XIV. CONCLUSION

With the increase in ICT indicators across all regions of the world, governments and nations around the globe should not miss the opportunity to provide quality and efficient public service delivery to its citizenry, businesses, enterprises and the general public. Even though countries in Europe, Asia, Arab States, Commonwealth Independent States and Africa have adopted one form of ICT through EG as a means to modernize the public administration process that would deliver quality and enhanced public service delivery, there is still more that needs to be done to meet the expectation of citizens in specific countries and regions of the world.

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