

E-Government Development in West African Countries: A Two Decade Review

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To Link this Article: <http://dx.doi.org/10.6007/IJARBSS/v14-i7/21653>

DOI:10.6007/IJARBSS/v14-i7/21653

Published Date: 06 July 2024

Abstract

This paper explores the evolution of E-government Development in West Africa over the past two decades through the E-government Development Index (EGDI) scores obtained from United Nations E-government Surveys. The study aims to assess trends and offer recommendations for enhancing E-government effectiveness and impact in the sub-region. It emphasizes the significance of studying E-government in the region to address governance challenges, promote socio-economic development, and empower citizens. The analysis of EGDI scores reveals that Cape Verde, Ghana, Liberia, and Nigeria demonstrate higher readiness for e-government initiatives, while other countries lag. Comparison of Global Average EGDI scores across the surveys shows overall progress with fluctuations in few surveys. In each of the surveys, West African countries generally fall below the Global Average, indicating a wide gap in E-government development in the sub-region. Leveraging E-government can foster inclusive growth, transparency, and citizen empowerment. However, challenges persist, requiring investment in ICT infrastructure, digital literacy, and governance processes. Future research could explore other regions and develop frameworks for enhancing EGDI components of OSI, TII, and HCI in West African countries.

Keywords: E-government Development Index (EGDI), E-government Evaluation, UN E-Government Surveys, West Africa, OSI, TII, and HCI.

Introduction

Background and Context of E-government Development Globally

In recent decades, the advancement in information and communication technologies (ICTs) has revolutionized the way governments interact with citizens and deliver public services. This transformation, commonly referred to as electronic government or E-government, entails the use of digital platforms and technologies to enhance governance processes, improve service delivery, and foster citizen participation (Strazza, 2022). The concept of E-government

emerged in the late 20th century as governments recognized the potential of ICTs to streamline administrative processes, increase transparency, and promote efficiency in public service delivery. Initially, E-government initiatives focused on automating routine tasks such as online tax filing or permit applications. However, as technology advanced and connectivity became more widespread, the scope of E-government expanded to encompass a broader range of services and interactions (Araújo & Andrade, 2022; Fernández et al., 2023).

One of the key frameworks used to assess the progress of E-government initiatives is the E-government Development Index (EGDI), developed by the United Nations Department of Economic and Social Affairs (UNDESA). EGDI measures the readiness and capacity of countries to use ICTs for E-government purposes based on three main dimensions - online services, telecommunications infrastructure, and human capital (UN-DESA, 2018, 2020). Globally, E-government has become a central component of efforts to promote good governance, enhance public sector efficiency, and foster socio-economic development. Countries around the world have implemented various E-government strategies and initiatives to leverage the potential of ICTs for public service delivery and citizen engagement (Arwati & Latif, 2021; Kumar et al., 2024; Mensah et al., 2021).

Importance of studying E-government in the West African context

The importance of studying E-government in the West African context lies in its potential to address the region's unique challenges while leveraging opportunities for socio-economic development. Studying E-government in the West African context is essential for leveraging technology to address governance challenges, promote socio-economic development, and empower citizens. By embracing E-government initiatives, West African countries can build more inclusive, transparent, and resilient societies that harness the full potential of the digital age. There are several reasons why studying E-government in West Africa is important. These include but not limited to enhanced service delivery, increased transparency & accountability, citizen engagement & participation, digital inclusion & empowerment. Support for Economic growth and innovation, resilience & crises management.

Firstly, West African countries face various challenges in delivering public services efficiently and effectively due to limited resources, bureaucratic inefficiencies, and infrastructure deficits. E-government offers an opportunity to streamline administrative processes, improve service delivery, and enhance accessibility to essential services such as healthcare, education, and public utilities (Sachan et al., 2018; Wairiuko et al., 2018; West, 2004). Secondly, E-government initiatives can promote transparency and accountability in governance by providing citizens with access to information, decision-making processes, and public expenditures (Kariuki et al., 2020; Sebina & Grand, 2014). Thirdly, E-government platforms can facilitate greater citizen engagement and participation in governance processes by providing avenues for feedback, consultation, and collaboration (Ochara & Mawela, 2015; Piderit & Jojozi, 2017). Fourthly, E-government has the potential to bridge the digital divide by providing remote communities with access to information and services, regardless of their geographic location or socio-economic status. By promoting digital literacy and inclusivity, E-government initiatives can empower vulnerable populations and promote social equity (Manda & Backhouse, 2018; Owusu & Penu, 2022; Terzoli et al., 2018). Similarly, E-government can serve as a catalyst for economic growth and innovation by fostering an enabling environment for entrepreneurship, digital commerce, and investment (Dhaoui, 2022; Lima et al., 2022; Tobgye et al., 2022). E-government systems can enhance the resilience of governments and

communities in the face of crises such as natural disasters, health emergencies, or political instability (Azmi & Zakaria, 2022; Fotiadis et al., 2024; Levesque et al., 2024).

Objectives of the Study

- a. To assess the trends and patterns of E-government development in West African countries over a period of two decades using EGDI scores.
- b. To provide recommendations for enhancing E-government development and implementation in West Africa based on the analysis of EGDI scores.

Literature Review

EGDI as a measure of E-government Development

The EGDI enables policymakers, researchers, and international organizations to monitor and benchmark the progress of E-government development at the national, regional, and global levels. By identifying strengths, weaknesses, and areas for improvement, EGDI helps inform policy decisions and strategies aimed at advancing E-government initiatives and promoting digital governance worldwide (Sukarno & Mutiarin, 2024; Younus et al., 2023). The EGDI is a composite index developed by the United Nations Department of Economic and Social Affairs (UNDESA) as part of its E-government Surveys. It assesses the readiness and capacity of countries to use information and communication technologies (ICTs) to deliver services to their citizens. It also serves as a benchmarking tool to measure the progress of E-government development globally and to compare the performance of countries over time (Paul & Adams, 2024).

The EGDI is calculated based on three main components - Online Service Index (OSI), Telecommunication Infrastructure Index (TII), and Human Capital Index (HCI). OSI measures the availability and sophistication of online services provided by government agencies to citizens, businesses, and other stakeholders. It evaluates factors such as the range of services offered online, the usability of online platforms, and the integration of services across different government departments (UN-DESA, 2020). TII assesses the level of ICT infrastructure and connectivity within a country, including factors such as Internet penetration, mobile cellular subscriptions, and broadband access (UN-DESA, 2020). HCI evaluates the capacity and skills of individuals within a country to access and utilize ICTs for E-government purposes. It considers indicators such as literacy rates, educational attainment, and digital literacy levels. Therefore, the HCI reflects the extent to which the population is equipped with the knowledge and skills necessary to engage with E-government services and platforms effectively (Alnaemi et al., 2021; UN-DESA, 2018).

Previous Studies Related to E-government Development Based on EGDI

Siau and Long (2009) investigate factors that affect E-Government development based on two theories of Growth and Human Capital. The research made use of secondary data from the United Nations E-Government survey of 2003 (UN-DESA, 2003). The research investigated the impact of two factors on E-Government development. The factors are Information & Computer Technology and Human Development Index. The research findings suggest that improvement in ICT alone is not enough for E-Government development; rather, human capital such as knowledge and economic conditions are also essential. Whitmore (2012) conducted research on statistical analysis of the construction of the UN EGDI. The research used EGDI data from the UN E-Government survey of the year 2010 (UN-DESA, 2010). It evaluates the standard in E-Government ranking. Result of the research reveals that there was alteration on the ranking of first 20 countries when the factor analysis was used. Therefore,

the research suggests that UN E-Government surveys should consider factor analysis in their E-Government ranking for a more thorough and statistically reliable ranking. Máchová and Lněnička (2015) conducted research on reframing E-Government Development Indices with respect to New Trends in ICT. The research considered many E-Government indices; however, our research is more interested in the UN E-Government surveys that were used by the researchers. These are UN E-Government surveys for 2012 and 2014 (UN-DESA, 2012, 2014). The research suggests consideration of more items to cater for new trends in ICT such as cloud computing, big (open) data and Internet of Things (IoT). These should be incorporated in subsequent surveys. Another research related to E-government Development was conducted by Chipeta (2018) which studied E-Government Development in Africa, focusing on Zambia. The research considered UN E-Government surveys of 2014 and 2016 (UN-DESA, 2014, 2016). The research found that there are 29% opportunities and 71% challenges in the Zambian E-Government implementation. Similarly, Turmanidze et al (2020) conducted a statistical analysis of the E-Government Development Index of Georgia. The study used UN E-Government surveys from 2003 up to 2018 but focusing on Georgia only. Table 1 summarised the reviewed literature and their coverage:

Table 1

Summary of Previous Studies on E-government Development

Authors (Year)	Research Title	UN Surveys considered	Countries covered
(Siau & Long, 2009)	Factors Impacting E-Government Development	2003	General
(Whitmore, 2012)	A Statistical Analysis of the Construction of the United Nations E-Government Development Index	2010	General
(Máchová & Lněnička, 2015)	Reframing E-Government Development Indices with Respect to New Trends in ICT	2012, 2014	General
(Chipeta, 2018)	A Review of E-Government Development in Africa, a Case of Zambia	2014, 2016	Zambia
(Turmanidze et al., 2020)	Statistical Analysis of E-Government Development Index (EGDI) of Georgia	2003 - 2018	Georgia

Research Gap

Table 1 above summarised the reviewed literature, each of which focused on E-government Development Index. Even though there are numerous surveys, most of the studies focussed on one or two surveys only (Chipeta, 2018; Máchová & Lněnička, 2015; Siau & Long, 2009; Whitmore, 2012). Similarly, in terms of geographical coverage, while some of the studies focussed on a single country each (Chipeta, 2018; Whitmore, 2012), other studies did not focus on any specific country. Therefore, there is a gap in longitudinal studies that track the E-Government development over extended periods across multiple countries, enabling a better understanding of trends and patterns. This gap **motivated** our study of E-government development in West Africa, considering eleven (11) surveys within two decades.

Methodology

Data Collection Method

Secondary data from the United Nations E-government Surveys is used for this research. This is because secondary data has numerous untapped opportunities in Information Systems research (Jarvenpaa, 1991). The data encompasses UN EGDI surveys from the year 2001 to 2020. According to Siau and Long (2009), UN E-government survey is the most extensive global E-government survey to date. It is also difficult for individual researchers to conduct such a comprehensive but costly survey (Siau and Long 2009). Each survey assesses the state of E-government readiness and implementation across different countries (Kamarudin et al., 2018; Zongpu & Samsu, 2023). The number of countries covered in each survey increased gradually over time, indicating a broader scope and participation in assessing E-government initiatives (Appendix A).

Note: From the 2003 survey up to 2020 survey, EGDI was valued from 0 to 1. However, for the first survey, that is the 2001 survey, the EGDI was valued from 1-5. Therefore, to unify the EGDI scores across all the 11 surveys, EGDI scores of **2001 survey are divided by 5** for this study.

Description of variables used in the study

- a. **Total EGDI (sum):** For each country, the **sum** is the total of EGDI scores obtained by the country within the participated surveys (Equation 1).

$$sum = \sum_f^1 EGDI \text{ Scores} \quad \dots \quad \dots \quad \dots \quad \text{Equation 1}$$

Where 1 represents the first score, and f represents the frequency or number of times a country participated in the surveys within the period under review.

Note: To avoid the negative effect of missing data in the calculations, the actual frequency (f) of participation of each country is used in this study. While those countries that participated in all the 11 surveys have the frequencies of 11 each, countries with missing values have frequencies of less than 11.

- b. **Average EGDI (π):** The π for each country under review is calculated as the ratio of sum to frequency.

$$\pi = \frac{sum}{f} \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \text{Equation 2}$$

- c. **Percentage of the Average EGDI score (%):** The % EGDI score of a country is calculated based on the formula in Equation 3.

$$\% = \frac{\pi}{\Sigma\pi} \times 100 \quad \dots \quad \dots \quad \dots \quad \dots \quad \text{Equation 3}$$

Where π is the Average EGDI of the country, $\Sigma\pi$ is the sum of the Average EGDI of the sixteen (16) West African countries.

- d. **Mean of Global Average (π_{ga}):** This is given as sum of the Global Averages of all the eleven surveys under review, divided by the total number of surveys (n), which is 11 in this case.

$$\pi_{ga} = \frac{\Sigma \text{ global average}}{n} \quad \dots \quad \dots \quad \dots \quad \dots \quad \text{Equation 4}$$

Results and Discussions

Presentation of EGDI scores for West African countries over two decades

The EGDI scores of the sixteen (16) West African countries, as obtained from UN E-government Reports based on UN-DESA (2001, 2003, 2004, 2005, 2008, 2010, 2012, 2014, 2016, 2018, 2020) were extracted and presented in Appendix B. From the data, some countries got missing data for at least a year. Cape Verde missed 2001 report, Cote D'ivoire missed 2003 report,

Guinea missed 2012 report, Guinea Bissau missed 2001, 2003, 2004, and 2005 reports, while Liberia missed 2001, 2003, 2004, and 2005 reports (Appendix B).

Identification of trends and patterns in E-government development

- a. **Ranking of the countries based on their Average EGDIs:** This section provides a ranking of the 16 West African countries based on their average EGDI scores (π) obtained within the period under review. While the Average EGDI (π) is calculated using Equation (2), the ranking is calculated using Percentage EGDI Score (%) in Equation (3). The ranking, therefore, is achieved by sorting the data in descending order based on values of the π (Table 2).

Table 2

Ranking of the countries based on percentages of their Average EGDI Scores

Country	Sum ($\sum_f^1 EGDI \text{ Scores}$)	Frequency (f)	Average EGDI (π)	%	Rank
Cape Verde	4.139	10	0.414	11.1	1
Ghana	3.778	11	0.343	9.2	2
Liberia	2.108	7	0.301	8.1	3
Nigeria	3.239	11	0.294	7.9	4
Senegal	2.923	11	0.266	7.1	5
Togo	2.851	11	0.259	6.9	6
Côte d'Ivoire	2.434	10	0.243	6.5	7
Benin	2.383	10	0.238	6.4	8
Gambia	2.377	11	0.216	5.8	9
Mauritania	2.199	11	0.200	5.3	10
Burkina Faso	2.068	11	0.188	5.0	11
Guinea-Bissau	1.266	7	0.181	4.8	12
Sierra Leone	1.927	11	0.175	4.7	13
Mali	1.876	11	0.171	4.6	14
Guinea	1.539	10	0.154	4.1	15
Niger	1.060	11	0.096	2.6	16
TOTAL	38.167			100	

Table 2 presents the ranking of the countries, following computation of the sum, average and percentage of their EGDI scores. The Table also presents frequency of participation of each country in the survey. Values in the Table are sorted in descending order of their Average EGDI scores (π).

Note: Percentage EGDI (%) for each country is calculated with respect to the total EGDI within the region, which is 38.167 (Table 1). Chart 1 presents the visualization of percentage EGDI scores of the countries.

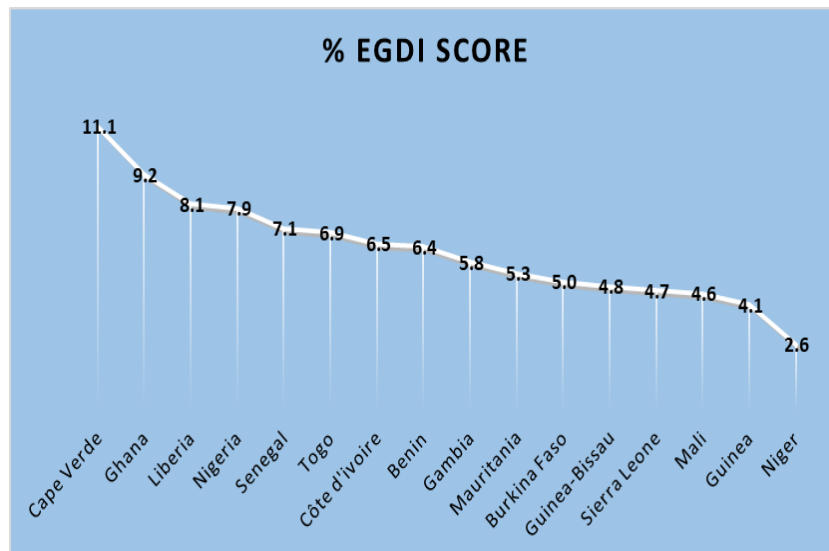


Chart 1. Performance of the countries within the period

Chart 1 illustrates the performance trends of the countries within the period under review, based on the percentage (%) of their Average EGD I scores (π). It can be observed that Cape Verde, Ghana, Liberia, and Nigeria had higher performances of 11.1%, 9.2%, 8.1%, and 7.9% respectively. Similarly, Niger, Guinea, Mali, and Sierra Leon had lower performances of 2.6%, 4.1%, 4.6%, and 4.7% respectively. Other countries fall between higher and lower performances.

b. **Comparison of Global Average EGD I scores (π_{ga}) of the surveys:** Here, the Global Average EGD I score of each survey was extracted with the aim of getting insight into the trend within the two decades (Table 3).

Table 3
Global Average EGD I scores of the surveys

Year of Survey	Global Average (π_{ga})
2001	0.3000
2003	0.4020
2004	0.4127
2005	0.4267
2008	0.4514
2010	0.4406
2012	0.4877
2014	0.4712
2016	0.4625
2018	0.5500
2020	0.6000
Total ($\Sigma\pi_{ga}$)	5.0048

Table 3 presents data on the Global Average EGD I scores (π_{ga}) across the surveys Data in the Table indicate a general upward trajectory in the global average across the surveys, with some

decrease in 2010, 2014 and 2016 surveys. Significant increases were observed in recent surveys, particularly 2018 and 2020 surveys (Chat 2).

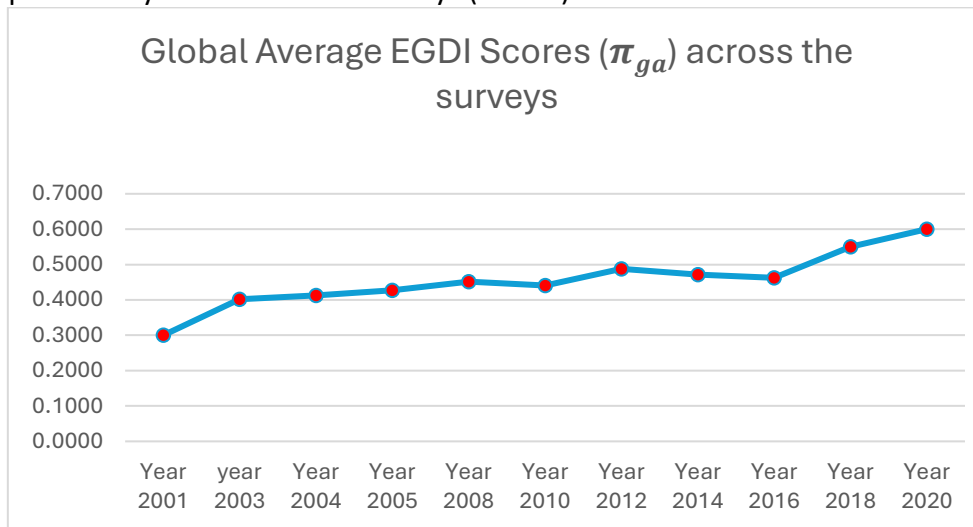


Chart 2. Trend of Global Average (ga)

Chart 2 illustrates the pattern of the Global Average EGD I scores across the 11 surveys, based on the values in Table 2. It can be observed that there has been steady increase in the Global Average EGD I in each survey except for the surveys of 2010, 2014, and 2016.

c. Comparison between average EGD I of the countries and mean of the global average:

This section provides a comparison between Average EGD I scores (π) of the countries, and the Mean of Global Average (Table 3).

Table 3
Average EGD I (π) Vs Mean of the Global Averages

Country	Average EGD I (π)	Mean of Global Average
Cape Verde	0.414	0.455
Ghana	0.343	0.455
Liberia	0.301	0.455
Nigeria	0.294	0.455
Senegal	0.266	0.455
Togo	0.259	0.455
Côte d'ivoire	0.243	0.455
Benin	0.238	0.455
Gambia	0.216	0.455
Mauritania	0.200	0.455
Burkina Faso	0.188	0.455
Guinea-Bissau	0.181	0.455
Sierra Leone	0.175	0.455
Mali	0.171	0.455
Guinea	0.154	0.455
Niger	0.096	0.455

Table 3 provides information on the average E-government Development Index (EGDI) for the West African countries, along with the Mean of Global Average EGDI scores within two decades. The mean of the global average EGDI scores, which is based on Equation (4) is 0.455 and serves as a benchmark for the comparison. Chart 3 provides a graphical illustration of the variables in Table 3.

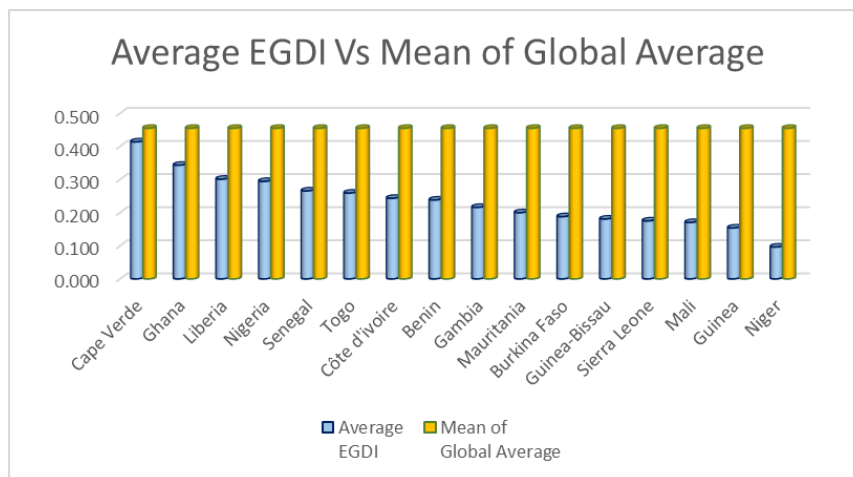


Chart 3. Comparison between Average EGDI (π) and Mean of Global Average

Chart 3 presents the graphical representation of the Average EGDI score (π) of each country with respect to the Mean of Global Averages. It can be observed that Cape Verde and Ghana were close to the Mean of Global Average, while other countries were far from it.

Conclusions

This study provides insights into E-government development in West African countries using their EGDI scores. It emphasizes the importance of studying E-government in the region for addressing governance challenges, promoting socio-economic development, and empowering citizens. Leveraging E-government can foster inclusive growth, transparency, and citizen empowerment, contributing to sustainable development. Analysis of EGDI scores shows varying levels of development among countries, with some demonstrating higher readiness for E-government than others. Global Averages of EGDI scores across the surveys indicate overall progress, though with fluctuations in few instances. Comparison of Averages of West African countries' EGDI scores with the mean of Global Average indicates that countries were far from the Global Average. While the countries make efforts for improvement, challenges still exist. The challenges necessitate investment in ICT infrastructure, digital literacy, and governance processes.

The study therefore contributes to knowledge by addressing the identified research gap concerning the need for a greater number of surveys. By examining the E-government development in West African countries, the study offers a comprehensive view of how these countries have progressed over time, highlighting significant trends and patterns within the period.

Future research could explore other regions or sub-regions, incorporating additional surveys and qualitative studies to develop a comprehensive framework for enhancing EGDI components in West African countries.

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APPENDIX A – OVERVIEW OF THE DATASET

S/n	Year	Title of survey	No. of countries
1.	2001	Benchmarking E-government: A Global Perspective – Assessing the UN Member States (UN-DESA 2001)	144
2.	2003	UN Global E-government Survey: E-government at the Crossroads (UN-DESA 2003)	173
3.	2004	UN Global E-government Readiness Report 2004: Towards Access for Opportunity (UN-DESA 2004)	179
4.	2005	UN Global E-government Readiness Report 2005: From E-government to E-Inclusion (UN-DESA 2005)	180
5.	2008	UN E-government Survey 2008: From E-government to Connected Governance (UN-DESA 2008)	182
6.	2010	UN E-government Survey 2010: Leveraging E-government at a Time of Financial and Economic Crises (UN-DESA 2010)	183
7.	2012	UN E-government Survey 2012: E-government for the People (UN-DESA 2012)	190
8.	2014	UN E-government Survey 2014: E-government for the Future We Want (UN-DESA 2014)	193
9.	2016	UN E-government Survey 2016: E-government in Support of Sustainable Development (UN-DESA 2016)	193
10.	2018	UN E-government Survey 2018: Gearing E-government to Support Transformation Towards Sustainable and Resilient Societies (UN-DESA 2018)	193
11.	2020	UN E-government Survey 2020: Digital Government in the Decade of Action for Sustainable Development (UN-DESA 2020)	193

APPENDIX B – EGD I SCORES OF THE COUNTRIES FOR THE 11 SURVEYS

Country/ Year	2001	2003	2004	2005	2008	2010	2012	2014	2016	2018	2020
Benin	-	0.235	0.220	0.231	0.186	0.202	0.206	0.169	0.204	0.326	0.404
Burkina Faso	0.150	0.135	0.182	0.133	0.154	0.159	0.158	0.180	0.160	0.302	0.356
Cape Verde	-	0.322	0.344	0.335	0.416	0.405	0.430	0.355	0.474	0.498	0.560
Côte d'Ivoire	0.210	-	0.173	0.182	0.185	0.281	0.258	0.204	0.219	0.278	0.446
Gambia	0.128	0.172	0.171	0.174	0.225	0.212	0.269	0.229	0.240	0.296	0.263
Ghana	0.196	0.241	0.237	0.287	0.300	0.275	0.316	0.374	0.418	0.539	0.596
Guinea	0.130	0.132	0.142	0.140	0.140	0.143	-	0.095	0.123	0.235	0.259
Guinea-Bissau	-	-	-	-	0.152	0.156	0.195	0.161	0.182	0.189	0.232
Liberia	-	-	-	-	0.217	0.213	0.241	0.177	0.234	0.274	0.261
Mali	0.124	0.140	0.096	0.093	0.159	0.182	0.186	0.163	0.182	0.242	0.310
Mauritania	0.182	0.161	0.170	0.172	0.203	0.236	0.200	0.189	0.173	0.231	0.282
Niger	0.106	0.060	0.062	0.066	0.114	0.110	0.112	0.095	0.059	0.110	0.166
Nigeria	0.204	0.225	0.249	0.276	0.306	0.269	0.268	0.293	0.329	0.381	0.441
Senegal	0.160	0.201	0.233	0.224	0.253	0.224	0.267	0.267	0.325	0.349	0.421
Sierra Leone	0.136	0.126	0.172	0.164	0.146	0.170	0.156	0.133	0.159	0.272	0.293
Togo	0.130	0.231	0.231	0.227	0.219	0.215	0.214	0.245	0.310	0.399	0.430