THE UNIVERSITY OF NAIROBI

SCHOOL OF COMPUTING AND INFORMATICS

RESEARCH TOPIC:

INFLUENCE OF USABILITY, ACCESSIBILITY AND COMPLIANCE ON E-GOVERNMENT DEVELOPMENT INDEX: A CASE STUDY OF EAST AFRICA COUNTRIES

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Declaration

This report is my original work and to the simplest of my information has not been submitted in any university for the award of degree or credential.

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Signature Date

This report has been conferred for examination upon approval of my supervisor.

Dr. Andrew Mwaura Kahonge

……. …….

Signature Date

Acknowledgement

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Abstract

Globalization has necessitated the need for the promptness in information dissemination and access regardless geolocation and time. Accordingly, East African countries government Ministries, Departments, and Agencies (MDA) have embraced Information Communication Technology (ICT) systems to widen accessibility to government services, reduce administrative cost, corruption, increase transparency, foster public participation which have an ultimate impact on service delivery. The implementation of online platforms is realized through either mobile apps or web-based application. Despite the level implementation and resource mobilization, these platforms still grapple with low-level adoption and usage as informed by the E-Government Development Index (E-GDI). The index assessment reviews progress in online services delivery, open data and mobile services, and public involvement. The study sought to ascertain the influence of usability, accessibility and compliance on E-GDI using correlational research design.

Regression analysis was used to formulate the predictive equation. Seventy-two government websites were selected from eighteen East Africa countries using a simple random sampling technique. Data was collected using Qualidator tool, Google mobile-friendly test, Nibbler tool, TAW Analysis Tool, Colour Contrast Checker, and Readability test. The instruments have a reliability of 0.98. Qualitative data were analyzed descriptively using inferential statistics report generated by SPSS tool. Report indicated a significant correlation between usability, accessibility, and compliance on E-GDI. Based on the results, predictive equation was formulated for the dependent and independent variable.

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Acronyms

AC – Accessibility

CFR – Colour Failure Rate

E-Government – Electronic Government

E-GDI – E-Government Development Index

EPI – E-Participation Index

FR – Friendliness Rating

GDC – Government Datacenter.

GCCN – Government Common Core Network

HCI – Human Capacity Index.

ICT – Information Communication & Technology

IFMIS – Integrated Financial Management System

IPPD – integrated Payroll and Personnel Database System.

IT – Information Technology

ISO – International Standards Organization.

KRA – Kenya Revenue Authority.

MDA – Ministries, Departments and Agencies.

MICT – Ministry of Information & Communication Technology.

NPSC - National Police Service Commission

NTSA – National Transport and Safety Authority.

OSI – Online Service Index

PR – Problem Rate

SDG – Sustainable Development Goals

SSPS – Statistical Package for Social Sciences

TA – Technology Adaptability

TII – Telecommunication Infrastructure Index

WCAG – Web Content Accessibility Guidelines

UE – User Experience

UNDESA - United Nations Department of Economic and Social Affairs

US – Usability

WR – Warning Rate

CHAPTER 1: INTRODUCTION

1.1 Background

Technological advancement has necessitated the an efficient, flexible and reliable means of service delivery is paramount. Worldwide, various government MDAs have embraced online information systems to foster accessibility to several government services to reduce the cost of administration, corruption, enhance public participation, reachability and promote accountability and transparency in service delivery. Realistically, deployment of these platforms famously known as e-government requires enormous resource mobilization.

Remarkably, these systems have immensely contributed to the improvement of service delivery and fostered a better decision-making process through broader public engagement. Moreover, the development of mobile money platforms has commendably eased the process of payment of bills and also opened up accessibility to other mobile facilities. Furthermore, locally, the Development of the NTSA TIMS system has also greatly aided the public in processing and renewal of Driving License, transfer of logbook and registration of vehicles (Government of Kenya, 2019). Also, the E-citizen system has greatly assisted in bringing all the government services in one platform and acted as a gateway for payment of government services. Additionally, the IFMIS system has also promoted accountability and transparency in managing government procurement operations and payment process (Government of Kenya, 2019). Also, application for birth certificates or electronic passports has been made possible through an online platform.

Outstandingly, other remarkable innovations include smart bins for waste management improvement, solar cycle path, info share to ease and quicken information accessibility, Internet voting, Artificial Intelligence using social media to monitor disaster preparedness and response, blockchain for identity management and financial inclusion, drones to improve health care, healthy habits promoted by the use of automated SMS platform, Online Courses, open data, e-government services, artificial intelligence and blockchain technologies. Correspondingly, the Kenya ICT Master Plan (2014) outlined the significance of online platforms in the realization of Kenya Constitution aspirations. The study sought to evaluate the influence of usability, accessibility and compliance to E-GDI. These online services have enormously benefited the public and the government in equal measure. Despite the enormous

benefits outlined and several deployments, most of the countries still register low E-GDI. E-GDI is based on the measurement of the effectiveness of online service delivery platforms, their patterns and performance, potential opportunities, and availability of human capacity and skill development requirement (UN-HABITAT, 2004). This research reviews usability, accessibility and compliance impact on E-GDI.

Usability is the extent to which a benefit can be derived from a product in fulfilment of the predetermined need (International Organization for standardisation, 1998). It is a mandatory requirement for all websites to ensure that they are easily navigable to attract more users (Mtebe & Kondoro, 2017). Which result in efficient information access, and proper utilization infrastructure resources (Nielson, 1995). Conversely, websites with accessibility challenges also hinder access and usage by people with disabilities. Web accessibility refers to an interactive site that is easily navigable and useable by everyone regardless of one's physical or cognitive ability (World Wide Web Consortium, 2018).

Recently concluded census report indicates 4.6 per cent of Kenyans have disabilities of various kinds (Kenya National Bureau of Statistics, 2019). Globally, the number of people with technology tools functional disabilities is between 15% to 30% which translates to about 750 million. This figure continues to grow due to the following factors: old age that may result to decline in hearing, vision, cognitive and physical abilities, and population growth (Disability as a Function of Age, 2001). Web accessibility is focused on the elimination of any hindrance encountered by people with disabilities of any kind, including hearing, visual, speech, physical, neurological and cognitive disabilities, to make content accessible to anyone. On the other hand, compliance relates to conformance to various standards and guidelines for a website or a mobile app to be useable, accessible, conformant and secure. Some of the few standards and guidelines include WCAG 2.0/1.0 and Sec 508.

As per the various standards and guidelines, it is of essence that websites and mobile apps platforms conform to standards and guidelines. A review of these platforms reveals growing concern on their usability, accessibility, usage, experience, effectiveness, efficiency, compliance to standards and security. Furthermore, most of the research works were centred on external attributes of the platforms yet the internal attributes are also a major contributing factor to low usage((Kaur, et al., 2016), (Alhassan & Okwum, 2018))

1.2 Problem Statement

Numerous studies indicate inconsistency in the actual implementation and user requirement ((Heeks, 2003), (Choudrie & Ghinea, 2005), (Alfawwaz, 2011)). Consequently, the resulting product is not simple and user-friendly (Albarrak, 2018). Additionally, the quality of the information in terms its accuracy, completeness, and timeliness significantly impacts on website usage ((Delone & McLean, 1992), (Venkatesh, et al., 2014)). Moreover, the size of the website also affects its performance and response time (Ma & Zaphiris, 2003). Likewise, non-compliance to standards and guidelines is also a factor of low usability, accessibility, and security (Gwardak & Pahlstorp, 2007).

Despite the existence of a wide variety of guidelines, availability of advanced computing devices and improved literacy levels, the issue of a low level of usage and adoption is still a predominate factor ((Kinuthia, 2013), (UNDESA e-Government Survey, 2018)). A critical empirical review points out that problems of usability, accessibility, and compliance have not been given great attention to determine their contributing factor to the level of E-GDI and ranking. Report by UNDESA e-Government Survey (2018) indicates that Africa UN members countries have 0.3423 E-GDI against 0.5491 for the world. According to Worldometer (2019), combined East Africa countries population is about 440 million which calls for the need for enhancing reachability and efficiency in service delivery.

1.3 Objectives of the Study

The key study objective is to ascertain the influence of usability, accessibility, and compliance on the E-GDI for East Africa countries. Other sub-objectives include;

i) To determine the underlining factors for usability, accessibility, compliance, and E-GDI.
ii) To develop and test a framework on the influence of usability, accessibility, and compliance on the E-GDI.
iii) To formulate a predictive equation for usability, accessibility, compliance, and E-GDI.

1.4 Research Hypotheses

The study evaluated the following:

H_1: There exists a significant correlation between usability and E-GDI.

H_2: There exists a correlation between website accessibility and E-GDI

H_3: Website compliance influence on E-GDI.

1.5 Justification

Internet is required to provide access to emails, news, shopping, online bank transaction, entertainment, and many others, at any time and anywhere (Darem & Suresha, 2013). Likewise, ICT is an omnipresent force that is modelling people's way of live aspects determining ways and means of communication, interactions and work (Abeywickrama & Rosca, 2015). Consequently, citizens continuously push for transitioning of traditional operations to online services to ease the process of settling bills over the internet and to create transparency and accountability and wider involvement and inclusion in the decision-making process (Kinuthia, 2013).

Despite several attempts to transition to online platforms, subsequent studies have unearthed challenges of the platforms with regards to equity and effectiveness in service delivery regardless of physical ability, and technological capability (Albarrak, 2018). Which has resulted in low online services usage and adoption ((Szeremeta, 2002), (Belanger & Carter, 2008), (Gupta, et al., 2008)).

Furthermore, Albarrak (2018) identified a lack of usability, security, and trust as other factors that have contributed to the loss of confidence in government websites and subsequently resulted in a low level of adoption and utilization as per the report by UNDESA e-Government Survey (2018). The report serves as a tool for reference, provides in-depth analysis of various online platforms in use hence plays a pivotal role in ICT development and also countries can use it to identify their strengths and weaknesses and accordingly develop policies and strategies to address issues in line with their aspirations. For this reason, the information provided by the tool is useful government, policy developers, civil society and researchers.

1.6 Scope

The research was based on establishing and evaluating the correlation of usability, accessibility and compliance on E-GDI for East Africa countries, UN members.

1.7 Assumptions of the Study

Study assumptions were:

a) That websites will be available for the review.
b) That the number of mainstream government ministries will remain constant.

c) That there will be no sites access restriction.

CHAPTER 2: LITERATURE REVIEW

2.1 Website Usability

In website development, usability and accessibility impact positively on platform usage, for instance usability and accessibility (Oyefolahan, et al., 2018). Usability is the benefit derived from a product in fulfilment of the predetermined need (International Organization for standardisation, 1998). Similarly, website usability assesses ease of users interfaces (Quesenbery, 2008). Furthermore, for a website to be useable it has to be simple, clear, operable, robust, memorable, navigable, error-free, consistent and enjoyable to use ((Cappel & Huang, 2007), (Mvungi & Tossy, 2015)).

Above definitions have a common factor which is the "ease of use". Accordingly, to make websites easily useable, Flavian et al. (2006) identified the following factors to consider in design: The ease of a user comprehending website structure, function, content, and interface. Furthermore, other factors proposed by other researchers include websites simplicity, information access ease, and site navigation ease.

Nielsen (2012) defined usability in terms of user interface attributes and improvement methodology for the same. The author comprehensively identified the five quality components for usability are efficiency, learnable, memorable, error-free and meets the objective. Figure 1 below indicates a derivative of usability components.

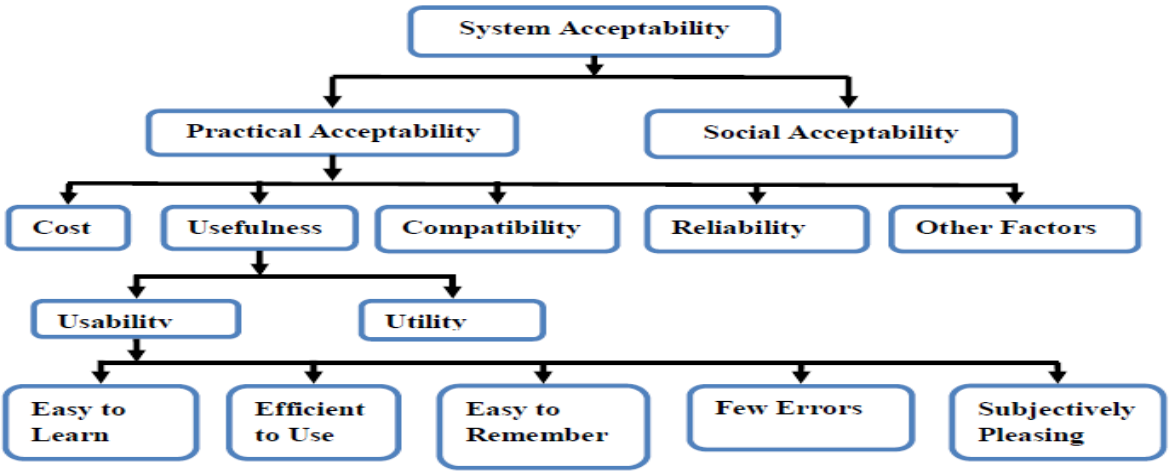

Figure 1: Usability model (Nielsen, 2012)

- Learnability: the ease for completing a simple task at the first encounter with a particular system.

- Efficiency: The promptness in performing a task.
- Memorability: How easy to reuse a system after using it for some time.
- Satisfaction: the measure of the level of contentment by the customers with the product, services and capabilities.

Analysis of low usability impact, from (Figure 2) of Nordby usability pyramid as cited by Alfawwaz (2011), shows that useable sites attract more users as opposed to websites with poor usability index.

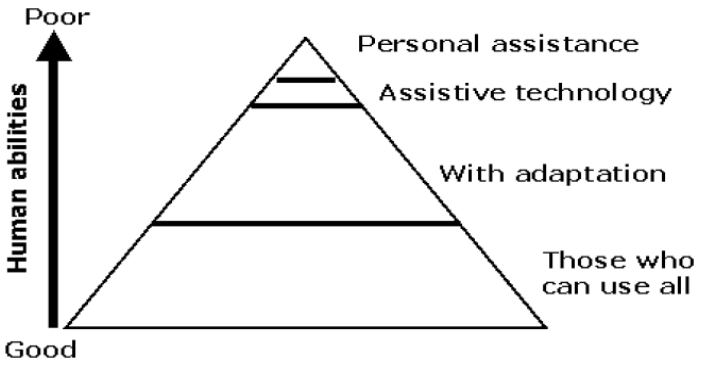

Figure 2: Nordby Usability pyramid (Carmien & Mohamad, 2008) as cited by (Alfawwaz, 2011)

This is because of high content quality, timely update of the websites, less download time and ease of use (Nelson, 2000). Conversely, lack of resolving web usability issues is the major cause of the decline in website usage and access (Mvungi & Tossy, 2015).

2.2 Website Accessibility

Web accessibility refers to an interactive site that is easily navigable and useable by everyone regardless of one's physical or cognitive ability (World Wide Web Consortium, 2018).

- Perceivable: Presentation of information and interface components in ways that can be perceived by the users.
- Understandable – Ease to read and comprehend site information and operable.
- Navigable: the ease to navigate network of information organized.

From the definition, it is quite evident that accessibility attempts to eliminate any difficulties encountered by website users regardless of their physical ability, cognitive and neurological capability and technology operation ability (Abanumy, et al., 2005). Furthermore, accessibility enables platform-independent information access with ease and without distortion whatsoever (Mtebe & Kondoro, 2017). Unfortunately, most websites do not include common accessibility features to improve on user experience when using devices like screen readers and

other dependable technologies like a personal digital assistant, mobile phone browsers and even low bandwidth connections. Furthermore, the other accessibility issues comprise of deficiency of alternative text for videos or images, use of image menus as opposed to text-based menus, and adaptive fluid layout (Darem & Suresha, 2013).

2.3 Compliance: Website Standards and Guidelines

To ensure usability and accessibility of websites, a wide variety of standards and guidelines are at the disposable of web designers (Ivory (2001), Nielson & Tahir (2002)). As outlined by Scapin et al. (2000), multiple guidelines are available under various categories: design standards, style guides specific to an environment, recommendation papers, ergonomic design algorithms, and design standards. Brajnik (2000a) categorizes the guidelines based on the following: Functionality, Flexibilities, Robustness, clarity and meaningful labels, efficiency in navigation, contextual navigation, the natural organization of information, adequacy in feedback, and consistency in presentation and controls.

Each of these guidelines focusses on the design of usable websites and addresses a wide range of design issues. However, as pointed out by Rukshan and Baravalle (2011), contradictions exist among various guidelines which might be as a result of technological dynamics, the difference in age, and applicability or appropriate to a specific group. The researcher further clarifies that although there exist contradictions and variations on guidelines, designers have the liberty to filter according to the scope of work under analysis and applicability. Web content Accessibility Guidelines plays a pivotal role in the provision of usability guidelines and apply to more advanced technologies like; ease to use and comprehend.

WCAG 2.0/1.0: are technical reference-able standards and procedures. They have guidelines organized under the following principles perceivable, robust, operable and understandable. Testable criteria for the guidelines include A, AA, and AAA. Section 508: the purpose of this guideline is to ensure that all ICT platforms are accessible so as to eliminate discrimination.
The study looked at the following aspects of compliance:

- Problem-Rate: are a number of the development aspect that did not follow the required procedures.
- Warning-Rate: Relates to development and style.
- Colour-Failure-Rate: Lack of conformance to colour standards.
- User-Experience

- Technology-Adaptability: mobility and adaptability.
- Friendliness

Many tools that conform to the WCAG guidelines have been developed and used by several researchers to test website accessibility. Ma and Zaphiris (2003) emphasized the importance of designing accessible online platforms to meet accessibility standards and guidelines and ultimately foster website usage.

2.4 E-Government

E-government is online service delivery platforms designed to promote promptness in information access and to foster reachability and public participation (Mayer-Schonberger & David, 2007). Globally, various e-government service delivery platforms are being utilized to foster efficiency in government operations, create good governance by promoting transparency, accountability, deducing corruption, to revamp service delivery, improve performance of civil servants, empowerment of citizens and promote efficient utilization of government funds (Almunawar, 2015). Furthermore, other values of e-government full implementation include time-saving as a result of streamlined government processes, fosters collaboration and knowledge co-production and sharing, contributes to green Information Technology (IT) and environmental saving, promotes a high level of information security, provision of prompt and seamless service delivery, increases levels of accountability, trust, and accountability (Abeywickrama & Rosca, 2015). To achieve this, e-government needs to adapt to dynamic and interactive ICT technologies in designing the best platform for service provision (Shareef, et al., 2011).

2.4.1 E-Government Websites Prospects

Technology advancement is majorly attributed to the effective utilization of ICT, for instance, cross-government agency co-operation, Government Operations, and crime-fighting (Asiimwe & Lim, 2010). Similarly, effective implementation of ICT technologies can permit efficiency in information dissemination and sharing. Furthermore, as observed by Mackey (2003), two-way communication is desirable as it can create ethics in public relations for the better of society as it results in fairness in policing and operations (Childers, 1989). Besides, the public would like to have the following government services offered electronically: filling of tax returns, renewal of driver's license, renewal of professional license, voting electronically, marriage and death certificate, ordering a birth certificate, submission of employment

information, one-stop access to services, and paying traffic tickets and requesting for services and information ((Alfawwaz, 2011), (Cook, 2000), (Al-Omari, 2006), (Reddick, 2004)).

Offering services electronically by the government results to the following benefits: avoidance of personal interaction by the citizens with government staff, offers more control on service delivery, offers convenience due to accessibility and availability of government services anywhere and anytime required, it's cost-effective as is offers opportunity to beat time and distance, citizens also have the opportunity to personalize and customize websites based on their needs, and finally, it fosters efficiency, accessibility of public information and thus it creates the sense of accountability and trust ((Cook, 2000), (Alfawwaz, 2011)). Migration from the traditional manual method of operation to an electronic platform has the following challenges: data accuracy and consistency, technology compatibility and complexity, system alignment and diversity, regulatory and engagements, policies and political goodwill, and social and economic demographics (Alfawwaz, 2011).

2.4.2 Profiles of East African Countries

According to Worldometer (2019), East Africa countries combined population is about 440 million. Urgently, there is a need for implementation of a robust, cost-effective, reliable, user-friendly, useable, accessible, secure and efficient online system. Implementation of a platform with those attributes results in improved service delivery to the citizens, better interaction between industries and businesses, citizens empowerment, efficiency in the management of government services, increased transparency, accountability, convenience in accessing government services cost-effectively.

E-GDI metrics is used to evaluate the effectiveness of online platforms in service delivery, it's patterns and performance, the potential opportunity of ICT, human capacity and development. The index is based on qualitative and comparative analysis on mechanism implemented by various governments. The E-GDI three broad metrics includes;

- Telecommunications Infrastructure Index (TII) reviews infrastructure adequacy
- Human Capital Index (HCI) evaluates available skillset, training and capability.
- Online Service Index (OSI); Ascertain online presence and its level of usage and advancement.

Figure 3 below is the E-GDI report for the East Africa eighteen countries selected for the study.

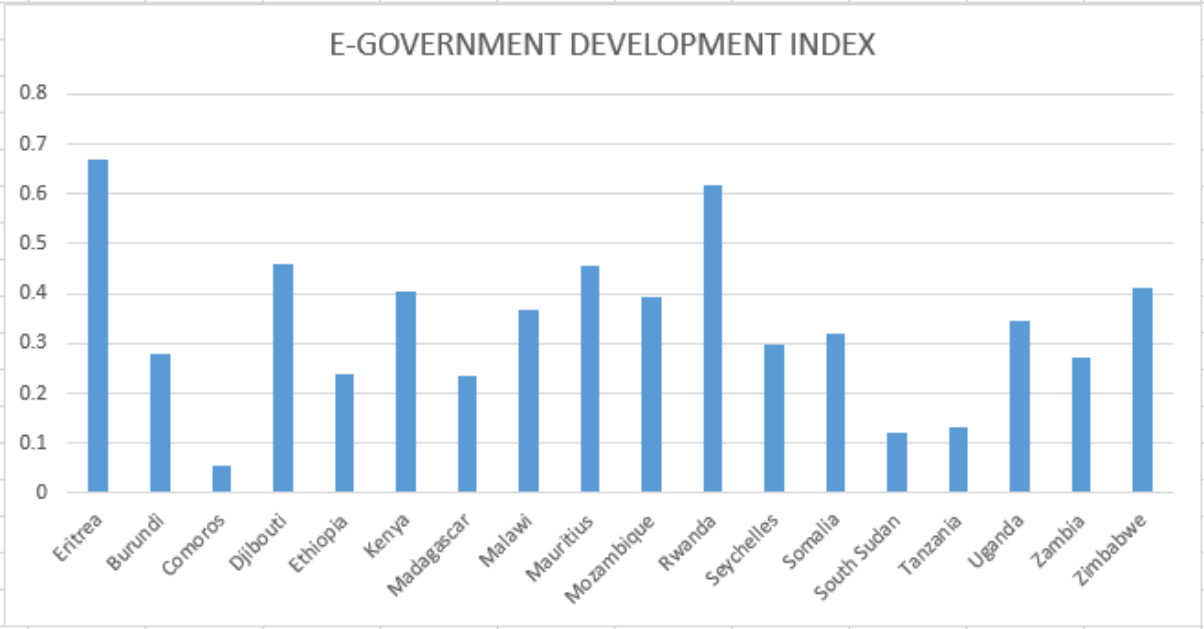

Figure 3: E-GDI Rating (UNDESA e-Government Survey, 2018)

Table 1 below further reports profiling the eighteen East Africa countries given their E-GDI, other attributes for E-GDI (TII, OSI and HCI), and Population:

No.	Country	E- GDI	TII	HCI	OSCI	Population in Millions
1	Mauritius	0.6678	0.5435	0.7308	0.7292	1.3
2	Seychelles	0.6163	0.5008	0.7299	0.6181	0.098
3	Rwanda	0.459	0.1733	0.4815	0.7222	13
4	Kenya	0.4541	0.1901	0.5472	0.625	53.8
5	Zambia	0.4111	0.1853	0.5689	0.4792	18.4
6	Uganda	0.4055	0.1566	0.4906	0.5694	45.7
7	Tanzania	0.3929	0.1403	0.4759	0.5625	59.7
8	Zimbabwe	0.3692	0.2144	0.5668	0.3264	14.7
9	Ethiopia	0.3463	0.0976	0.3094	0.6319	115
10	Mozambique	0.3195	0.1398	0.3951	0.4236	31.3
11	Burundi	0.2985	0.0786	0.5113	0.3056	11.9
12	Madagascar	0.2792	0.0499	0.4822	0.3056	27.7
13	Malawi	0.2708	0.0834	0.472	0.2569	19.13
14	Djibouti	0.2401	0.0961	0.3325	0.2917	0.99
15	Comoros	0.2336	0.0871	0.5166	0.0972	0.87
16	Eritrea	0.1337	0	0.3179	0.0833	3.5
17	South Sudan	0.1214	0.0262	0.2269	0.1111	11.2
18	Somalia	0.0566	0.0586	0	0.1111	15.9

Table 1: East Africa Countries Profiles ((UNDESA e-Government Survey, 2018), (Worldometer, 2019))

Other research work attributes low level of E-GDI to high level of illiteracy, unfordable computer equipment, lack of electricity, inadequate ICT infrastructure, payment gateway, inconsistency of user requirement and the actual implementation, implementation of sophisticated technology, policy-driven limitations and many more (Kinuthia, 2013).

2.5 Websites Evaluation Methods

Evaluation of website usability can be done in two ways. One, by use of usability test methods, which involves engaging users. The main advantage of this method as highlighted by Holzinger (2005), that direct information on website usage by the users is sourced. The instruments deployed are: questionnaires, thinking aloud and field observation (Mtebe & Kondoro, 2017). Usability inspections method is another method for website evaluation involving reviewing and comparing against the existing standards and guidelines. The usability inspections methods include action analysis, heuristic evaluation, and cognitive walkthrough. Additionally, according to Parush (2001), Brinck and Hofer (2002), evaluation of usability can be done using an empirical or analytical approach.

The empirical approach engages users directly in the process (Nelson, 1994). Whereas, analytical evaluation assessment process involves a combination of several guidelines, models and criteria (Brinck & Hofer, 2002). Comparatively, usability test methods as proposed by Holzinger (2005) is similar to empirical evaluation as suggested by Parush (2001), Brinck and Hofer (2002). Similarly, the Usability inspection method put forward by Holzinger (2005) is indistinguishable to the analytic evaluation approach recommended by Parush (2001), Brinck and Hofer (2002). Websites complexity and diversity, and dynamism of users requirements, carrying out evaluation using usability test methods may tend to be very difficult (Mtebe & Kondoro, 2017).

2.5.1 Automated Website Evaluation Tools

There are various tools for carrying evaluation of the website with regards to usability, accessibility, and compliance as recommended. The researcher reviewed evaluation tools based on the following categories:

2.5.2 Usability and Accessibility Evaluation Tools

MFT Tool: the tool reviews mobile technology adaptability of an online service by evaluating its usability and accessibility. The tool's result categories website into the following; very friendly, friendly, not friendly and not reachable (Oyefolahan, et al., 2018). Very friendly sites

full load on any mobile computing device while friendly sites loads with few challenges. Not friendly websites are those that experience several challenges. Not reachable websites are those that are not accessible at all.

A-Checker Tool (Oyefolahan, et al., 2018): is used for accessibility evaluation with regards to standard guidelines and web development compliance. The tool is an online-based platform. The tool categories the results as Potential Problems (PP), Likely Problems(LP), Known Problems (KP). Known Problems (KP) is used as the basis of judging compliance with WCAG 2.O as it is the most vital of all the problems identified (A-Checker, 2019).

European Internet Inclusion Initiative (EII) Tool (Oyefolahan, et al., 2018) (EII, 2019); has the EII web page for performing accessibility tests. Used for XHTML elements numbers and compliance to standard guidelines and provides accessibility report in terms of percentage.

WAVE (Web Accessibility Evaluation) Tool (Oyefolahan, et al., 2018) (WAVE, 2019): checks all codes and design errors and highlights codes that are not compliant with WCAG 2.0/1.0 guidelines. The tool is used for debugging purposes by counting alerts, errors and contrast errors. With the information, the designers can rectify website mistakes. The tool does not provide code element numbers in compliance with standard guidelines.

Functional Accessibility Evaluation Tool (Oyefolahan, et al., 2018): the tool assists in revealing information about the level of compliance. Report non-compliance as a failure and compliance as a pass. The overall rating for the website is scored over 100 per cent (FAE, 2019).

Web Grader: is a free online platform tool capable of determining whether the website is strong in terms of mobility, security, performance and SEO (Website Grader, 2020).

HTML Toolbox: Available from NetMechanic Inc.(2019). The tool can measure downtime time, HTML check & repair and browsers compatibility (Mustafa & Al-Zouabi, 2007).

Qualidator Tool: Reviews website pages with a 60-70 automated test, on aspects of accessibility, usability, quality (technical), and SEO. Report is in percentage (Qualidator, 2019).

SEOptimer Tool: An online free tool used for evaluating website usability and measuring website features like page analysis, social, performance, and mobile user interface (Khandare & Gawade, 2017). The evaluation report can be generated (Seoptimer, 2019).

TAW (Alhassan & Okwum, 2018): Tool developed by CTIC Centro Technologies to check against the required compliance guidelines. The results are classified based on violation extend as operable, perceivable, robust and understandable, other classifications include difficulties, warning and not reviewed. The tool is available online, downloadable version and add-on version is available (TAW, 2019).

GTmetrix (GTmetrix, 2019): a tool for providing insight on website page loading time and how best to optimize it. The tool can be customized to carry out testing on a daily, weekly, or monthly basis. Analysis carried out from various regions around the globe. The report is based on page speed, page load time, email alerts, total page size and Yslow score.

Nibbler (Nibbler, 2019): the tool provides a report on accessibility, social media, search engine optimization (SEO) and technology.

Readability Test (Juicy Studio, 2019): This tool is used to analyze the ease of reading text. The algorithms incorporated on the tool indicate the suitability of content for the intended audience.

Xenu's Link Sleuth (Snafu.de, 2001): The tool was developed by Tilman Hausherr for detecting broken links and is available at no cost. The tool was named after Xenu, who was a Scientology scripture ruler.

2.5.3 Standards and Guidelines Evaluation Tools

WAVE Tool: Reviews all codes and errors in design and highlights codes that are not compliant with WCAG 2.0/1.0 guidelines. The tool is used for debugging purposes by counting alerts, errors and contrast errors. With the information, the designers are able to rectify website mistakes. Thus, the tool does not provide code elements numbers in compliance with standard guidelines.

Functional Accessibility Evaluation Tool: assists in revealing information about the level of compliance. Non-compliance reported as a failure while compliance as a pass. Failure and passes numbers are scored over 100 per cent.

Colour Contrast Check (Alhassan & Okwum, 2018) (CheckMyColours, 2019): This tool is for gauging colours, permits to specify background and foreground colour and regulates if they offer required contrast. The tool checks colour alternation and brightness to determine if they have surpassed the verge. A pass is when only one of the two values surpasses the required threshold. While a fail is when neither of the value has surpassed the required threshold. Also, the tool is able to determine compliance of colours to the new WCAG 2.0 on a formula for contrast ratio. The WCAG 2.0 formula determines whether the text is smaller or larger than the 18pt. The test is based on an algorithm as recommended by World Wide Web Consortium (2018).

2.6 Research Methodology Review

The researcher used correlation research methodology a non-experimental approach. Through this, the study assessed the statistical relationship between the two variables and their influence on each other. For Usability, accessibility, and compliance of sites can be analyzed using either of the two approaches: Inspection Method/ or Analytical Approach or Test Method/Empirical Approach. The inspection Method/Analytical approach does not involve end-users as opposed to the Test method or Empirical approach which involves the end-users during the research ((Holzinger, 2005), (Brinck & Hofer, 2002), (Parush, 2001)). The study chose and used the Inspection method/ analytical approach.

2.7 Review of Related Work

As evident from numerous empirical studies, the benefits of having a usable, accessible, compliant and secure website are undeniably numerous. Consequently, numerous research have been carried out to review the underlying factors affecting websites' usability and accessibility with a bid to foster a high level of utilization and adoption.

Omolo (2015) researched on the effect of technology adoption and E-PI a case study of Kenya MDAs using correlational research methodology. The data was collected using questionnaires, group discussions and one on one interviews. Excel and SPSS was used analyze data. The

research established that despite various initiative and technological growth, less has been done to promote EPI.

Kinuthia (2013) Used lab-based testing followed by a post-test survey to analyze usability and user experience, a case study of Kenya Government Websites. The study uncovered numerous usability challenges that hamper website usability and accessibility. A few of the issues identified include stale data on websites and the security of personal data.

Mtebe and Kondoro (2017) Analyzed the accessibility and usability of Tanzania Government sites using Sort Site Tool. Report was scrutinized against US Federal (Usability.gov) guideline, WCAG 2.0 guidelines and section 508. Evaluation results revealed the accessibility and usability challenges of the websites that hamper citizens' usage and access. As a result, several improvement recommendations were provided for consideration.

Adepoju and Shehu (2014) evaluated the usability of Nigeria University platforms using HERA, WAVE and Web Accessibility Check automated tools. The tools scrutinized violation of standard guidelines and reported as either error or problems. The results revealed lack of compliance with the standard regulation guidelines and numerous accessibility issues. The author gave several recommendations for improvement.

Oyefolahan et al. (2018) evaluated the Government of Nigeria Airlines online platforms usability and accessibility using a cocktail of automated tools to determine compliance levels. The tools included A-checker, WAVE, EIII, Mobile-Friendly Test, and Functional Accessibility Evaluation tool. Various airlines were found not compliant with the guidelines and hence the research provided many recommendations for improvement.

Gopinath, et al. (2016) evaluated accessibility and usability by sampling 47 the most used websites in the Sri Lankan Government. The web analytics tools used by the author include Powermapper, Pingdom, GooglePageSpeed insight, WAVE, and Google Mobile-Friendly test. The level of compliance with the guidelines was ascertained using a weighted method.

Kaur et al. (2016) evaluated Punjab Universities usability levels using Qualidator and Site Analyzer tools. From the findings, various improvement recommendations were outlined by the author.

Junaini (2002) based on WCAG 2.0 guidelines and navigation website design factors, conducted a level of usability of 11 Malaysia Public Universities Websites using Bobby and LIFT tools. The study reported dismal usability and accessibility levels.

Mustafa and Al-Zouabi (2007) evaluated a sample of Jordan University websites using Webpage Analyzer and HTML Toolbox. The results ranked the websites as either suitable or not, based on conformance to usability standards and guidelines.

2.7.1 Critique on Related Studies

Research work by Omolo (2015) adopted a correctional approach research design using Questionnaires, group discussions and one on one interviews for data collection. Data analysis carried out using Excel and SPSS statistical package. The approach is the same except the study used an automated evaluation tool for data collection which does not require human interaction. Also, the scope of this study is for seventy-two websites from eighteen East Africa countries. Other research works are based on descriptive research methodology approach. The only similarity to the study is the use of evaluation automated tools for data collection.

2.7.2 Research Gap

Undeniably, from related studies, numerous research has been conducted all over the globe with an attempt to foster online platform utilization and adoption. Despite the studies and numbers of implementation, e-government website usage is still predominately dismal as reflected in the report by UNDESA e-Government Survey (2018). Interestingly, with the advancement and extensive coverage of internet connection in the country, demand by citizens for more online participation is exponentially on the rise. Consequently, there is an immediate requirement for an improved service delivery irrespective of physical ability, location and technological capability. From my analysis, a comprehensive study of ascertaining the correlation of usability, accessibility, and compliance on the E-GDI, is yet to be done.

2.8 Conceptual Framework Adopted for the Study

In this study, the independent variables were usability, accessibility, and compliance while the dependent variable was E-GDI. From the literature review, below is the derived conceptual framework as per figure 4.

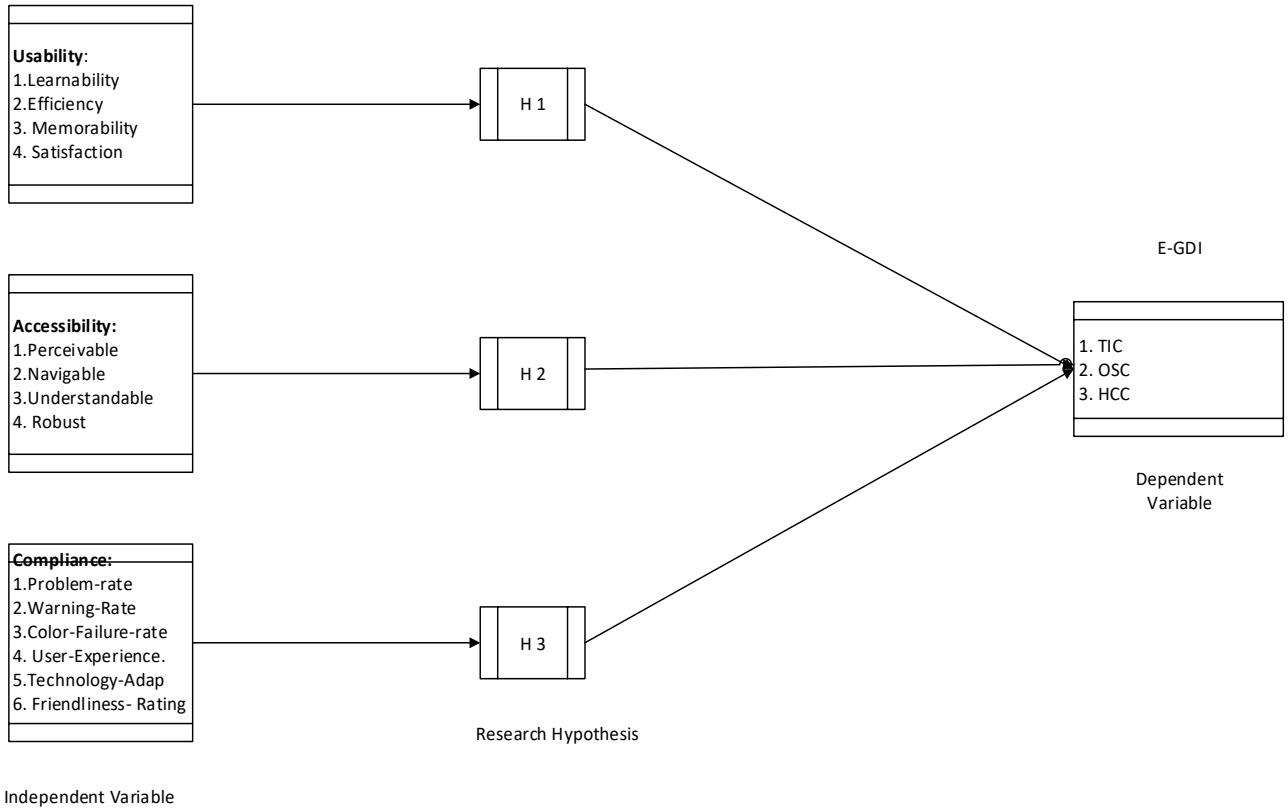

Figure 4: Derived Conceptual Framework for the study

Figure 4 above illustrates the relationship between usability, accessibility, compliance and E-GDI. E-GDI will be measured by reviewing the influence of usability, accessibility and compliance. As per the hypothesis test result, usability, accessibility and compliance improvement strategy selection can translate to a high level of utilization and adoption of online platforms so as to improve on service delivery and foster public participation. Most of East Africa countries have invested enormously on technological infrastructure, human capital development and online services to realize their service delivery strategies. These strategies if well-managed, countries can strengthen their resilience and easily attain sustainable development goals (SDGs).

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Research Design

Correlational design, a quantitative method was used to evaluate the possible relationship among variables. The independent variables were usability, accessibility, and compliance whereas the dependent variable was E-GDI.

The research methodology application outline:

Research Objectives:	**Research Methodology**
To determine the underlining attributes for usability, accessibility, compliance and E-GDI.	Literature Review
To develop and test a framework on influence of usability, accessibility and compliance on E-GDI.	Literature Review, Correlational Design
To formulate predictive equation for dependent and independent variables.	Correlation Design

Table 2: Research Design

3.2 Study Population

Eighteen East Africa countries mainstream ministries was the study population. The total number of ministries in the selected eighteen east African countries was approximately three hundred and twenty-four (324). The breakdown is as follows: Kenya 21, Uganda 31, Tanzania 19, Rwanda 17, Burundi 20, Ethiopia 29, Somalia 26, Madagascar 31, Eritrea 18, Mozambique 23, South Sudan 24, Malawi 18, Zambia 19, Djibouti 15, Seychelles 11, Mauritius 23, Zimbabwe 20 and Comoros 9 (Commonwealth, 2019). A total of 324 is the targeted population.

3.3 Sampling Strategy

A simple random sampling using the lottery method was used to obtain a sample size of seventy-two from a target population of three hundred and twenty-four websites.

3.4 Sample & Sampling technique

The study chose a sample of seventy-two (72) East Africa government websites selected four each from eighteen countries using a simple random sampling technique. The below breaks down the sampling technique and the sample six selected.

No.	Country	Targeted Population size	Sampling Method	Sample
1	Mauritius	23	Simple Random	4
2	Seychelles	11	Simple Random	4
3	Rwanda	17	Simple Random	4
4	Kenya	21	Simple Random	4
5	Zambia	19	Simple Random	4
6	Uganda	31	Simple Random	4
7	Tanzania	19	Simple Random	4
8	Zimbabwe	20	Simple Random	4
9	Ethiopia	29	Simple Random	4
10	Mozambique	23	Simple Random	4
11	Burundi	20	Simple Random	4
12	Madagascar	31	Simple Random	4
13	Malawi	18	Simple Random	4
14	Djibouti	15	Simple Random	4
15	Comoros	9	Simple Random	4
16	Eritrea	18	Simple Random	4
17	South Sudan	24	Simple Random	4
18	Somalia	26	Simple Random	4
	Total	**324**		72

Table 3: Sample and Sampling Technique

3.5 Instruments

These were techniques or methods deployed to gather information to evaluate the study hypothesis. Al-Soud & Natata (2010) research pointed out a lack of common agreement on the most suitable tools to carry out website assessment on usability, accessibility, compliance, and security. Furthermore, since all tools have advantages and disadvantages rarely there is a "one-size-fits-all solution" (Hoelscher, 2017). Consequently, the researcher deployed a combination of various tools. The evaluation tools included Qualidators, Google mobile-friendly test, Nibbler tool, TAW Analysis Tool, Colour Contrast Checker, and Readability test.

3.6 Data collection procedure

3.6.1 Primary Data Collection

3.6.1.1 Observation Method

Commonly deployed in most research on behavioural science analysis (Kothari, 2004). The study used an online and desktop-based tools to evaluate and observe the sampled government websites based on the following:

a) Website content: their usability, accessibility, coverage, accuracy, objectivity and readability.
b) Page Analysis: page size (total image size, HTML page size and image numbers), downtime, composition, and compatibility.
c) Design: Structure of the layout and underlying design techniques used.
d) Accessibility: Conformance to standard guidelines.
e) Search Engine Optimization (SEO): ease for the readers to locate websites, meta description in use (title tags, ALT tags and heading tags), site maps and image descriptions.
f) Mobile: Capability of the websites to be used in other mobile computing technology platforms.
g) Usability: Compatible and optimized for all websites browsers and mobile users. Available functional links without broken links.
h) Performance: downloading time and lack of broken links.
i) Social: linkage to social media.
j) And any other relevant observation during the evaluation.

The result was tabularized according to the level of usability, accessibility, compliance, and security.

3.6.2 Secondary Data Collection

Sources published data reviewed:

a) Government publication.
b) Other organizations and international bodies publications (e.g., IMF, World Bank, UN, etc.).
c) Research reports.
d) Print media e.g. newspaper, magazines and books.
e) Websites.
f) Empirical literature and various published studies.

3.7 Instruments Reliability

Dependable results yielded by the study instruments. The study deployed Test re-test method to ascertain instruments reliability. A sample of one website was selected from different countries. The adopted instruments were administered to them. Data was captured. A time interval of one week between the test, under a constant set of conditions. The results were

captured. The first and second test data was collected using spearman's coefficient of correlation which yield a score of 0.957. A commendable consistency and reliability on the instruments.

3.8 Validity of the Instruments

Refers to the correctness, meaningfulness, accuracy of soundness and inferences of the information concluded, based on the obtained findings (Kothari, 2004). In this research, expert advice on establishing the validity of the instruments was sought.

3.9 Data Processing and analysis Criteria

A virtual test environment was set to run the evaluation of automated tools. Data from the seventy-two (72) East Africa government websites were collected using the web-based and desktop-based application. The tools processed data based on the criteria shown in table 4 below. Also, secondary data from various publications were captured.

Criteria/Tool	Qualidator	MFT mobile-friendly test	Nibbler	TAW	Colour Checker	Readability Test
Usability	Yes	Yes	No	No	No	No
Accessibility	Yes	No	No	No	No	No
Problem -Rate	No	Yes	No	Yes	No	No
Warning-Rate	No	Yes	No	Yes	No	No
Colour-Failure-Rate	No	No	No	No	Yes	No
User Experience	No	No	Yes	No	No	No
Technology Adaptability	No	Yes	Yes	No	No	No
Friendliness	No	Yes	Yes	Yes	Yes	No

Table 4: Automated Tools Data Collection Criteria

4.0 Ethical Considerations

High level of ethical standards was maintained during the research. The ethical consideration included respecting the legal requirements for sites, using the obtained data for study purpose only without ill intent.

4.1 Data Analysis

Inferential and descriptive data analysis methods were applied in this study. The collected data was reviewed, clustered based on coding sheets. Then captured into SPSS program. Descriptive analysis computed, which included frequencies, percentages, weighted means and standard deviation. Correlation analysis was used on data to indicate the extent to which usability, accessibility and compliance influence E-GDI. Hypothesis testing was done using the Chi-

square (χ^2) test. P-values > 0.05 was rejected, on the contrary, if the level of significance was < 0.05 was accepted. The data obtained were discussed and applied to make the conclusion and the recommendations. Table 5 summarizes data analysis:

Research Hypothesis	**Independent Variable**	**Dependent Variable**	**Statistical Test and Data Presentation**
Ho1: There exists a significant correlation between website usability and E-GDI	Usability	E-GDI	Percentages, Frequencies Mean and Standard Deviation (χ^2) test
Ho1: There exists a correlation between website accessibility and E-GDI	Accessibility	E-GDI	Percentages, Frequencies Mean and Standard Deviation (χ^2) test
Ho1: Website compliance influence on E-GDI.	Compliance	E-GDI	Percentages, Frequencies Mean and Standard Deviation (χ^2) test

Table 5: Data Analysis Plan

CHAPTER 4: RESEARCH FINDINGS AND DISCUSSIONS

4.1 Response Rate

It was important to determine the response rate by the websites analyzed using the automated tools.

Evaluation Tool Category	Number Sampled Analyzed	Number Analysis Result obtained	Percentage %
Qualidator	72	72	100%
MFT	72	72	100%
Nibbler	72	68	94.44%
TAW	72	62	86.11%
Colour Checker	72	58	80.56%
Readability Test	72	64	88.89%
Total	432	396	**91.67%**

Table 6: Response Rate

From table 6 above, out of 432 websites URLs analysis carried out, 396 results were obtained by the researcher which represented 91.67% or n=396. The high response was possible because of the consistent and reliable tools deployed. The response rate was, therefore, considered satisfactory and adequate to make conclusions.

4.2 Influence of Usability on E-GDI.

To achieve part of the second objective, the researcher sought to determine the influence of usability on and E-GDI.

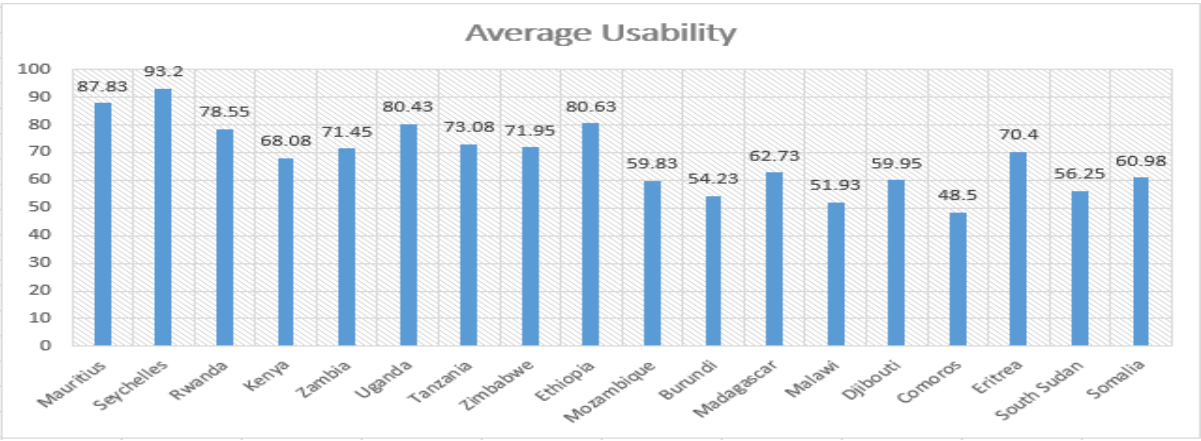

Figure 5: Average Usability Per East Africa Country

Figure 5 demonstrates the average usability of government websites for the selected country. It is evident that usability ranges from 48.5% and 93.2 %. The countries with the lowest usability percentage include Comoros, Malawi and Burundi. That said, Seychelles, Mauritius and Ethiopia recorded the highest average usability percentage. Kenya's average usability is 68.08 percentage.

4.2.1 Hypothesis Testing H_1

Part of the second objective was to determine the correlation between Usability and E-GDI. The following hypothesis was used to test significance Usability on E-GDI.

H_1: There exists a significant correlation between website usability and E-GDI.

	Mean	Std. Dev	N	Correlation	Sig. Value
Usability	68.33	12.57	18	0.750	0.001
E-GDI	0.338	0.158	18	0.750	

Table 7: Usability & E-GDI descriptive Statistics & Correlation Results

Table 7 above , demonstrates pearson's correlation results. Reported 0.750 positive correlation coefficient, an indication of a strong correlation and high significance since it is >0.5. The p-value for the study is 0.001<0.05, an indication of significant, hence the hypothesis, was accepted.

4.3 Influence of Accessibility on E-GDI.

To achieve part of the second objective, the researcher sought to determine the influence of accessibility on E-GDI. The information is shown in figure 6 below.

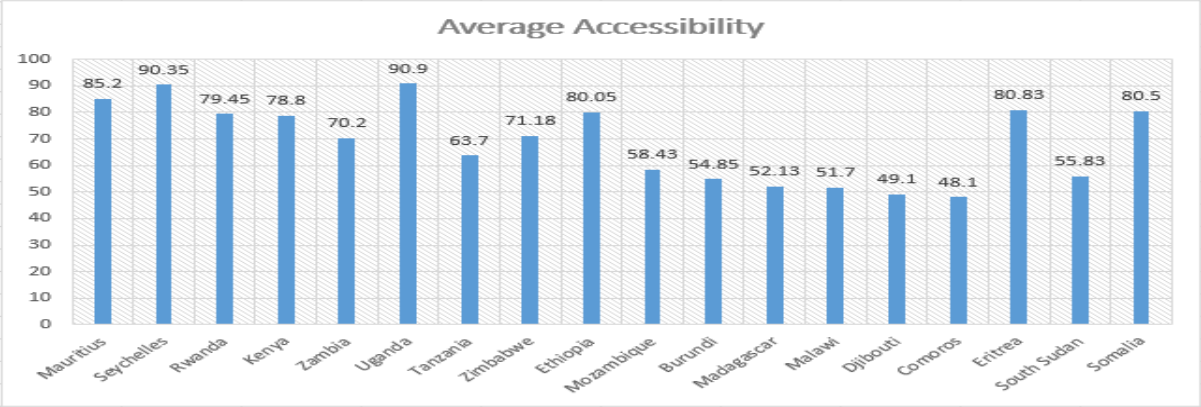

Figure 6: Average Accessibility Per East African Country

Figure 6 above shows the average rate of government website accessibility for the selected countries measures as a percentage. From the table, Djibouti recorded the lowest accessibility rat while Uganda had the highest.

4.3.1 Hypothesis Testing H_2

Part of the second objective was to determine the correlation between accessibility and E-GDI. The following hypothesis was used to test if there an influence of Accessibility and E-GDI.

H_2: There exists a correlation between website accessibility and E-GDI.

	Mean	Std. Dev	N	Correlation	Sig. Value
Accessibility	68.96	14.82	18	0.485	0.041
E-GDI	0.338	0.158	18	0.485	

Table 8: Accessibility & E-GDI descriptive Statistics & Correlation Results

In table 8 above, the correlation coefficients for the influence of website accessibility on E-GDI rate are presented. Notably, the factor is significantly high (0.485) and positive for this data. An indication positive and high correlation with the E-GDI. P-value was 0.041<0.05, an indication significant relationship between the variables. Hence the hypothesis was accepted

4.4 Website Compliance Influence on E-GDI.

The second objective was to ascertain the influence of website compliance on E-GDI. The information is shown in table 9.

No.	Country	E-GDI	Problem-rate	Warning-Rate	Color-Failure-rate	User-Experience	Technology-Adaptability	Friendliness Rating
1	Mauritius	0.6678	61.33	194	116.25	9.35	8.68	0.75
2	Madagascar	0.2792	148	78.4	179.34	7.93	7.83	0.75
3	Somalia	0.0566	80	485	190.835	7.13	5.98	0.25
4	Rwanda	0.459	79.33	310	128.08	8.4	7.35	0.75
5	Djibouti	0.2401	280	506	264.83	7.4	7.7	0.25
6	Uganda	0.4055	90.7	350	93.11	7.53	7.5	0.75
7	Comoros	0.2336	301	517	129.84	2.35	3.6	0.25
8	Zimbabwe	0.3692	65	406.33	126.92	7.03	7.93	0.75
9	Kenya	0.4541	85.25	380.25	102.55	7.825	7.18	0.75
10	Tanzania	0.3929	127	384.5	121.75	7.2	7.03	0.75
11	Seychelles	0.6163	52.25	172.5	110	8.88	8.55	0.75
12	Burundi	0.2985	240.25	260	123	6.38	7.33	0.75
13	Mozambique	0.3195	216.25	446.75	148.25	7.45	7.08	0.75
14	South Sudan	0.1214	640	1080	196.58	6.68	5.65	0.25
15	Eritrea	0.1337	47	780	197.83	8.23	8.08	0.75
16	Ethiopia	0.3463	94	120	143.08	7	7.73	0.75
17	Malawi	0.2708	150	481.9	134.33	7.15	7.4	0.75
18	Zambia	0.4111	105.6	335	156.45	7.73	7.43	0.50

Table 9: Compliance factors.

From Table 9, the researcher obtained results for factors for compliance (Problem-Rate, Warning-Rate, Colour-Failure-Rate, User Experience, Technology Adaptability and Friendliness Rating) per each country.

4.4.1 Hypothesis Testing H_3

Part of the second objective was to determine the correlation between Compliance and E-GDI.

The following hypothesis was used to test the influence of website Compliance on E-GDI.

H_3: Website Compliance Influence on E-GDI.

	Mean	Std. Dev	N	Correlation	Sig. Value
Problem-Rate	159.05	143.35	18	-0.473	0.047
Warn-Rate	404.87	237.45	18	-0.639	0.004
Colour-Rate	147.95	43.12	18	-0.656	0.003
User-Exp.	7.31	1.45	18	0.473	0.047
Tech-Adapt	7.220	1.17	18	0.541	0.02
Friendliness-Rating	0.639	0.214	18	0.606	0.008

Table 10: Accessibility & E-GDI descriptive Statistics & Correlation Results

Table 10 above, demonstrates Pearson Correlation coefficients and the significant value obtained by correlational analysis of the E-GDI with various dependent variables for compliance. Notably, the metrics for testing for compliance, in this case, include the rates of encountering problems during navigation, warning rates, and general user experience, platforms adaptability to new technologies, and the average rating of colour contrast failure. From the table, users' experience, technology adaptability and friendliness have a positive coefficient while warning rates, problems-rates and colour contrast failure registered a negative coefficient. All six parameters registered a significant relationship. Hence the hypothesis was accepted.

4.5 The Predictive Equation Usability, Accessibility and E-GDI

To achieve the third objective, the researcher sought to derive the predictive equation for Usability, Accessibility, Compliance, E-GDI and their attributes through regression correlational analysis. E-GDI as dependent variable in relation with the following predictors: (Constant), User-Experience, Colour-Failure-rate, Warning-Rate, Accessibility, Problem-rate, Friendliness Rating, Technology-Adaptability, Usability. Table 11 below illustrates the analysis outcome.

F-Rating	Tech-Adapt	User-Expe	C-F-Rate	Warn-Rate	Problem-rate	Accessibility	Usability	Y-Intercept
0.35	0.024	0.038	-0.0031	-0.000028	-0.00015	0.0091	0.012	0.42
0.208	0.045	0.029	0.0008	0.00013	0.00025	0.0034	0.0036	0.24
0.8996	0.069							
10.08	9							
0.38	0.043							

Table 11: Non-Linear Regression Analysis Using Linest Function

Table 11 was generated using Linest excel function to find the best fit curve for the non-linear slopes, R^2 = 0.90; Taken as a set, the predictors Usability, Accessibility, Technology-Adaptability, Colour-Failure-Rate, Warning-Rate, Friendliness Rating and Problem-Rate account for 90% of the variance in E-GDI. An indication of good predictor selection.

From The table 11, F = 10.08, degree of freedom (df) = 9, constant value (y-intercept/Line of best fit intercept) is 0.42, the coefficient values for the variables; friendliness- Rating 0.35, Technology-Adaptability 0.024, User-Experience 0.038, Colour Failure Rating -0.0031, Warning-Rate -0.000028, Problem Rate -0.00015, Accessibility -0.0091, and Usability 0.012. Therefore, the predictive equation for the usability, accessibility, compliance and E-GDI is;

E-GDI = 0.42 + 0.012 (US) + 0.024 (TA) +0.038 (UE) + 0.0091 (AC) + 0.35 (FR) – 0.0031 (CFR) – 0.000028 (WR) – 0.00015 (PR) ……...**(i)**

Where: US – Usability

TA – Technology Adaptability

UE – User Experience

AC- Accessibility,

FR – Friendliness Rating

CFR – Colour Failure Rate

WR – Warning Rate

PR – Problem Rate

FR – Failure Rate

The above equation simply indicates the average value of E-GDI as a function of the eight predictors that is usability, accessibility, colour failure rate, Technology adaptability, User Experience, Friendliness, Problem Rate, Warning Rate and the constant. Using the predictors, the value of E-GDI can be derived.

5.0 Discussions

A recapitulation of the presented approach promises an increased understanding of the concept of East Africa Countries E-GDI in relation to other variables. The attention on e-government has received robust support across public administration in recent decades. The supported technology platform for service delivery is inspired by its capability to enhance performance in terms of efficiency and effectiveness. The primary areas of interest are the public quest for information, interaction, and transaction with the government. Given this, the design of a website is of paramount influence on E-GDI. The key elements that play a critical role in the design are access, ability, content navigation, and aesthetics, not to mention the level of customization, personalization, custom self-care aid communities are critical in the design process. This research sought to test the relationships between usability, compliance, and accessibility on E-GDI across eighteen East Africa countries.

In H_1, the researcher reviewed the influence of usability on E-GDI. Usability, which is often associated with user experience refers to the aspects of interaction that an individual derives from using a particular product. Different domains and principles are used to describe website interaction in this domain, including the complexities and features that influence navigation. A usable website supports access to the desired services irrespective of the skills of the user. People consider technologies usable when they can extract information efficiently, timely, and at a low cost. The perceived ease to use, especially among people with little computer skills, affects the continued use. It is imperative that websites that have adequate features and clear direction about navigation and use are more satisfying to the users and vice versa. The perceived complexity and usefulness record strong loadings in the analysis. The nature of the experiences with the websites determines the trust that the public has for them. This test employed a Pearson correlation test to determine the relationship established that usability is a strong positive correlation with E-GDI.

In the second Hypothesis, H_2, Web accessibility refers to the features that designers employ to ensure that the citizens are not restricted from accessing the website. It includes features that ensure that marginalized people, those with disabilities, as well as those from low socioeconomic status, have adequate access to information. The other key features that determine accessibility are bandwidth and speed. Similar to usability, this analysis established that the E-GDI has a positive significant relation with website accessibility for the selected countries.

Hypothesis, H_3, a test on the impact of compliance on E-GDI was assessed. Compliance refers to the strategies of making information accessible to those that are in need. Since compliance is a vague term, the available data about user experience, problem rate, colour contrast failure rate, adaptability of the website to novel technologies and warning rates were used in the assessment of this proposition. User-friendliness was included in the analysis because it illuminates on the public ease of navigating the website that leads to a pleasurable fulfilment of a seed or service in the end. Friendliness is determined by the level at which features are designed and developed to take care of the site visitor's needs. It is often determined by website responsiveness in the delivery of the required data. Concerning the warning rates and experience, this research ascertained that the characteristics of the users can be influential in the usage of government websites.

As an illustration, when the websites demand users with advanced technical, internet, and computer skills, this can adversely affect the aspiration of users who cannot meet the threshold. Most likely, the users who never faced technical challenges previous encounters with the website are likely to visit the websites again while those without skills may opt-out of the websites or never come back after facing challenges. Besides, aesthetics can influence the attitude of the public towards the government's online portals. While having a homepage conveying the value of the website is critical, colour contrast contributes significantly to the hedonic quality of a website that can encourage people to come back.

Aesthetics interaction goes beyond visuals to encompass effective experience when using the website. Technological adaptability entails innovativeness is also critical in the user's intention to use. A website can attract more visits if it can accommodate different technologies and apps. To test hypothesis H_3, both correlation and regression analyses were performed on the various metrics of conformance. The approach was chosen for the analysis because it could reveal both the type and strength of the correlation of the variables with the E-GDI. The correlation model revealed positive beta values for correlation and regression for the included variables except for the problem, colour-failure-rate and warning rates. Usability, Accessibility and Colour-Failure-Rate registered a strong significant relationship.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Findings Summary

A total of 432 websites analysis was done on the 72 sampled sites. Out of 432 analyses, a response rate of 91.5 per cent or n=396 was got. The response rate was therefore considered sufficient and satisfactory. From the finding's, usability reported p-value of 0.001 and 0.75 coefficient, accessibility p-value of 0.41 and 0.485 coefficient. The indicators for compliance; problem rate reported p-value of 0.047 and -0.473 coefficient, warning rate p-value of 0.004 and -0.639 coefficient, colour failure rate p-value of 0.003 and a coefficient of -0.656, user experience a p-value of 0.047 and 0.473 coefficient, technology adaptability p-value of 0.02 and 0.541 coefficient, and friendliness p-value of 0.008 with 0.606 coefficient.

This indicated that usability, accessibility and compliance has a significant relationship with the E-GDI. Usability and accessibility registered a positive correlation, which means that an increase can translate to a corresponding rise in the adoption of online platforms which can impact on the level of E-GDI. The same equally applies to the indicators for compliance that is user experience, technology adaptability and friendliness that registered positive relations. For the other indicators of compliance that is problem rate, warning rate, and colour failure rate that registered negative correlation, a decrease in their level can translate to a corresponding impact on the level of E-GDI and vice versa. This simply means that e-government platforms with few errors and challenges can have a high level of utilization and ultimate impact on the level of E-GDI.

5.1.1 Website Usability and the Level of E-GDI.

The key study objective was to determine the influence of Usability on E-GDI for the East Africa Countries UN members. The study established that usability has a highly positive significant influence on E-GDI. This implies that an increase in the level of usability to foster a high level of adoption which in turn can put pressure on advancement and the resulting impact on the level of E-GDI. The study revealed that by ensuring that the e-government platforms are simple, clear, useable, learnable, robust, memorable, consistent and enjoyable, can in turn significantly contribute a high level of utilization and adoption of the platforms.

5.1.2 Website Accessibility and the Level of E-GDI.

The key study objective was to determine the influence of accessibility on E-GDI for the East Africa Countries UN members. A positive significant relation on E-GDI was reported. Which implies that an increase in the level of accessibility can foster a high level of adoption which in turn can put pressure on advancement and resulting impact level of E-GDI. The study revealed that by ensuring that the e-government platforms are accessible, perceivable, and navigable, can in turn significantly contribute a high level of utilization and adoption.

5.1.3 Influence of Website Compliance on the Level of E-GDI.

The key study objective was to evaluate Website Compliance influence on E-GDI for the East Africa Countries UN members. User experience, technology adaptability and friendliness registered a positive correlation, which means that an increase in them can translate to a corresponding rise in adoption of online platforms with an impact on the level of E-GDI. The other indicators of compliance that is problem rate, warning rate, and colour failure rate that registered negative correlation, a decrease in their level can translate to a corresponding increase in the level of E-GDI and vice versa. Which simply means that e-government platforms with few errors and challenges can have a high level of utilization and in turn impacts significantly in the level of E-GDI. The results indicated that by ensuring that the online platforms are compliant to the standards and guidelines, user-friendly, few errors, technology adaptable, and rich of user experience, can in turn significantly contribute a high level of utilization and adoption of the platforms.

5.1.4 The Predictive Equation for E-GDI and its predictors.

The objective was to formulate a predictive equation for the dependent variable E-GDI and the predictors: usability, accessibility and factors of compliance. From regression analysis using excel linest function, F = 10.08, df = 9, constant value (y-intercept) is 0.42, the coefficient values for the variables; Friendliness-Rating 0.35, Technology-Adaptability 0.024, User-Experience 0.038, Colour Failure Rating -0.0031, Warning-Rate -0.000028, Problem Rate -0.00015, Accessibility -0.0091, and Usability 0.012. Therefore, the predictive equation for the usability, accessibility, compliance and E-GDI is;

E-GDI = 0.42 + 0.012 (US) + 0.024 (TA) +0.038 (UE) + 0.0091 (AC) + 0.35 (FR) – 0.0031 (CFR) – 0.000028 (WR) – 0.00015 (PR) ……..**(i)**

The above equation simply means, that the average value of E-GDI as a function of the eight predictors that is usability, accessibility, colour failure rate, Technology adaptability, User Experience, Friendliness, Problem Rate, Warning Rate and the constant. Using the predictors, the value of E-GDI can be derived.

5.2 Recommendation of the Study

The author recommends the following: That the design of online platforms must be simple, clear, learn, robust, memorable, consistent and enjoyable to use to promote high usability levels. That the online platforms must be accessible, perceivable, and navigable to foster reachability for people with various disability challenges. That e-government platforms should be compliant to the standards and guidelines design regulations to ensure that they are user friendly, error-free, technology adaptable, and rich of user experience.

5.3 Further Research

From the findings, it is recommended that since usability, accessibility and compliance significantly influences E-GDI, the researcher proposes the following for future studies considerations: A similar research be conducted with an expanded dataset. A combination of questionnaires and evaluation tools can be deployed in future research work. An expanded list of other possible influencers for E-GDI can be considered in future research.

5.4 Study Limitation

The study was limited to East Africa countries UN members. This may affect the generalization of findings of the study to whole East African countries. Although the study had this specific focus, the findings can be generalized to other UN member countries. Also, the study was limited to only three variables namely usability, accessibility and compliance leaving out other possible variables. The research limited itself to the collection of data using evaluation tools with at times can have reliability challenges. This was remedied by Test re Test Method to check and ensure that the tools meet the required level for reliability.

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Appendix 1: List of the Selected Websites

No.	Country	Selected Government Website	Website URL	Website Symbol
1.	Kenya	NPSC	https://www.npsc.go.ke	W 1
		Kenya Revenue Authority (KRA)	https://itax.kra.go.ke/KRA-Portal	W 2
		Foreign Affairs Ministry	http://www.mfa.go.ke	W 3
		National Transport and Safety Authority (NTSA)	https://tims.ntsa.go.ke	W 4
2.	Uganda	National Police service	https://www.upf.go.ug/	W 5
		Uganda Revenue Authority	https://www.ura.go.ug/	W 6
		Foreign affairs Ministry	https://www.mofa.go.ug/	W 7
		Ministry of Works & Transport	https://www.works.go.ug/	W 8
3.	Tanzania	Finance and Economic Affair ministry	https://www.mof.go.tz	W 9
		Dar es salaam University	https://www.udsm.ac.tz/	W 10
		Foreign Affairs and East African Cooperation Ministry	https://www.foreign.go.tz/	W 11
		Tanzania Revenue Authority	https://www.tra.go.tz/	W 12
4	Rwanda	The Ministry of Education	https://mineduc.gov.rw/	W 13
		Finance and Planning Ministry	http://www.minecofin.gov.rw/	W 14
		Ministry of ICT & Innovation	https://www.minict.gov.rw/home/	W 15
		Foreign Affairs and International Cooperation Ministry	https://www.minaffet.gov.rw/	W 16
5.	Ethiopia	Ministry of Culture and Tourism (MOCT)	http://www.moct.gov.et	W 17
		Federal Affairs Ministry	http://www.mofa.gov.et	W 18
		Foreign Affairs (MFA)	http://www.mfa.gov.et	W 19
		Women, Children and Youth Affairs	http://www.mowcya.got.et	W 20

No.	Country	Selected Government Website	Website URL	Website Symbol
6.	Somalia	Planning, Investment and Economic Development	http://mop.gov.so/	W 21
		University of Somalia	https://www.uniso.edu.so/	W 22
		Foreign Affairs	http://www.mfa.gov.so/	W 23
		Planning, Investment and Economic Development	http://mop.gov.so/	W 24
7.	Madagascar	Ministry of Public Health	https://www.devex.com/organizations/ministry-of-public-health-madagascar-52578	W 25
		University of Toamasina	http://www.univ-toamasina.mg/	W 26
		Travel Madagascar	http://www.travelmadagascar.org/recommended%20websites.html	W 27
		Ministry of Agriculture	http://www.agriculture.gov.mg	W 28
8.	Eritrea	University of Asmara	https://universityofasmara.com/	W 29
		Eritrea Institute of Technology	http://eit-ae.academia.edu/	W 30
		Ministry of Information	http://www.shabait.com/	W 31
		Embassy of Eritrea	http://www.embassyeritrea.org/	W 32
9.	Burundi	Ministry of Foreign Affairs	https://www.mae.gov.bi/en/	W 33
		Investment Promotion Agency	https://www.investburundi.bi/	W 34
		Burundi Revenue Authority	https://www.obr.bi/	W 35
		Burundi Government	http://www.burundi.gov.bi/	W 36
10.	Mozambique	Finance and economics	http://www.mef.gov.mz/	W 37
		Sea, Inland Waters and Fisheries	http://www.mozpesca.gov.mz/	W 38
		Transport and Communication	http://www.mtc.gov.mz/	W 39
		Catholic University	http://www.ucm.ac.mz/index.php/pt/	W 40

No.	Country	Selected Government Website	Website URL	Website Symbol
11.	South Sudan	South Sudan Government	http://www.goss-online.org/	W 41
		Ministry of Finance and National Planning	http://www.mofep-grss.org/	W 42
		University of Juba	http://jubauni.net/	W 43
		Ministry of General Education and Instruction	http://mogei.org/	W 44
12.	Malawi	Ministry of Agriculture, Irrigation and Water Development	https://www.agriculture.gov.mw/	W 45
		Education and Technology Ministry	https://www.education.gov.mw/	W 46
		Foreign Affairs Ministry	https://www.malawi.gov.mw/	W 47
		Malawi University of Science and Technology	https://www.must.ac.mw/	W 48
13.	Zambia	Health Ministry	https://www.moh.gov.zm/	W 49
		Finance Ministry	https://www.mof.gov.zm/	W 50
		General Education	https://www.moge.gov.zm/	W 51
		University of Zambia	https://www.unza.zm/	W 52
14.	Djibouti	Ministry of Public Health and Social Affair	http://www.sante.gouv.dj	W 53
		National and Higher Education	http://www.education.gov.dj	W 54
		Ministry of Economy, Finance, and Planning in charge of Privatization	http://www.ministere-finances.dj	W 55
		University of Djibouti	http://www.univ.edu.dj/	W 56
15.	Seychelles	University of Seychelles	https://unisey.ac.sc/	W 57
		Education and Human Resource Development	http://www.education.gov.sc/	W 58
		Foreign Affairs	http://www.mfa.gov.sc/	W 59
		Finance, Trade Investment and Financial Planning	http://www.finance.gov.sc/	W 60
16.	Mauritius	University of Mauritius	http://www.uom.ac.mu/	W 61

No.	Country	Selected Government Website	Website URL	Website Symbol
		Education and Human Resources	http://ministry-education.govmu.org/	W 62
		Health and Wellness	http://health.govmu.org/English/Pages/default.aspx	W 63
		Foreign Affairs, Regional Integration & International Trade	http://foreign.govmu.org/English/Pages/default.aspx	W 64
17.	Zimbabwe	University of Zimbabwe	http://www.uz.ac.zw/	W 65
		Ministry of Primary and Secondary Education	http://www.zim.gov.zw/government-ministries/ministry-primary-and-secondary-education	W 66
		Foreign Affairs	http://www.zimfa.gov.zw/	W 67
		ICT and Postal Services Ministry	http://www.ictministry.gov.zw/	W 68
18.	Comoros	Foreign Affairs	http://www.mfa.gov.bn/Pages/comoros-fdm.aspx	W 69
		Ministry of Finance, Budget and Banking Sector	https://douane.gov.km/en/actualite.php?article_id=109	W 70
		Government of Comoros	https://www.gouvernement.km/	W 71
		Ministry of External Relations and Cooperation	https://www.gouvernement.km/index.php?id=12	W 72

Table 12: List of the Sampled Website

Appendix 2: Work plan

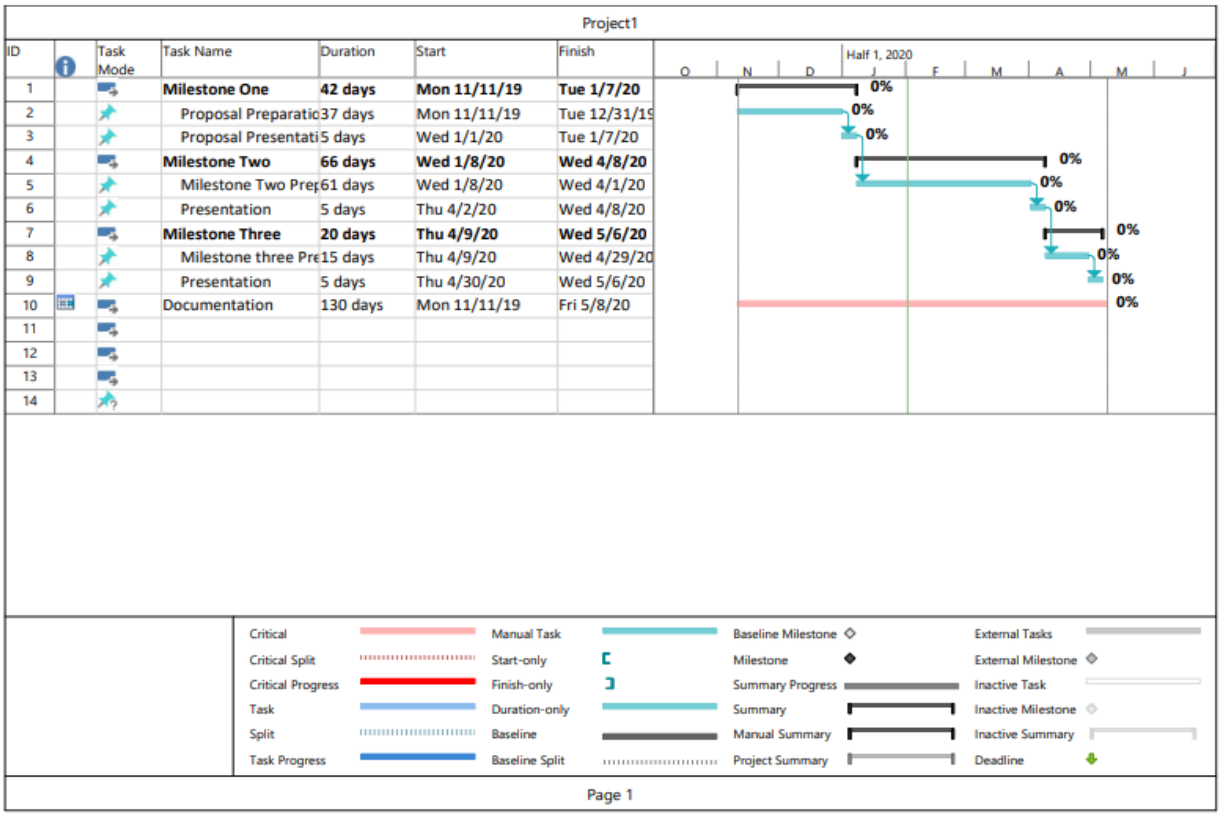

Figure 7: Workplan Gantt Chart

Appendix 3: Resources Required

No.	Items
1.	A laptop/PC
2.	Printing Papers
3.	Time
4.	Research articles/Journals
5.	Evaluation tools

Table 14: Resource Requirement.

Appendix 4: Data Collected using Qualidator Tool

Website Symbol	Accessibility	Usability
W 1	63.4%	70.2%
W 2	76.7%	61.3%
W 3	75.5%	70.2%
W 4	66.4%	71.0%
W 5	82.2%	85.0%
W 6	82.9%	80.1%
W 7	89.4%	73.8%
W 8	95.7%	84.1%
W 9	62.4%	84.7%
W 10	71.1%	63.5%

Website Symbol	Accessibility	Usability
W 11	64.9%	71.9%
W 12	55.9%	73.5%
W 13	72.2%	76.2%
W 14	81.5%	94.3%
W 15	92.2%	78.2%
W 16	70.5%	97.1%
W 17	97.9%	95.2%
W 18	51.1%	59.1%
W 19	80.7%	90.0%
W 20	90.7%	78.5%
W 21	63.9%	62.3%
W 22	98.2%	50.6%
W 23	65.7%	63.1%
W 24	92.9%	61.3%
W 25	53.1%	70.8%
W 26	61.3%	50.7%
W 27	45.9%	61.2%
W 28	51.1%	62.3%
W 29	81.2%	76.0%
W 30	64.6%	62.1%
W 31	86.5%	84.3%
W 32	88.6%	67.9%
W 33	51.4%	54.5%
W 34	51.3%	56.5%
W 35	54.5%	59.9%
W 36	51.3%	49.0%
W 37	51.9%	59.3%
W 38	52.2%	58.7%
W 39	54.8%	55.0%
W 40	58.3%	54.3%
W 41	59.4%	55.6%
W 42	56.0%	58.8%
W 43	55.0%	57.9%
W 44	59.9%	53.7%
W 45	54.1%	54.5%
W 46	52.8%	58.8%
W 47	52.2%	48.9%
W 48	46.5%	45.7%
W 49	71.5%	73.9%
W 50	74.3%	66.4%
W 51	70.6%	73.6%
W 52	71.4%	68.8%
W 53	52.2%	58.2%
W 54	49.2%	49.2%
W 55	56.6%	59.0%
W 56	49.8%	47.8%
W 57	97.6%	87.4%
W 58	86.9%	94.0%
W 59	95.0%	90.3%
W 60	90.9%	85.2%

Website Symbol	Accessibility	Usability
W 61	97.2%	96.9%
W 62	82.2%	87.9%
W 63	88.7%	88.4%
W 64	86.6%	90.1%
W 65	72.0%	75.8%
W 66	71.9%	73.3%
W 67	70.5%	68.3%
W 68	71.4%	68.4%
W 69	48.7%	48.1%
W 70	39.7%	50.2%
W 71	49.8%	40.3%
W 72	49.8%	51.3%

Appendix 5: Data Collected using Google Mobile Friendly Test Tool

Website Symbol	Very Friendly	Friendly	Not Friendly	Not Reachable
W 1	No	No	Yes	No
W 2	No	No	Yes	No
W 3	No	Yes	No	No
W 4	No	No	Yes	No
W 5	Yes	Yes	No	No
W 6	No	No	Yes	No
W 7	No	No	Yes	No
W 8	Yes	Yes	No	No
W 9	No	No	Yes	No
W 10	Yes	Yes	No	No
W 11	Yes	Yes	No	No
W 12	Yes	Yes	No	No
W 13	Yes	Yes	No	No
W 14	No	No	Yes	No
W 15	No	No	Yes	No
W 16	No	No	No	Yes
W 17	Yes	Yes	No	No
W 18	Yes	Yes	No	No
W 19	Yes	Yes	No	No
W 20	Yes	Yes	No	No
W 21	Yes	Yes	No	No
W 22	Yes	Yes	No	No
W 23	Yes	Yes	No	No
W 24	No	No	Yes	No
W 25	Yes	Yes	No	No
W 26	Yes	Yes	No	No
W 27	No	No	Yes	No
W 28	No	No	No	Yes
W 29	Yes	Yes	No	No
W 30	Yes	Yes	No	No
W 31	No	No	Yes	No
W 32	No	No	Yes	No
W 33	Yes	Yes	No	No

Website Symbol	Very Friendly	Friendly	Not Friendly	Not Reachable
W 34	Yes	Yes	No	No
W 35	No	No	Yes	No
W 36	Yes	Yes	No	No
W 37	No	No	Yes	No
W 38	No	No	Yes	No
W 39	Yes	Yes	No	No
W 40	Yes	Yes	No	No
W 41	Yes	Yes	No	No
W 42	No	No	Yes	No
W 43	Yes	Yes	No	No
W 44	Yes	Yes	No	No
W 45	No	No	Yes	No
W 46	No	No	Yes	No
W 47	No	No	Yes	No
W 48	Yes	Yes	No	No
W 49	No	No	Yes	No
W 50	Yes	Yes	No	No
W 51	Yes	Yes	No	No
W 52	Yes	Yes	No	No
W 53	No	No	Yes	No
W 54	Yes	Yes	No	No
W 55	No	No	Yes	No
W 56	Yes	Yes	No	No
W 57	Yes	Yes	No	No
W 58	No	No	Yes	No
W 59	No	No	Yes	No
W 60	Yes	Yes	No	No
W 61	Yes	Yes	No	No
W 62	No	No	Yes	No
W 63	No	No	Yes	No
W 64	No	No	Yes	No
W 65	Yes	Yes	No	No
W 66	No	No	Yes	No
W 67	Yes	Yes	No	No
W 68	No	No	Yes	No
W 69	Yes	Yes	No	No
W 70	Yes	Yes	No	No
W 71	No	No	No	Yes
W 72	No	No	No	Yes

Table 13: Raw data from Google Mobile Friendly Test Tool

Appendix 6: Data Collected using Nibbler Tool

Website Symbol	Experience	Technology
W 1	7.9	7.2
W 2	7.5	5.8
W 3	8.0	8.1
W 4	7.5	7.9
W 5	6.4	8.0
W 6	7.9	7.3

Website Symbol	Experience	Technology
W 7	6.4	7.3
W 8	9.4	7.3
W 9	7.6	5.3
W 10	6.9	8.3
W 11	6.6	8.9
W 12	7.8	6.8
W 13	9.4	8.5
W 14	8.3	7.7
W 15	9.3	8.5
W 16	8.5	6.5
W 17	8.3	8.5
W 18	7.8	8.7
W 19	5.7	5.4
W 20	7.8	8.2
W 21	7.5	4.4
W 22	7.0	7.1
W 23	7.8	5.4
W 24	7.5	6.4
W 25	-	-
W 26	0.0	0.0
W 27	7.93	7.83
W 28	-	-
W 29	8.6	7.1
W 30	8.7	8.4
W 31	7.5	8.7
W 32	8.6	7.5
W 33	7.0	7.5
W 34	6.4	6.9
W 35	6.0	7.2
W 36	7.3	7.7
W 37	6.3	6.4
W 38	-	-
W 39	7.0	8.3
W 40	8.1	6.4
W 41	6.2	5.9
W 42	5.9	5.5
W 43	7.5	4.8
W 44	7.1	5.0
W 45	-	-
W 46	7.3	6.0
W 47	7.8	9.2
W 48	7.0	6.6
W 49	6.6	6.6
W 50	6.5	6.4
W 51	7.1	7.3
W 52	8.4	9.3
W 53	6.9	7.4
W 54	7.3	7.2
W 55	6.7	6.9
W 56	7.7	6.9
W 57	9.3	8.7

Website Symbol	Experience	Technology
W 58	8.7	8.5
W 59	8.6	8.8
W 60	7.9	9.3
W 61	9.3	9.6
W 62	9.1	8.5
W 63	9.4	8.5
W 64	8.9	9.4
W 65	7.8	8.6
W 66	6.8	7.8
W 67	7.1	6.6
W 68	7.8	6.7
W 69	4.0	3.2
W 70	3.3	3.3
W 71	3.6	3.7
W 72	3.6	3.7

Table 14: Raw Data from Nibbler Tool

Appendix 7: Data Collected using TAW Analysis Tool

Website Symbol	Problems	Warnings	Not Reviewed
W 1	92	264	16
W 2	74	263	14
W 3	88	470	16
W 4	90	525	16
W 5	98	289	17
W 6	86	295	17
W 7	86	478	16
W 8	-	-	-
W 9	307	676	17
W 10	54	99	15
W 11	62	663	15
W 12	78	484	14
W 13	57	476	14
W 14	66	129	14
W 15	88	703	15
W 16	98	24	16
W 17	-	-	-
W 18	-	-	-
W 19	108	47	17
W 20	80	205	16
W 21	65	571	15
W 22	28	200	19
W 23	209	469	15
W 24	30	556	15
W 25	35	67	18
W 26	102	35	16
W 27	439	67	17
W 28	16	148	15
W 29	69	583	14
W 30	31	1048	17

Website Symbol	Problems	Warnings	Not Reviewed
W 31	84	761	15
W 32	-	-	-
W 33	129	490	16
W 34	526	73	16
W 35	177	271	17
W 36	158	181	16
W 37	350	402	15
W 38	71	426	14
W 39	39	251	14
W 40	448	709	16
W 41	920	813	18
W 42	731	1,507	19
W 43	107	1,419	16
W 44	818	506	17
W 45	39	499	17
W 46	-	-	-
W 47	361	701	18
W 48	65	284	14
W 49	120	75	17
W 50	116	541	14
W 51	18	70	14
W 52	151	653	19
W 53	223	686	16
W 54	-	-	-
W 55	180	654	17
W 56	435	190	15
W 57	19	92	17
W 58	57	108	13
W 59	47	330	15
W 60	108	116	15
W 61	26	167	15
W 62	85	121	14
W 63	84	209	13
W 64	46	246	13
W 65	59	317	16
W 66	-	-	-
W 67	-	-	-
W 68	73	506	16
W 69	-	-	-
W 70	301	517	16
W 71	-	-	-
W 72	-	-	-

Table 15: Raw Data from TAW Analysis Tool

Appendix 8: Data Collected using Colour Contrast Checker Tool

Website Symbol	No. of Failures on Luminosity Contrast Ratio	No. of Failures on Brightness Difference	No. of Failures on colour Difference	Average Failures
W 1	138	109	171	139.33
W 2	-	-	-	-

Website Symbol	No. of Failures on Luminosity Contrast Ratio	No. of Failures on Brightness Difference	No. of Failures on colour Difference	Average Failures
W 3	51	151	241	147.67
W 4	16	16	25	19
W 5	58	60	262	126.67
W 6	98	98	98	98
W 7	95	90	95	93.33
W 8	59	59	59	59
W 9	-	-	-	-
W 10	123	101	210	141.67
W 11	119	12	204	111.67
W 12	-	-	-	-
W 13	-	-	-	-
W 14	115	115	127	119
W 15	-	-	-	-
W 16	86	184	133	134.33
W 17	121	121	121	121
W 18	160	10	204	124.67
W 19	40	70	291	133.67
W 20	176	176	176	176
W 21	120	189	120	143
W 22	393	89	360	280.67
W 23	231	257	257	248.67
W 24	120	119	120	119.67
W 25	122	122	122	122
W 26	101	456	156	237.67
W 27	-	-	-	-
W 28	-	-	-	-
W 29	215	215	215	215
W 30	54	54	54	54
W 31	760	39	159	319.33
W 32	0	0	0	0
W 33	32	26	59	39
W 34	46	103	370	173
W 35	201	119	216	178.6667
W 36	138	98	138	124.6667
W 37	189	562	571	440.6667
W 38	74	29	73	58.66667
W 39	42	28	23	31
W 40	31	33	33	32.33333
W 41	380	380	380	380
W 42	32	32	32	32
W 43	178	173	244	198.33
W 44	176	176	176	176
W 45	258	258	258	258
W 46	8	6	57	23.66667
W 47	34	34	173	80.33333
W 48	437	149	151	245.6667
W 49	-	-	-	-
W 50	-	-	-	-
W 51	-	-	-	-

Website Symbol	No. of Failures on Luminosity Contrast Ratio	No. of Failures on Brightness Difference	No. of Failures on colour Difference	Average Failures
W 52	117	230	106	151
W 53	983	734	284	667
W 54	172	74	99	115
W 55	178	167	181	175.3333
W 56	46	45	245	112
W 57	215	215	215	215
W 58	128	116	303	182.33
W 59	73	73	73	73
W 60	23	12	30	21.67
W 61	4	4	4	4
W 62	69	167	762	332.6667
W 63	15.4	5.7	4.9	8.666667
W 64	-	-	-	-
W 65	-	-	-	-
W 66	88	88	88	88
W 67	279	128	261	222.667
W 68	62	54	60	58.6667
W 69	17	60	110	62.33333
W 70	280	26	286	197.3333
W 71	-	-	-	-
W 72	-	-	-	-

Table 16: Raw data from Colour Contrast Test Tool

Appendix 9: Data Collected using Readability Test Tool

Website Symbol	Grade Level
W 1	7
W 2	4
W 3	8
W 4	5
W 5	8
W 6	9
W 7	10
W 8	9
W 9	-
W 10	9
W 11	9
W 12	8
W 13	-
W 14	12
W 15	-
W 16	9
W 17	9
W 18	2
W 19	7
W 20	7
W 21	8
W 22	11

Website Symbol	Grade Level
W 23	10
W 24	8
W 25	8
W 26	12
W 27	12
W 28	14
W 29	12
W 30	12
W 31	9
W 32	6
W 33	9
W 34	12
W 35	9
W 36	9
W 37	9
W 38	13
W 39	10
W 40	9
W 41	10
W 42	10
W 43	10
W 44	10
W 45	10
W 46	10
W 47	9
W 48	7
W 49	-
W 50	-
W 51	-
W 52	10
W 53	10
W 54	9
W 55	-
W 56	8
W 57	11
W 58	11
W 59	10
W 60	8
W 61	11
W 62	11
W 63	8
W 64	9
W 65	11
W 66	-
W 67	7.8
W 68	9.0
W 69	7.4
W 70	8.2
W 71	8.6
W 72	8.6

Table 17: Data from Readability Tool

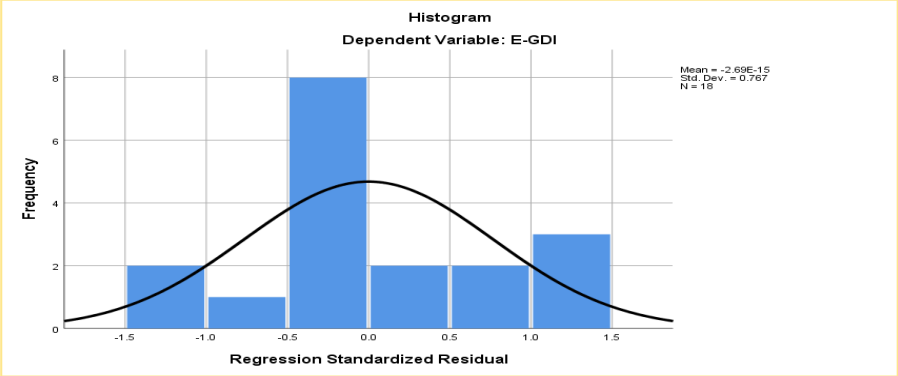

Figure 7: Histogram Dependent Variable : E-GDI

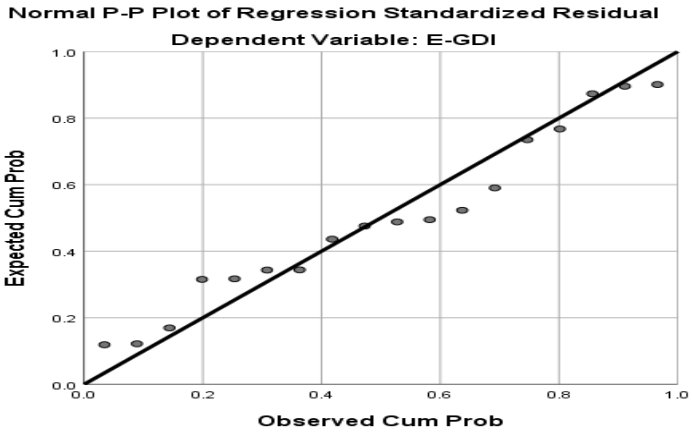

Figure 8: Plot Regression E-GDI