Accessibility Evaluation and Performance Analysis of e-Government Websites in Nigeria

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Abstract—**Accessibility issues in websites design have been receiving a lot of global attention till date. This is as a result of the importance that is attached to having a website that is not only accessible but also usable to all. Through the deployment of various websites by the state government in Nigeria, e-government services could now be easily accessed. Despite this, there is need to know the accessibility and performance of these websites. Hence, this paper evaluates the accessibility and performance analysis of the state government websites in Nigeria by using two online automated tools: TAW and site analyser. The aim is to test for their conformance with the Web Content Accessibility Guidelines (WCAG). Results from the study show that none of the websites evaluated totally conform to WCAG 2.0 standard. Also, the overall performance obtained shows that most websites tested are above average. The results also show that there is no significant difference in the performance of the websites among different states in the country.**

Index Terms—**accessibility, usability, automated, Nigeria, websites, e government**

I. INTRODUCTION

The rate of development as a result of warm embrace of Information and Technology by Nigerian government in this decade has been on the increase. As a nation which is stablising democratically, Nigeria has witnessed a dramatic growth in its developmental strides in the present dispensation. As a result of this, state governments' programme and activities, which have hitherto, being secretive, unavailable and inaccessible, are now well known to the citizens. This is made possible via e government services that are available through different websites hosted by the government. With the introduction of e-government there is now digital interaction between the citizens and their government. It has been observed that government agencies wishing to provide a service through any channel must make it equally available to every citizen irrespective of their status, age or sex [1] and [2]. Therefore, making information available and accessible to all categories of users (citizens) is of utmost

importance to the present day government. This is a clear departure from what was obtainable in the past.

To make services more available as well as accessible to the various categories of citizens, government at various levels has come up with e-government services which are available via websites. This means the populace is kept abreast of government activities through its websites. However, this development alone has its own challenges via usability and accessibility issues.

Lack of usability affects e-government services to the people [3] and [4]. From the statistics obtained recently, percentages of online services for persons with disabilities are not encouraging: It stands lowest for Africa (4%), Americas (31%), Asia (32%), Europe (53%) and Oceania (14%). From another statistics, the population of internet users is on the increase even in Africa as a whole [5]. Despite this, the government is making tremendous improvement in its performance in e-government development index [6]. In order for the citizens to avail themselves of the various benefit of online government services which include better efficiency, user convenience and better citizen political participation [7], there is need to improve the usability and accessibility of the websites. This will ensure that all categories of citizens have access to services without any barrier or denial. So, to what extent do all categories of citizens really have easy and undeniable access to these websites and what is the level of its accessibility and usability?

This study is motivated by the fact that all over the world, research on web usability and accessibility has been on the increase. It has been receiving utmost attention from both private and public government agencies globally. However, most studies have been focusing mostly on the developed and developing countries outside the shore of Africa. Till date, there is dearth of such study in Nigeria and especially in West Africa as whole.

Hence, the need arises to braze the trail by focusing on the most advanced economy in the Africa continent. This study therefore evaluates the accessibility and performance of the thirty six state government websites in Nigeria. This is with a view to discover their level of

compliance with Web Content Accessibility Guidelines (WCAG). The study will also find out if there is any significance difference in the overall performance of websites in the Southern and Northern parts of the country. This is necessary as a result of political and education dichotomy between the Southern and Northern parts of the country

II. LITERATURE REVIEW

Since the advent of the web, research in web accessibility has been on the increase both in developed and developing countries. There have been studies which focused on USA, Greece, Malaysia, Dubai, Saudi Arabia, China and Kuwait to mention a few [1], [2], [3], [8]-[13]. In these studies, a lot of accessibility issues in both developed and developing countries websites have been discovered [10].

Study on Malaysia e-government was conducted by [2]. It was discovered that none of the websites studied conformed to WCAG 1.0 standard. A further study in the same country was carried out by [14]. Three automated tools; website optimization, Axandra, and EvalAcess 2.0 were used. It was discovered that there are several issues in Malaysia e-government websites usability and accessibility. Furthermore, websites of the state government were discovered to have more issues than of the federal government. Reference [15] evaluated Chinese local government websites in order to know how accessible they are. Truwex online 2.0 was used and it was discovered that none of the 347 websites passed the W3C priority 1 accessibility detection.

Research on accessibility of UK websites was also carried out by [16] by using Access Valet as a tool. The study was to know how UK websites has improved over the years. Websites chosen within three groups; public organisation, Financial Times Stock Exchange (FTSE) companies and universities were used. It was discovered that the overall accessibility of the websites within the three groups had improved over the years. . In a further study by [1] the usability and content accessibility of the e government in UK was carried out. Two automated tools were used; Bobby and LIFT. The study showed a relatively high compliance with the WCAG and low usability ratings for most UK e-government websites. Reference [17] conducted an in depth usability evaluation on Taiwan central government websites based on WCAG. The results indicate that the government websites in general have made various mistakes warned against in the guidelines.

A. Web Content Accessibility Guidelines

According to Web Accessibility Initiative [14]:

"Web Content Accessibility Guidelines covers a wide range of recommendations for making web content more accessible to a wider range of people with disabilities, including blindness and low vision, deafness and hearing loss, learning disabilities, cognitive limitations, limited movements, speech disabilities, photosensitivity and combinations of these".

It is aimed at making web content more usable by older individuals with changing abilities due to aging and often improve usability for users in general. According to WCAG 2.0 standard, a website must be based on four principles of Perceivable, Operable, Understandable and Robust. Perceivable means it must allow information and user interface component that is presentable to users in ways they can perceive. Operable means having user interface component and navigation that is operable. Understandable refers to having information and the operation of user interface that is understandable. Robust implies that the content must be robust enough that it can be interpreted reliably by a wide variety of user's agent including assistive technology. See Appendix 1.

III. DESCRIPTION OF AUTOMATED TOOLS USED

Though there are many accessibility and Website Optimization tools available for use. The researchers decided to use TAW and Site analyzer due to their simplicity and easy representation of results. They are described below.

Web Accessibility Tester (TAW) is an online tool for the accessibility analysis of web sites based on the W3C WCAG 1.0 and WCAG 2.0. Its goal is to analyze the level of accessibility in the design and development of web pages to allow access for all, regardless of their specific characteristics.

Site Analyzer: Site Analyzer is an optimization tool for website. The tool analyzed websites and generated a multi-point audit sorted by category into accessibility, design, texts, multimedia and networking. The analysis report is made of more than fifty criteria based on the optimization of the server configuration, HTML tagging, text content, multimedia content, internal and external networking and page popularity. It checks the performance of a website in order to improve the visibility of the website for search engines.

IV. METHODOLOGY

The websites of all the thirty six states in the country were used for the study. The study was carried out between July and August, 2014. Two Automated tools discussed in section three were used. TAW checks for the conformance of each state websites with WCAG 2.0, while site analyzer gives the overall performance of the websites in terms of percentage. The websites URL were collected by searching for "state government websites in Nigeria" via Google search engine. As at the time of carrying out this research the websites of Katsina, Sokoto and Zamfara states were not available. The URL of the websites is shown in Appendix 2.

For the tools to be used in evaluation, the URL of the websites will have to be entered. Upon submission the respective website will be scanned and analyzed. The results obtained are then produced indicating the type of violation or errors discovered and their numeric values. Site analyzer gives its results in percentage showing the overall performance of the website based on the criteria sued.

V. RESULTS AND FINDINGS

The result obtained from using TAW is shown in Fig. 1. They are categorized into four based on the content of WCAG 2.0. The violations discovered are broken down into Perceivable, Operable, Understandable and Content by the tool. The highest violation (46%) discovered are under Perceivable principle which is closely followed by Robust (35%). 16% and 3% of the violation are under Operable and Understandable principles respectively.

Violations discovered have to do mostly with guidelines 1 and 2. These include missing of linked images, missing alternate text, empty links and form control without label. A missing alternate text implies that image alternate are not present on the websites. Linked image missing occurs when there is an image without alternate text is present in the webpage. Empty implies that a link contains no text. Missing form label indicates that a form control does not have a corresponding label, while document language missing shows that the language of the document is not identified. Akwa Ibom state website has the highest number of perceivable problem followed at a distant by Kogi state.
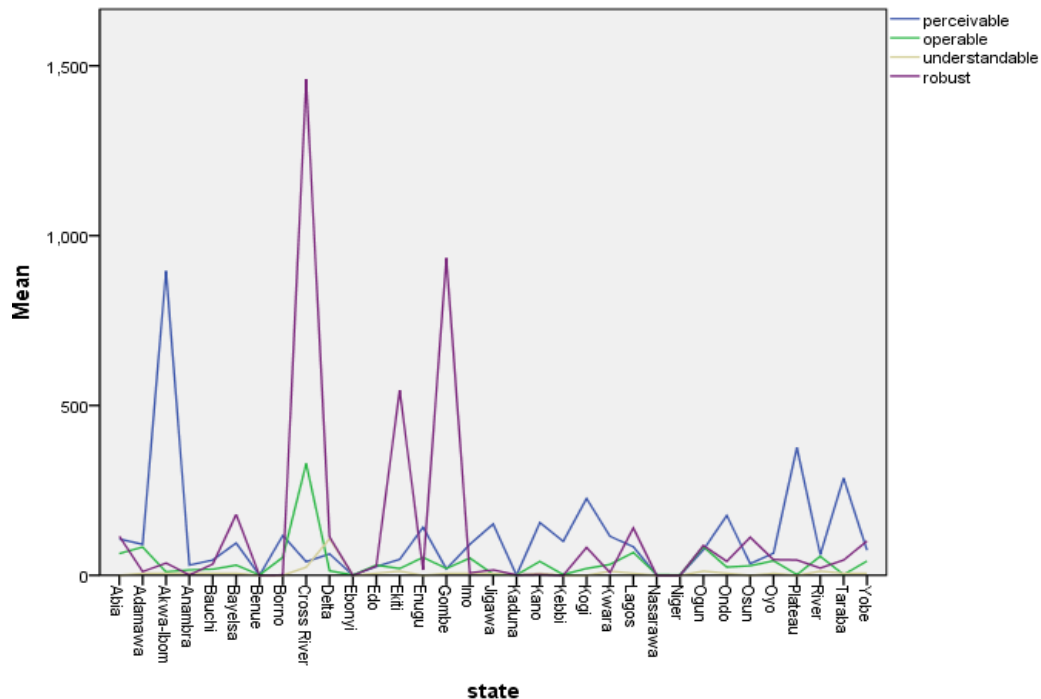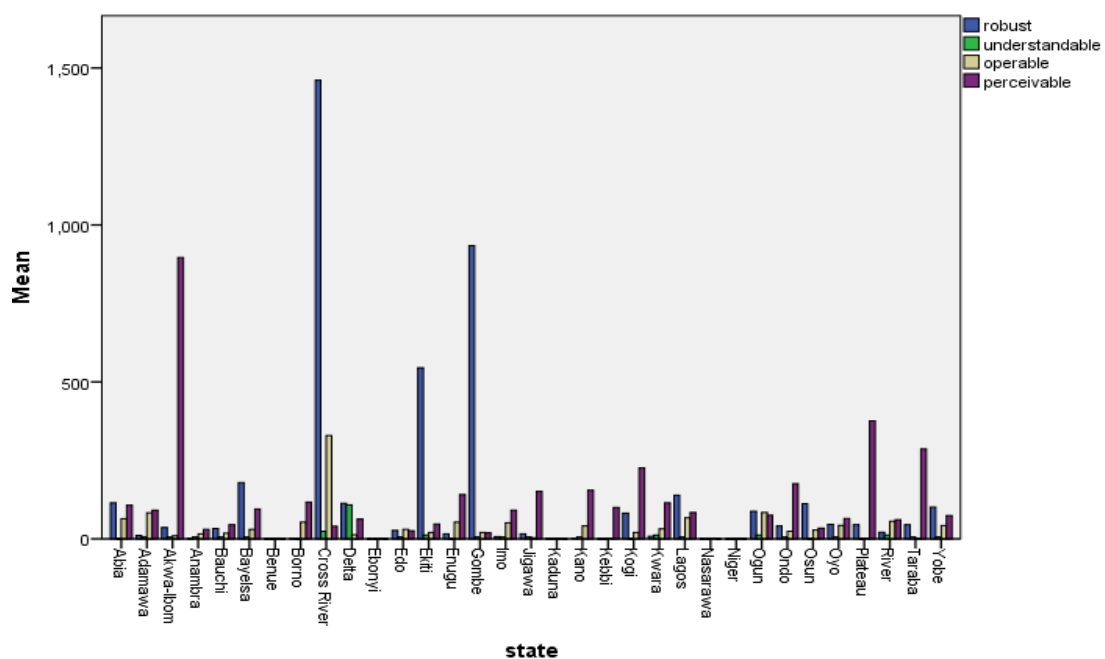

Figure 1.   TAW error result.
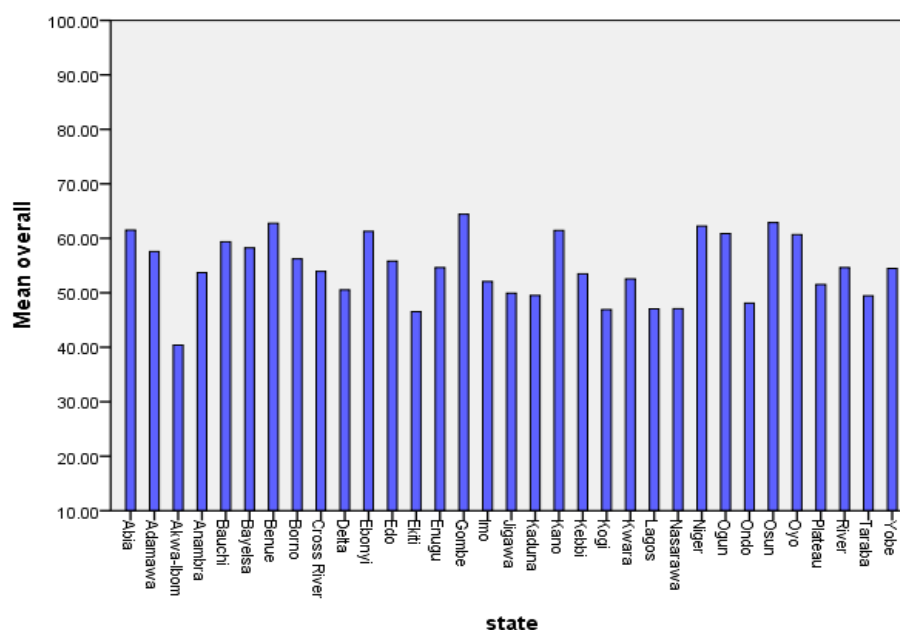

Figure 2.   TAW warnings result.

Figure 3.   Site analyser result.

VI.   CONCLUSION AND FUTURE STUDY

Kogi also incidentally has the highest number of robust errors. Websites of Niger, Benue, Kaduna and Nasarawa recorded the least number of errors under the entire category. Further results obtained from TAW as regards the number of warnings are depicted in Fig. 2. 43% and 40% of the warning notices are from violations robust and perceivable principles. The highest being from Cross River, Akwa Ibom, Gombe and Ekiti states respectively. Though these are mere warnings, it shows that certain things need to be checked in the website.

Site analyser result is shown in Fig. 3. The computed result is rated over 100. From the result none of the websites scored up to 70% in the global score based on the performance metric used as discussed in Section III. Only nine states (26%) scored 60% and above in the global score with the maximum being 64.42%. Kogi also has the highest number of robust errors. Websites of Niger, Benue, Kaduna and Nasarawa recorded the least number of errors under the entire category.

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Site analyser result is shown in Fig. 3. The computed result is rated over 100. From the result none of the websites scored up to 70% in the global score based on the performance metric used as discussed in Section III. Only nine states (26%) scored 60% and above in the global score with the maximum being 64.42%. Results from ANOVA ($p=0.114$), shows that there is no significant difference in the overall performance of the websites developed in both Northern and Southern states of the country.

The study has clearly shown the level of accessibility and performance of state government websites in Nigeria. Though, great efforts are being made by different states to show case government activities via their websites. However, accessibility guidelines which will give both the able and disabled people equal access to the websites are not fully taken into consideration by the developers. Most websites do not follow the guidelines set up by even the National Information Technology Development Agency (NITDA).

It is therefore recommended that appropriate regulation be put in place by the government to ensure the accessibility of all websites developed in the country. This will go a long way to bridge the digital divide between the developed and developing country like Nigeria. Also various state governments should mandate the IT directors in the respective ministry to ensure that those saddled with the responsibility of developing websites perform website analysis before, during and after deployment.

Future work employing other automated tools to test for more parameters could still be used. More so, a comprehensive usability evaluation of the web site using user testing methodology can still be conducted.

APPENDIX I

WCGA 2.0 GUIDELINES
1. PERCEIVABLE
1.1 Provide text alternatives for non-text content.
1.2 Provide captions and other alternatives for multimedia.
1.3 Create content that can be presented in different ways including by assistive Technologies without losing meaning.
1.4 Make it easier for users to see and hear content.
2. OPERABLE
2.1 Make all functionality available from a keyboard.
2.2 Give users enough time to read and use content.

2.3 Do not use content that causes seizures.	
2.4 Help users navigate and find content.	
3. UNDERSTANDABLE	
3.1 Make text readable and understandable.	
3.2 Make content appear and operate in predictable ways.	
3.3 Help users avoid and correct mistakes.	
4. ROBUST	
4.1 Maximize compatibility with current and future user tools.	

APPENDIX II

STATE	URL
Abia	www.abiastate.gov.ng
Adamawa	www.adamawa.gov.ng
AkwaIbom	www.aksgonline.com
Anambra	www.anambrastate.gov.ng
Bauchi	www.bauchistate.gov.ng
Bayelsa	www.bayelsa.gov.ng
Benue	www.benuestate.gov.ng
Borno	www.bornostate.gov.ng
Cross River	www.crossriverstate.gov.n
Delta	www.deltastate.gov.ng
Ebonyi	www.ebonyistate.gov.ng
Edo	www.edostate.gov.ng
Ekiti	www.ekitistate.gov.ng
Enugu	www.enugustate.gov.ng
Gombe	www.gombestate.gov.ng
Imo	www.imostate.gov.ng
Jigawa	www.Jigawastate.gov.ng
Kaduna	www.kadunastate.gov.ng
Kano	www.kano.gov.ng
Kebbi	www.kebbisaca.org
Kogi	www.kogistate.gov.ng
Kwara	www.kwarastate.gov.ng
Lagos	www.lagosstate.gov.ng
Nasarawa	www.nasarawastate.com.ng
Niger	www.nigerstate.gov.ng
Ogun	www.ogunstate.gov.ng
Ondo	www.ondostate.gov.ng
Osun	www.osunstate.gov.ng
Oyo	www.oyostate.gov.ng
Plateau	www.plateaustate.gov.ng
Rivers	www.riversstate.gov.ng
Sokoto	www.sokotostate.gov.ng
Taraba	www.tarababir.gov.ng
Yobe	www.yobestate.gov.ng

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