Evaluation of Websites of Nigerian State Governments using Heuristic Technique and Automated Tool

Ismaeel A. Sikiru[1], Olayiwola W. Bello[2] and Rafiat A. Oyekunle[3]
Department of Information and Communication Science,
University of Ilorin,
Kwara State,
Nigeria
Email: [1]ismaeel.as@unilorin.edu.ng,
[2]laibello@gmail.com
[3]ummusumayya1@yahoo.com

ABSTRACT
The immense improvement in digital revolution across the globe has motivated several governments to adopt the use of ICTs in their administrative dispositions and government-citizens transparent communications, thereby, increasing citizens' awareness and expectations of Internet-based services. However, most e-governments adopters are yet to fulfil the goal(s) due to low level of usability delivery – accessibility, quality, and privacy, which calls for continuous evaluation of their websites. Nigeria is also not different in this global drive motive, a country with a vast landmass, made up of 36 states and Federal Capital Abuja, and 774 local governments across the 6 geopolitical regions. This study presents an evaluation of E-government website of states in Nigeria. The methodological approach employed is the use of automated tool and checklist-based evaluation approach. Our findings reveal that a substantial number of the states under investigation were found with our heuristic assessment to have functional websites. The accessibility result using FAE 2.0 evaluation tool showed that Benue state official website has highest implementation level score in terms of Violations, Warnings, Manual Checks, & Passed Rulesets, and Implementation status, and likewise labels both the Benue and Sokoto states official websites with the Partial Implementation – Required (PI-R) status against others with Not Implemented (NI-R) status. Conclusively, recommendations are made to make Nigeria's states websites be in the competitive race with those of developed nations'.

Keywords: *State government, heuristic technique, e-government, website evaluation, automated tool*

I. INTRODUCTION

With the increasing penetration of Internet and benefits of Information and Communication technology multiplying in a geometric progression, governments have in recent times seen the use of ICT as a viable tool to achieve and deliver their mandates. In a borderless attempt of the Government agencies to reach out and be reached, a need of ICTs arises to offer e-belonging to citizens as e-services. E-service is an enabling tool or platform where government agencies carry out different activities such as informational, transactional and administrative [1] ranging from democratic activities such as digital voting to online services provided to the citizens. The ability to utilize the Internet for these activities has led many government organizations to invest on having web presence in the name of websites. An effective presence on the web appears as a competitive advantage for private and governmental organizations as the power of the Internet and web technology has been clearly demonstrated in areas such as e-commerce, education, e-health, job application and recruitment, research and development among others [2].

Governments across the world have also keyed into this revolution and made significant efforts to implement electronic government (e-government) in public sectors [3], [4]. Such a rapid development can be adduced to the fact that e-government has the potential to change the working environment of the traditional government by enhancing access and delivery of government. By the perspective of World Bank [5], e-government is described as the use of ICT to transform government with the aim of making it more accessible, effective, and accountable to its citizens. Succinctly, the deployment of the Internet and ICT tools to deliver improved products and services by the government, and interactive feedback from the citizens in the real-time is what is referred to as E-government.

E-government in terms of its benefiting impact has created a rebirth in the government delivery system as it equally incorporates all status of human capabilities – abled and disabled, in a system tagged eInclusion [6]. For instance, in 2010, [7] reported that among 192 member countries of the United Nations, nearly 98% have web-based e-government systems services [8]. In such an environment, users have increasingly been able to interact with government by searching for government information and conducting government services without time, space, and ability limitations. Nowadays, there are a significant number of e-governments initiatives operating at national and local levels that are accessible via the Internet and provide a variety of online information and services [9] [10] [11]. In recent time, larger percentage of African governments at some level - local, state, and/or national (federal) - have implemented e-Government services; ranging from static web pages to fully fledged portals that are one-stop gateways for services by all, or most, government agencies [12][13]. However, the slow diffusion and implementation of e-Government services on the African continent are attributable to a number of obstacles. Among those mentioned most often, especially in sub-Saharan Africa (with the exception of South Africa and a few others), are the lack of infrastructure, low literacy rates, slow and low economic development, and a variety of cultural factors [14][15], as well as poor documentation of e-Government services in countries of the continent [16][13][17].

As a matter of fact, an organization's Website is an indispensable gateway to its information, interactivity, products, and services; there is a need for evaluation and analysis of this information artefact to determine its conformity to lay down standards [18]. Also, it is important that the extent to which the Website is equipped to serve its targeted public be established. In this view, several studies have been carried out in the area of Website evaluation and analysis. For academic Websites, some works have been carried out in Nigeria [19] [20] [21]. Similar studies have also been carried out in other parts of the world [22]. The Websites of business organizations have also been analyzed [23] [24] [25]. Similar studies have also been observed in the area of government Websites both in Nigeria [26] [27] [28] and outside the country [29] [17]. However, Nigeria is yet to fully integrate e-government activities into government administration. Therefore, there is timely need for continuous evaluation and analysis of websites of the states that have adopted the phenomenon, as well as to check out how satisfied the stakeholders are in terms of access and usability.

This study, therefore, attempts to fill the gap in the literature of e-government services in Nigeria through the evaluation of Websites of State government using the combination of content analysis method and automated tools, with respect to deployment services they provide, the features available through the websites, the level of development of e-government services for each state, as well as to standardize the expected internal and external

attributes to be incorporated into e-government websites. This study is obliged to: identify the delivery services of the e-government websites; and state the recommendations that could address the identified irregularities.

This paper is organized as follows: Section II highlights the literature review. Section III presents the research methodology used to carry out the work. Data analysis and discussion are presented in Section IV; Section V gives the concluding remarks while the recommendations are made in Section VI.

II. LITERATURE REVIEW

2.1. E-Government Development in Nigeria

Some work has been carried out on this subject to mitigate perennial difficulties and denial of access to services featured in the traditional means of government and governance. [30] stated that the process of eGovernment implementation in Nigeria started with the establishment of the National IT Policy in March 2001; National Information Technology Development Agency, NITDA in March 2003; and National eGovernment Strategies, NeGSt in March 2004 as SPV (special purpose vehicle) of PPP (public-private partnership). These IT-driven establishments were to facilitate eGovernment implementation in Nigeria, besides its innovative means of achieving the vision 2020. [31] highlighted the responsibilities NITDA is saddled with when it was founded to include focusing its strategies on creating e-government model for Nigeria in areas such as eAdministration, eJudiciary, eHealthcare, eTaxation, eEducation among others.

Due to this notable step, Nigeria, at then, had the fastest growing information and communication technology market in Africa. Regrettably, Nigeria's e-government service at present is on the second stage as a result of its unwillingness to ensure a two way communication pattern in the governing process [32].

Similarly, [33] carried out a study to analyze the status of e-government services in Nigeria. The findings showed significant shortcomings with existing state government websites in Nigeria, including Federal Capital Territory (FCT) Abuja. In addition, the analysis also showed that larger number of the government websites analyzed could not even offer expected eGovernment services delivery to Nigeria citizens.

[34] carried out research using a heuristic approach to obtain the numeric value for selected 16 countries across the globe. In the report, the best-positioned countries obtained a 70% score while only 3 countries fell below 50%. In the percentage reached by each country, regarding "e-governance", "design", and "content", Nigeria obtained 56.47%, 60.78%, and 37.86% respectively, where only two states (Kano, and Ondo) and FCT Abuja were assessed.

On this note, the geometric development of ICT and telecommunications infrastructure over the past couple of years portends that Nigeria's infrastructure ranking to have improved tremendously. [26] proved this assertion right by citing the status of e-government ranking related to Nigeria system of governance where it showed that the country's Infrastructure Index has moved up from 0.0013 in 2004 to 0.0492 in 2008. This result corroborated [35], stating that, as far back in 2009, Nigeria was reported to have a very lucrative telecommunications industry globally. This improvement was also justified by the recent report of Africa Infrastructure Development Index (AIDI) in [36] as it scales up from 17.58 in 2013 to 22.37 in 2018. Some of the enlisted reasons for the improvement in Nigeria's infrastructure index were the success recorded in the Nigerian telecommunications sector.

With the encouraging impacts of e-government and the records of teledensity nature of active subscribers in Nigeria, there are strong challenges combating full implementation of eGovernment in Nigeria as highlighted by [37] - advance fee fraud (419), cable and facility vandalisation, connectivity problems, epileptic power supply, high cost of funds, high duty and tax regime, and relatively low consumer purchasing power.

[27] opined that there are two approaches to e-government framework: the top-down approach characterized with a high degree of control by the central government, which usually includes the development of a strategy. The second is the bottom-up approach in which individual departments and local governments independently move forward with their own projects; common standards are flexible and overall national strategy is not so important.

On this note, time-to-time evaluation of the Nigeria States' websites has been observed by the researchers to yield unimaginable improvement in the deployment of full e-government in Nigeria using automated tools and Content

analysis. This would not only be a tool of improvement but also as errors detection and correction in a variety of key areas of e-government websites such as Budget Allocation, Information sharing, Performance measurement, Cross-agency collaboration, E-Government, and Component-based architecture.

Framework of this study encompasses careful analysis of the contents of the websites with the use of the checklist method, which is conducted by humans and experts, to evaluate the external attributes [38], while Automated (Web) tool is put in place to verify the internal attributes of the Websites, the tool check the broken links, aesthetics, page analysis, HTML errors, and textual duplicates of links embedded in images among others, which are all reported for correction in order to make Nigeria States Websites stand the test of time.

2.2 Effect of Usability on the Implementation of E-Government

Usability is seen to measure user efforts for interacting, learning how to navigate, or accessing content and services offered through the website. Usability measure in the context of e-government can never be overemphasized as the time, accuracy, overall success, and satisfaction are the backbones in the successful operation of the digital government [39]. Therefore, the usability effect on e-government portends vital service delivery and wider citizens' satisfaction in the following - re-assessment of the country's state of e-governance preparedness and service transition from traditionalist bureaucratization to modernist participatory administration [40]; eConnection of communities, vital agencies, institutions of Government and educational institutions at all levels with ICT [27]; better cost-effective service delivery and wealth creation for investors [26].

2.3 Usability Effect on Users of E-Government

In any government, citizens are to be given priority. This is of higher priority in eGovernment because the platform should be user-centered design. With this assumption, usability effect should not only focus on the implementation but also include the users of eGovernment.

Summarily, it is the significant satisfaction ratings of the effect of digital government dividends when tested against users' measurable usability goals [41]. However, the users' measurable usability goals include time, accuracy, and success.

That is why [42] highlighted transparency metrics by the citizens, and eProcurement facilities opportunity as the effects of usability on e-government users.

2.4 Accessibility Concept

Accessibility is the measures of the degree in which a website can be accessed by people, despite the limitations of individuals or usage context. This is the pinnacle behind the submission of [43] who stated that the major challenge of the accessibility is the inability of the rural dwellers to have access to the Internet and other tools of ICT. Therefore, in Nigeria and most developing nations, "access" is largely limited to the urban areas and there is an urgent need to extend affordable access to the rural areas.

In recourse to the accessibility concept earlier highlighted, the standard effect of accessibility on e-government can in no time be overlooked. By the effect, impacts of accessibility effects on digital government include – Enhancement of open-door policy and governance; optimization of the government's ranking status and teledensity across the globe, a yardstick for ICT development and sustainability, and cordial communication between the government and citizens [41].

Displeasingly, accessibility effect on e-government practice in Nigeria has been combated with a lot of setbacks including Internet facilities & services deployment, most especially, in remote areas. Therefore, the users witness drawbacks in Citizen Participation, Civil responsibility, and Informative Text [44]. However, in a bid to enable all citizens to benefit from the full potential of e-Government services, it is important to secure universal accessibility. This accessibility enables persons with disabilities to take full advantage of the information and services offered by e-Government initiatives; the same way a person with no disability would [45], that is, a system devoid of vision impairment, hearing impairment, cognitive disability, motor skill impairment, legacy technologies, and temporary disabilities.

2.5 Conformance Testing as a Mean to Assess Web Accessibility

Conformance to a standard is a means of satisfying 'requirements' of the standard. In WCAG 2.0 the

'requirements' are the Success Criteria. To conform to WCAG 2.0, Success Criteria must be satisfied, that is, no content violates the Success Criteria [46]. Therefore, to make e-Government websites accessible and "inclusive", it is recommended that web designers conform to the World Wide Web Consortium (W3C) Web Content Accessibility Guidelines (WCAG) [47]. WCAG is considered today as the most comprehensive and authoritative reference for website accessibility.

WCAG 2.0 guidelines are categorized into three levels of conformance in order to meet the needs of different groups and different situations: A (lowest), AA (mid-range), and AAA (highest). Conformance at higher levels indicates conformance at lower levels. For example, by conforming to AA, a Web page meets both the A and AA conformance levels. Level A sets a minimum level of accessibility and does not achieve broad accessibility for many situations. For this reason, University of California (UC) recommends AA conformance for all Web-based information. The WCAG document does not recommend that Level AAA conformance be required as a general policy for entire sites because it is not possible to satisfy all Level AAA success criteria for some content [48].

The WCAG promotes accessibility by producing guidelines and techniques to make Web content (text, images, sound, video on both the server as well as the client side) accessible to people with disabilities. Conformance to the WCAG guidelines involves designing, testing, and maintaining e-Government websites against these guidelines. There are many ways by which one can assess and test for e-Government website accessibility. These include expert testing, end-user testing, automated testing, and surveys targeting e-Government webmasters and site developers. All these methods are based on crosschecking against some accessibility targets, usually set by individual governments [47].

From the above diverse perspectives, it could be affirmed that E-government is a citizen-centric medium of government with a definite Information and Communication Technology (ICT) to bridge the gap that could be found in "tracks of government" using a model, approach, or initiative readiness.

III. METHODOLOGY

While many research works have paid more attention to accessibility, usability, contents, and functions [49], this study will employ human-centered (heuristic evaluation) and Web tool to evaluate the Nigeria State's official websites.

3.1. Usability evaluation

This research work adopted the use of heuristic evaluation and automated usability methods, noting that heuristic evaluation is the dominant usability evaluation method for its ease-of-use and effectiveness by both the experts and novices. Heuristic evaluation is an expert-based usability evaluation method whereby usability experts or other stakeholders appraise a user interface based on a set of predefined rules or principles. However, automated usability testing is the use of a software-based system with predefined guidelines (by consortiums) to evaluate an interface in a bid to identify areas of its compliance or otherwise with the WCAG.

The heuristics implemented for this study were adapted from the improved four-dimensional usability metrics by user effect [50]. These 25-point evaluation variables were reduced to 23 variables using a triangulation approach across the 4-D usability metrics. The checklist [50] was categorized to four on the account of evaluating the websites in terms of accessibility, Identity, Navigation and Content.

Five final year students of the department of Information & Communication Science were carefully selected to assess the states, including Federal Capital Territory (FCT), with official websites. Their selection was based on their appreciable technical know-how in Human Computer Interaction (HCI) course. Their assessment was based on the refined twenty-three (23) variables adopted from [50] to determine to what extent each website complies with them. Dichotomous variables type is adopted, to score availability of the variables on the websites "one" or otherwise "zero", as shown in Table 3.

On the other hand, heuristic evaluation was supplemented by an automated evaluation tool. In this study, Functional Accessibility Evaluator (FAE) 2.0 was implemented to evaluate internal attributes, such as accessibility. The choice of FAE 2.0 was due to its significance in terms of cost, goal (assessing accessibility conformance or fixing accessibility violations), interaction form (online or stand-

alone applications), effectiveness, breadth and depth of accessibility reports, conformance guideline support, and conformance levels supported [51].

Therefore, the two evaluation techniques were conducted concurrently to evaluate both the external and internal attributes of the websites respectively, and the results depict the overall usability score.

3.2 Selection of websites

After defining the scope and limitation alongside the framework of this research work, a list of official websites was selected as shown in table 1.

The criteria for selection are as follows:
- Each state website is searched for using the Google search engine
- Only the State's official websites were reckoned with
- The first ten search results of Google is the check-range
- The states without official websites are classified as *States with web presence*

The percentage difference of the Nigeria states with official websites and the states without official websites is depicted in figure 1.

The heuristic approach of evaluating the usability of the states including FCT websites is presented in Table 3.

Table 3 shows usability evaluation of each of the websites. All the evaluated states have custom not-found/404 page. However, each of the website has "adequate text-to background", "legible font face and size" and their links are consistent and easy to identify.

3.3. Tool Based Evaluation Method

The 0.9.9 version of Functionality Accessibility Evaluator (FAE) 2.0 software accessibility testing tool was selected to probe the extent to which each of the 32 Nigeria states e-Government sites meet W3C WCAG 2.0 Single A and AA Success Criteria. These accessibility conformance tests were conducted between 15th and 23rd of November, 2018 inclusively. Therefore, this accessibility results might change since the last time the testing was carried out.

The accessibility evaluation was limited to the homepage of each tested e-Government website to keep the scope of this study more realizable. This is a generally accepted approach that yields acceptable results [52]. Moreover, it is reasonable to presume that accessibility issues emerging from the homepage assessment are likely to propagate to other web pages. This is why [51] echoed [53] who declared that "the homepage plays the role of the index to other hyperlinked documents within the website and is the façade that shapes the end user's first impression upon visiting a given e-Government portal".

FAE 2.0 is chosen based on [53] declaration, as a project of the Open Accessibility Alliance and OpenAjax Accessibility Task Force. It analyses web pages for requirements defined by the W3C WCAG 2.0 Single A and AA Success Criteria. FAE 2.0 rules support not only accessibility but also usable web design through the use of W3C Accessible Rich Internet Application (ARIA) 1.0 and W3C HTML Specification, for people with disabilities [54]. It also enables the assessor to specify one page (such as the home or index page) or the entire website pages for automated accessibility testing. For each accessibility checkpoint, it provides a detailed report of detected issues, as well as additional tagged warnings that require manual inspection and human judgment on the part of the tester.

The FAE automated tool adopted is meant to determine to what extent the websites under examination conforms to Web Accessibility Inspector / Validator guidelines which are based on W3C Web Content Accessibility Guidelines (WCAG). The attributes assessed include *Rule Scope View Options* and *Implementation Status.* Rule scope view option is to evaluate each website based on *Violation, Warnings, Manual Checks,* and *Passed rules* conformity, while Implementation Status evaluates in the light of *Websites, Pages,* and *Elements Score.*

3.4. Experimental Procedure of Functional Accessibility Evaluator (FAE) 2.0

To evaluate internal attributes of each website, Functional Accessibility Evaluator (FAE) 2.0 was implemented. This type of evaluation was conducted by the first author of this paper alongside four selected students of the department of Information & Communication Science. The selected students are those found to be the best students in Human Computer Interaction (HCI), Web design, and IT outsourcing courses.

The step-by-step procedure is highlighted below:
- Each expert signed up account in FAE official website
- Evaluation page opened up to run FAE
- Each evaluating state website's URL is copied and pasted into the "Starting URL" field
- Title is assigned to each website such as "Official website of Abia state"
- The following parameters were set:
  - "Include second-level pages" was checked under "Depth of Evaluation"
  - "Specified domain only" was checked under "Follow Links In"
  - "HTML5 and ARIA Techniques" was checked under "Ruleset"
  - Evaluation was limited to 5 pages
- "Evaluate" button is clicked
- Summary report is recorded and tabulated in Table 4

Summarily, in [55] violation ruleset (V) is flagged when one or more target elements fail the requirements of a required rule. Warning (W) ruleset is flagged when one or more target elements fail the requirements of a recommended rule. Manual Check (MC) ruleset is flagged when there is need for human inspection as well as associated WCAG 2.0 requirement for evaluation. Pass (P) ruleset is flagged when all rule requirements are satisfied.

The data for analysis consists of 36 states of Nigeria and Federal Capital Territory (FCT), Abuja. All states were checked for official websites using *the Google* search engine; the result showed the states with official websites and those with only web presence (such as *Facebook account*). Out of the study population, 32 states were found with official websites showing 86.5% of the entire states of the federation. This number has posited an immense positive yield against the [28] earlier findings.

It was also observed that only two out of the six geopolitical zones of Nigeria have two of its states each without official websites – North Central and North East zones. Kogi and Niger states fall in the North Central geopolitical zone, while Adamawa and Gombe are the two states found without official websites in the North-East geopolitical zone of Nigeria.

IV. DATA ANALYSIS AND DISCUSSION

The data for analysis consists of 36 states of Nigeria and Federal Capital Territory (FCT), Abuja. All states were checked for official websites using *the Google* search engine; the result showed the states with official websites and those with only web presence (such as *Facebook account*). Out of the study population, 32 states were found with official websites showing 86.5% of the entire states of the federation. This number has posited an immense positive yield against the [28] earlier findings.

It was also observed that only two out of the six geopolitical zones of Nigeria have two of its states each without official websites – North Central and North East zones. Kogi and Niger states fall in the North Central geopolitical zone, while Adamawa and Gombe are the two states found without official websites in the North-East geopolitical zone of Nigeria.

4.1. Difference in Naming System

The trend in the naming system observed in the URL of the states government website shows a combination of the state's name and the word *state* attached to it, while having .gov and .ng as their top-level domain. Table 1 shows that *twenty-seven* States Websites URLs have the word *state* attached to their names and immediately followed by .gov and .ng domain names in their URLs e.g www.abiastate.gov.ng. However, *three* States Websites (Bayelsa, Kano, and Osun) have no *state* attached to their names but also include .gov and .ng domain names in their URL. FCT has its URL as fcta.gov.ng, which could be tolerated for not being a state but the country capital. Kaduna State has a distinct Website URL i.e. **kdsg.**gov.ng. The difference in the URL naming system is graphically represented in figure 2.

4.2 Website Evaluation Using Functional Accessibility Evaluator

Functional Accessibility Evaluator (FAE) assessment on the states websites has its values as depicted in Table 4.

Table 4 above depicts the *Functional Accessibility Evaluator 2.0: Testing (version 0.9.9) e*valuation of each of the 32 websites. This evaluator uses *HTML5 and ARIA Techniques Ruleset* and Depth of 2. The result shows that Akwa Ibom state has highest **Violations Rule** of 20 while Sokoto state has the least of 5.

In the assessment of the warning ruleset, Ogun state has highest **Warnings Rule** of 7 while Benue, Plateau, & FCT states have the least of 1 each.

While evaluating each of the websites manual check ruleset, AkwaIbom, Lagos, & Ogun states were reported to have the highest **Manual Checks Rule** of 42 against Sokoto state with the least of 23.

Besides, Benue state is evaluated to have highest **Passed Rule** of 31 while Jigawa state has the least value of 4.
However, FCT has the highest **No Automated Rule** of 83, while Jigawa & Taraba have the NIL value each.
Surprisingly, Delta state website is found to have no ruleset score record across the entire variables – violation, warning, manual check, and passed ruleset. This no record feature of delta state official website resulted to have its status as "Non Available" (NA) in its implementation level as shown in Table 4.

Result in Table 5 revealed that the AkwaIbom state official website fail (as a violation rule) the requirements of the required compliance rules in terms of content, labeling, and properties. This effect is also shown in our heuristic evaluation as it does not conform to some criteria of identity and navigation; the passive state of "invest" link on the website page is an additional proof. However, Sokoto state official website has the least violation rate of 5.

In the accessibility signal of conformance to the recommended rule, Ogun state official website has highest warning rate of 7 against other three North Central zone states – Benue, FCT, & Plateau with the least value of 1.

Likewise, AkwaIbom, Lagos, and Ogun states have the highest level of programmatic inability to determine the result. This requires higher need of human inspection evaluation and associated WCAG 2.0. While Sokoto state official website has the least manual check defects of 23. This result shows proportional relation to violation effect. The state official website with the highest satisfactory rule requirements is Benue against Jigawa state official website with the least value of 4. Unfortunately, FCT official website was discovered to have the most irrelevant target elements; this could be due to its mandate as the territory of the Nation, and not a state. This is likewise depicted in its URL. However, both Jigawa and Taraba states official websites have no record of an irrelevant target element.

Conclusively, the FAE 2.0 evaluation ranked Benue state official website the highest implementation level score and thereby labels both Benue and Sokoto states official websites with the (Partial Implementation – Required) PI-R status against others with (Not Implemented) NI-R status as shown in Table 6.

V. CONCLUSION

Since the implementation of e-government in Nigeria started with the establishment of the National IT Policy in March 2001, the National Information Technology Development Agency, NITDA in March 2003, and National eGovernment Strategies, NeGSt in March 2004, there has been a time-to-time assessment of its status in order to make it compete with the global standards. The series of assessment have been taking different dimensions according to the goal(s) of the researchers as clarified in the literature review. One of the theoretical and practical implications of the study is a move towards a standardized use of the website evaluation attributes to gauge stages of e-Government implementation. These attributes can also serve as indicators for the States governments to strive toward advanced stages of eGovernment implementation.

However, this study has been viewed to be unique in terms of the approach employed for the evaluation, as no previous research has diligently evaluated Nigeria's states official websites using heuristic approach and automated web tool in a single research work.

While in the analysis of **FAE (2.0)** report, **Benue** state has the highest conformity rule to the ruleset: HTML5 and ARIA Techniques and Implementation status within the Depth of 2. Delta state is regrettably found to have no applicable ruleset across the evaluation metrics, showing that buoyant improvement is to be deployed to it more than its counterpart states.

Recommendations
In the light of this research work, the following recommendations are made:
    i.   State's Website reported to have least Rule conformity and Implementation status in terms of website contents, pages, and elements needs the real-time of an upgrade.
    ii.   Governments of all 5 States without official websites should (as depicted in table 2) endeavor to employ a professional team to design

functional websites, as such will promote and strengthen transparency and open door policy.

iii. All 4 states (Bayelsa, Kaduna, Kano, and Osun) without self-descriptive state governmental websites are to be readdressed to strengthen uniformity of URL.

iv. Government and stakeholders should only engage a professional team who really understand the need of each state, government strengths and weaknesses, and the citizens' need.

v. Each State Website is also to feature indigenous languages in the state; this is to pull more traffic on the site and consequently aids dividends of e-government.

vi. Employment, job applications, advice, complaints, and career opportunities should only be disseminated and processed via websites.

vii. Government and stakeholders should subject designed websites to W3C standards to check the internal attributes before launching.

REFERENCES

[1] T. Zefferer, "Future Directions in Mobile Government," *International Journal on WWW/Internet,* vol. 13(2), pp. 17-33, 2015.

[2] E. Turban, J. Whiteside, D. King, and J. Outland, "Innovative EC Systems: From E-Government to E-Learning, Knowledge Management, E-Health, and C2C Commerce" (2017). In *Introduction to Electronic Commerce and Social Commerce,* pp. 137-163, Springer, Cham.

[3] E. Abu-Shanab, and L. Q. Bataineh, "Key Success Factors of E-Government Projects: Jordanians' Perceptions", *International Journal of Information Technology Project Management (IJITPM)*, vol. 7(1), pp. 32-46, 2016.

[4] InfoDev. (2002). The e-Government handbook for developing countries. Washington, DC: The World Bank. Retrieved from http://unpan1.un.org/intradoc/groups/public/documents/ap city/unpan007462.pdf **o**n 20/11/18

[5] InfoDev (2004). *E-government Handbook for Developing Countries*, available: http://www.infodev.org **o**n 20/11/18

[6] G3ict, "Procurement f ICTs for inclusive Education: Guide for engaging ICT vendors", November, 28, 2018. Available: https://g3ict.org/publication/procurement-of-icts-for-inclusive-education-guide-for-engaging-ict-vendors

[7] UN Public Administration Programme (2010). United Nations e-government survey 2010**,** available: http://www2.unpan.org/egovkb/global_reports/10report.htm **o**n 20/11/18**.**

[8] M. W. Donker-Kuijer, M. Jong, and L. Lentz, "Usable guidelines for usable websites: An analysis of five e-government heuristics", *Government Information Quarterly*, vol. 27, pp. 254–263, 2010.

[9] R. J. Gil-Garcia and T.A. Pardo, "E-government Success Factors: Mapping Practical Tools to Theoretical Foundation", *Government Information Quarterly,* vol. 22, pp. 187-216, 2005.

[10] M. Vicente, and B. Sussy, "Determining Aspects in the Development of Municipal e-Government", *Proceedings of International Conference on eDemocracy & eGovernment (ICEDEG),* pp. 158-165, 2018.

[11] S. O. Yinus, A. A. Adegoroye, and M. O. Oladejo, "Impact of E-Government on Governance Service Delivery in Nigeria," *International Journal of Advances in Management and Economics (IJAME),* vol. 4, pp. 132-138, June 2015.

[12] A. Rorissa, and D. Demissie, "An analysis of African e-Government service websites", *Government Information Quarterly*, vol. 27(2), pp. 161-16, 2010.

[13] J. D. Twizeyimana, H. Larsson, and Å. Grönlund, "E-government in Rwanda: Implementation, Challenges and Reflections", *Electronic Journal of e-Government,* vol. 16(1), pp. 19-31, 2018

[14] R. Heeks, "E-Government in Africa: Promise and practice", *Information Polity,* vol. 7(2, 3), pp. 97−114, 2002.

[15] B. W. Wirtz, and P. Daiser, "A meta-analysis of empirical e-government research and its future research implications", *International Review of Administrative Sciences*, vol. 84(1), pp. 144-163, 2018.

[16] A. Rorissa, and D. Demissie, and M. Gharawi, "A Descriptive Analysis of Contents of Asian E-Government Websites", *In E-Government Website Development: Future Trends and Strategic Models*, IGI Global, pp. 102-116, 2011.

[17] S. F. Verkijika, and L. De Wet, "A usability assessment of e-government websites in Sub-Saharan Africa", *International Journal of Information Management,* Vol. 39, pp.20–29, 2018.

[18] T. H. AlBalushi, and S. Ali, "Evaluation of the Quality of E-Government Services: Quality Trend Analysis", in *International Conference on Information and Communication Technology Research (ICTR)*, pp. 226-229, 2015.

[19] D. E. Asuquo, B. Oluwade, and A.S. Adepoju, 'A User- Centered Approach to Websites Usability Evaluation', *African Journal of Computing & ICT*, Vol. 2(1), pp. 31-39, 2009; available: https://afrjcict.net/wp-content/uploads/2017/08/afrj-vol-21-june-2009n1.pdf

[20] S. A. Olaleye, I.T. Sanusi, D.C. Ukpabi, and A. Okunoye, "Evaluation of Nigeria Universities Websites Quality: A Comparative Analysis", *Library Philosophy and Practice e-journal*, 2018, available: https://digitalcommons.unl.edu/libphilprac/1717 on 24/11/2018

[21] O. Osunade, and C. O. Ogundele, "Evaluation of the university of Ibadan website using webometric ranking parameters", *Transnational Journal of Science and Technology*, vol. 2(3), 2012.

[22] F. Mohsenzadeh, H. Behzadi, and A. Sarchami, "Evaluating Islamic Azad University's Websites within the Knowledge Management Standards Viewpoint", *International Proceedings of Economics Development & Research,* vol. 42*,* pp. 23-34, 2012.

[23] M. B. Al-Otaibi, and R. M. Al-Zahrani, "E-Commerce adoption in Saudi Arabia: An Evaluation of Commercial Organizations' Web Sites", *in International Conference on Information Technology in Asia (CITA)*, pp. 26-31, 2004.

[24] C. K. Ayo, J. O. Adewoye and A. A. Oni, "Business-to-consumer e-commerce in Nigeria: Prospects and challenges", *African Journal of Business Management,* Vol. 5 (13), pp. 5109-5117, 2011.

[25] C. Bezes, "E-Commerce Website Evaluation: A Critical Review". Working Paper LARGEPA, 2009. ATER – Université Paris II Panthéon-Assas, 2011.

[26] A.B. Adeyemo, (2010). "E-government implementation in Nigeria: An assessment of Nigeria's global e-gov ranking", *Journal of Internet and information system*, vol. 2(1). pp. 11-19, 2010.

[27] S. Mohammed, K.M. Abubakar and A. Bashir, "E-government in Nigeria: a catalyst for national development", in *Proceedings of 4th International Conference on Development Studies.* University of Abuja, FCT, Nigeria, 2010.

[28] A. Oni, A. Okunoye, and V. Mbarika, "Evaluation of E-Government Implementation: The Case of State Government Websites in Nigeria", *Electronic Journal of e-Government,* Vol. 14(1)*,* pp. 48-59, 2016.

[29] B. E. Asogwa, "The state of e-government readiness in Africa: A comparative web assessment of selected African countries", *Journal of Internet and Information Systems*, Vol. 2(3), pp. 43-57, 2011.

[30] O. Agunloye, "E-Government program implementation in Nigeria: Implication for a public-private partnership policy, 2008, available: http://www.loginafrica.net/loginafricanew on 15/6/2018

[31] G. O. Ajayi, "E-Government in Nigeria's e-Strategy", in *5th Annual African Computing and Telecommunications Summit*, Abuja, Nigeria, 2003.

[32] B. A. Adah, "The status and nature of e-governance in Nigeria", in *Proceedings of 2nd Covenant University Conference on e-Governance in Nigeria (CUCEN)*, Covenant University Canaanland, Ota, Ogun State, Nigeria, 2015.

[33] D. Mundy, and B. Musa, "Towards a Framework for eGovernment Development in Nigeria", *Electronic Journal of e-Government,* vol. 8(2), pp. 148-161, 2010.

[34] R. Rodríguez, E. Estevez, D. Giulianelli, and P. Vera, "Assessing e-Governance Maturity through Municipal Websites – Measurement Framework and Survey Results", *Red de Universidades con Carreras en Informática (RedUNCI),* pp. 722-731, 2009.

Vol. 12, No. 3, September 2019, pp. 1 - 17   *ISSN 2006-1781*

Ismaeel A. Sikiru, Olayiwola W. Bello and Rafiat A. Oyekunle (2019), Evaluation of Websites of Nigerian State Governments using Heuristic Technique and Automated Tool

[35] F. Aneke, "Talking telecommunications in Nigeria", Dynamic Export, 2009, available: www.dynamicexport.com.au on 25/8/2018.

[36] Africa Infrastructure Development Index, *Africa Infrastructure Knowledge Program,* 2018, available: http://infrastructureafrica.opendataforafrica.org/rscznob/africa-infrastructure-development-index-aidi on 21/11/2018

[37] S. Palvia, A. B. Anand, P. Seetharaman, and S. Verma, "Imperatives and Challenges in using E-Government to Combat Corruption: A Systematic Review of Literature and a Holistic Model", *AMCIS,* 2017.

[38] http://expertusability.com. Retrieved on 23/11/2018

[39] R. A. Hackney, U. Sivarajah, A. Omar, H. Lee, Z. Irani, and R. El-Haddadeh, "Cloud Based e-Government Services: a proposal to evaluate user satisfaction", in *23rd Americas Conference on Information Systems,* 2017.

[40] F.O. Okwueze, "E-Governance as Tool for Public Sector Development in Nigeria". *International Journal of Research in Arts and Social Sciences*, vol. *2*, pp. 515-534, 2012.

[41] Usability.gov , "Creating a user-centered Approach", available: https://www.usability.gov/what-and-why/user-centered-government.html on 23/11/2018

[42] S. S. Padhi, and P. K. J. Mohapatra, "Adoption of e-procurement in the government departments", *Electronic Government an International Journal.* vol. 7 (1), pp. 41-59, 2010.

[43] S. Opara and I. Ituen, (2009), "Nigeria's ICT sector: Growth, gains, and challenges", *The Punch Newspaper*.

[44] P. I. Hajnal, *Civil society in the information age,* 1st ed. London: Routledge, 2018.

[45] B. Al Mourad, and K. Faouzi (2013). "Accessibility Evaluation of Dubai e-Government Websites: Findings and Implications", *Journal of E-Government Studies and Best Practices*, pp. 1-15, 2013.

[46] Understanding WCAG 2.0., *Understanding Conformance,* available: https://www.w3.org/TR/UNDERSTANDING-WCAG20/conformance.html#uc-levels-head on 23/11/2018

[47] WCAG., Web Content Accessibility Guidelines (WCAG)*, 2012,* available: http://www.w3.org/WAI/intro/wcag.php on 23/11/2018

[48] Electronic Accessibility, *WCAG 2.0 conformance levels.* available: http://www.ucop.edu/electronic-accessibility/standards-and-best-practices/levels-of-conformance-a-aa-aaa.html on 23/11/2018

[49] J.O. Fatile, "Electronic Governance: Myth or Opportunity for Nigerian Public Administration?", *International Journal of Academic Research in Business and Social Sciences,* vol. *2(9),* pp. 122-140, 2012.

[50] https://drpete.co/blog/25-point-website-usability-checklist. Retrieved on 25/11/2018

[51] A. M. Basel and F. Kamoun, "Accessibility as an integral factor in e-government web site evaluation: The case of Dubai e-government", *Information Technology & People*, vol. 27(2), pp. 208-228, 2014.

[52] A. Olalere, and J. Lazar, "Accessibility of U.S. federal government home pages: Section 508 compliance and site accessibility statements", *Government Information Quarterly*, vol. *28*(3), pp. 303–309, 2011.

[53] M. Abdul Latif, and M. N. Masrek, "Accessibility Evaluation on Malaysian E-Government Website", *Journal of E-Government Studies and Best Practices*, pp. 1-11, 2010.

[54] http://www.fae20.cita.illinois.edu/about. Retrieved on 19/11/2018

[55] https://fae.disability.illinois.edu/abouts/concepts/. Retrieved on 19/11/2018

Table 1: STATES WITH WEBSITES

S/N	STATES	WEBSITES ADDRESSES	POSITION OF WEBSITES ON GOOGLE SEARCH RESULTS
1	ABIA	www.abiastate.gov.ng	First search result, first item
2	AKWA-IBOM	www.akwaibomstate.gov.ng	First search result, first item
3	ANAMBRA	www.anambrastate.gov.ng	First search result, first item
4	BAUCHI	www.bauchistate.gov.ng	First search result, first item
5	BAYELSA	www.bayelsa.gov.ng	First search result, first item
6	BENUE	www.benuestate.gov.ng	First search result, first item
7	BORNO	www.bornostate.gov.ng	First search result, first item
8	CROSSRIVER	www.crossriverstate.gov.ng	First search result, first item
9	DELTA	www.deltastate.gov.ng	First search result, first item
10	EBONYI	www.ebonyistate.gov.ng	First search result, first item
11	EDO	www.edostate.gov.ng	First search result, second item
12	EKITI	www.ekitistate.gov.ng	First search result, first item
13	ENUGU	www.enugustate.gov.ng	First search result, first item
14	FCT	www.fcta.gov.ng	First search result, last item
15	IMO	www.imostate.gov.ng	First search result, first item
16	JIGAWA	www.jigawastate.gov.ng	First search result, first item
17	KADUNA	www.kdsg.gov.ng	First search result, first item
18	KANO	www.kano.gov.ng	First search result, first item
19	KATSINA	*www.katsinastate.gov.org*	First search result, first item
20	KEBBI	www.kebbistate.gov.ng	First search result, first item
21	KWARA	*www.kwarastate.gov.ng*	First search result, first item
22	LAGOS	www.lagosstate.gov.ng	First search result, first item
23	NASARAWA	*www.nasarawastate.gov.ng*	First search result, first item
24	OGUN	www.ogunstate.gov.ng	First search result, first item
25	ONDO	www.ondostate.gov.ng	First search result, first item
26	OSUN	www.osun.gov.ng	First search result, first item
27	OYO	www.oyostate.gov.ng	First search result, first item
28	PLATEAU	*www.plateaustate.gov.ng*	First search result, first item
29	RIVERS	www.riversstate.gov.ng	First search result, first item
30	SOKOTO	www.sokotostate.gov.ng	First search result, first item
31	TARABA	www.tarabastate.gov.ng	First search result, first item
32	YOBE	www.yobestate.gov.ng	First search result, first item

Table 2: STATES WITHOUT WEBSITES

| S/N	STATES	TYPES OF WEB PRESENCE
1	ADAMAWA	https://en.wikipedia.org/wiki/Adamawa_State, https://standardbiblio.000webhostapp.com
2	GOMBE	https://en.wikipedia.org/wiki/Gombe_State
3	KOGI	en.wikipedia.org/wiki/Kogi_State,*www.facebook.com*, *www.nigeriagalleria.com*
4	NIGER	https://en.wikipedia.org/wiki/Niger_State, http://www.nssb.org.ng
5	ZAMFARA	en.wikipedia.org, nnn.com.ng, zamfaraonline.net
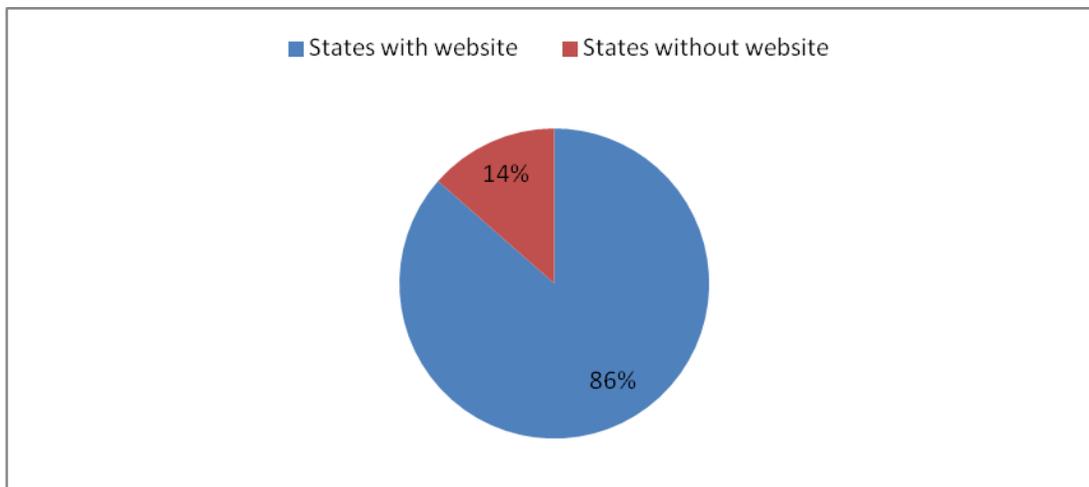
Figure 1. The percentage difference of the Nigerian states official websites

Table 3: USABILITY EVALUATION CRITERIA

CRITERIA STATES	ACCESSIBILITY						IDENTITY					NAVIGATION						CONTENTS					
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	Q	R	S	T	U	V	W	X
Abia	1	1	1	1	1	0	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1
Akwa Ibom	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Anambra	1	1	1	1	0	0	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	0	1
Bauchi	1	1	1	1	1	0	1	1	1	0	0	0	0	0	0	1	0	0	1	1	0	1	1
Bayelsa	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
Benue	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	0	0	1	1	0
Borno	1	1	1	1	1	0	1	1	0	0	1	1	1	1	1	1	1	1	1	0	0	1	0
Crossriver	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	1	0	1	1	1	1	1	0
Delta	1	1	1	0	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1
Ebonyi	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
Edo	1	1	1	1	1	0	0	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1
Ekiti	1	1	1	0	1	0	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1
Enugu	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	0	0	1	0	1	1	0
FCT	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
Imo	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	0
Jigawa	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
Kaduna	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Kano	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	0	1	1	1		1	1
Katsina	1	1	1	1	0	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1
Kebbi	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1
Kwara	1	1	1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1
Lagos	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1
Nasarawa	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1
Ogun	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ondo	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Osun	0	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1
Oyo	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1
Plateau	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
Rivers	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1
Sokoto	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	0	0	1	0	1	1	1
Taraba	0	1	1	1	0	0	1	1	0	0	0	0	1	1	1	1	0	1	1	1	1	1	1
Yobe	1	1	1	1	0	0	0	1	1	1	1	1	1	0	0	1	0	1	1	1	1	1	1

A- Site load- time is reasonable

B- Adequate text- to- background contrast

C- Font size/spacing is easy to read

D- Flash & add- ons are used sparingly

E- Images have appropriate ALT tags

F- Site has custom not- found/404 page

G- State logo is prominently placed

H- Tagline makes state's purpose clear

I- Home- page is digestible in 5 seconds

J- Clear path to state information

K- Clear path to contact information

L- Main navigation is easily identifiable

M- Navigation labels are clear & concise

N- Number of buttons/links is reasonable

P- State logo is linked to home- page

Q- Links are consistent & easy to identify

R- Site search is easy to access

S- Major headings are clear & descriptive

T- Styles & colors are consistent

U- Emphasis (bold, etc.) is used sparingly

V- Ads & pop- ups are unobtrusive

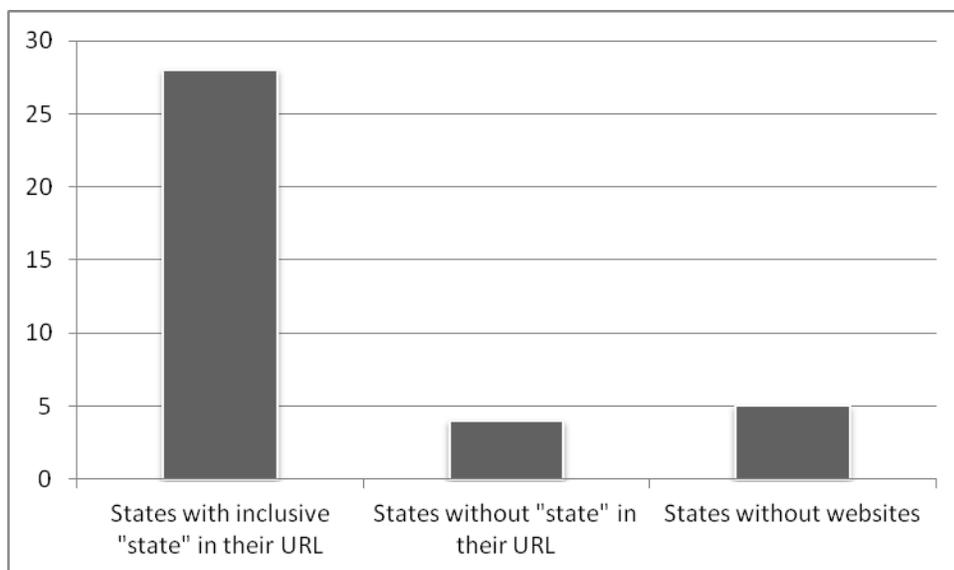W- URLs are meaningful & user- friendly

X- HTML page titles are explanatory

Figure 2. Difference in URL naming system of Nigeria states website

Table 4: Functional Accessibility Evaluator 2.0: Testing (version 0.9.9)

S/N	States	Number of Rules					Implementation Level	
		V	W	MC	P	N/A	Score	Status
1	Abia	15	3	35	15	64	32	NI-R
2	Akwa Ibom	20	4	42	20	46	35	NI-R
3	Anambra	18	5	36	28	45	43	NI-R
4	Bauchi	8	3	31	29	61	47	NI-R
5	Bayelsa	14	4	36	17	61	39	NI-R
6	Benue	6	1	32	31	62	52	PI-R
7	Borno	9	3	28	21	71	40	NI-R
8	Cross river	12	3	33	22	62	37	NI-R
9	Delta	-	-	-	-	-	-	N/A
10	Ebonyi	15	2	34	15	66	34	NI-R
11	Edo	15	4	40	24	49	37	NI-R
12	Ekiti	11	2	33	13	73	30	NI-R
13	Enugu	15	4	39	22	52	38	NI-R
14	FCT	9	1	29	10	83	26	NI-R

15	Gombe	14	5	36	22	55	44	NI-R
16	Jigawa	10	3	27	4	-	18	NI-R
17	Kaduna	18	4	34	22	54	42	NI-R
18	Kano	8	4	30	10	80	27	NI-R
19	Katsina	11	4	29	14	74	34	NI-R
20	Kebbi	9	3	31	18	71	37	NI-R
21	Kwara	18	3	29	24	58	44	NI-R
22	Lagos	11	2	42	28	49	44	NI-R
23	Nasarawa	11	5	29	14	73	36	NI-R
24	Ondo	13	3	38	15	63	31	NI-R
25	Osun	11	4	35	12	70	31	NI-R
26	Ogun	17	7	42	25	41	42	NI-R
27	Oyo	12	3	30	22	65	43	NI-R
28	Plateau	11	1	32	5	83	19	NI-R
29	Rivers	6	5	31	26	64	47	NI-R
30	Sokoto	5	3	23	23	51	-	PI-R
31	Taraba	9	5	35	24	-	42	NI-R
32	Yobe	16	5	35	22	54	43	NI-R

"-" means No record is found

Table 5: Rule Scope ranges of Functional Accessibility Evaluator 2.0

Violations Rule		Warnings Rule		Manual Checks Rule		Passed Rule		N/A	
Highest	Least	Highest	Least	Highest	Least	Highest	Least	Highest	Least
Akwa Ibom (20)	Sokoto (5)	Ogun (7)	Benue, FCT, & Plateau (1)	AkwaIbom, Lagos, & Ogun (42)	Sokoto (23)	Benue (31)	Jigawa (4)	FCT (83)	Ogun (41)

Table 6: Implementation Status of Functional Accessibility Evaluator (FAE) 2.0

Score		Status	
Highest	Least	PI-R	NI-R
Benue (52)	Sokoto (0)	Benue & Sokoto	Others