

Web Accessibility of the Federal Democratic Republic of Ethiopia Governmental Websites

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Summary

National and local governments use the tools and systems made possible by information and communication technologies to address necessary information and to provide public services that enable to the citizen, business and government entities save time and resources. These information and public services should be accessible by everyone including people with disabilities. The prevalence of people with disabilities was estimated around 17.6 percent in 2011 in Ethiopia. In this work, the accessibility of Ethiopia governmental websites evaluated using four automated web accessibility evaluation tools. The results showed that most of the Ethiopia government web sites do not meet the requirements of the guidelines that can be tested by these tools. The most common problems are lack of alternative texts, lack of distinguish ability, lack of adaptability and parsing. The web accessibility evaluation tools also tested within themselves and within each other. Tools found problems in each other's and/or their own home pages.

Key words:

People with disabilities, web accessibility, governmental websites, Ethiopia.

1. Introduction

Due to the improvement on information and communications technologies (ICTs) most of the governmental information and the services currently processed by using websites or portals. That enables to improve the public sector services by using resources efficiently and save time to accomplish those services. Hence when the communication or the information diversified it brings accountability and transparency within the organization and the people [1]. People with disabilities have the same needs as non-disabled people to use the internet. Web accessibility means that websites, tools, and technologies are designed and developed so that people with disabilities can use them [2]. So the websites should be accessible at any level of the disabilities such as cognitive, auditory, physical, speech and visual [3].

Some countries developed their own web accessibility polices and standards as a basement to increase web accessibility that the website designers or the developers consider them as guidelines [4]. Web Content

Accessibility Guidelines (WCAG) that was developed by the Wide Web Consortium (W3C), providing a global standard that explains how to make the contents of the web pages more accessible [5]. Website accessibility evaluation is the process of evaluating or testing the accessibility of the websites to identify the accessibility weather, it is accessible by peoples with disabilities or not [3].

The web site designers and programmers or quality assurance teams have to evaluate the accessibility of their work in the software project management especially in the design phase of the software testing life cycle (STLC). Evaluation of web accessibility requires both automated evaluation tools and manual evaluation. Manual test is performing by an expert or an expert group who recognizes and understand all the web accessibility problems. There are several software programs and online services for free or commercial to determine whether web page contents meet the accessibility guidelines named as automated evaluation tools. The automated testing depends on the tools, standards that utilized to assess the availability of web and it should run in different operating systems and browsers. The disadvantages of automated evaluation are low accuracy rate of the problem and may be it produce false result of the evaluation because it depend automated testing tools [6].

Governmental websites must be accessible to everyone without any restriction therefore to test the accessibility of the websites is mandatory. Governmental websites accessibility evaluation is important to identify problems and to raise awareness about web accessibility. There are several published works that discuss the web accessibility of the central and local governmental websites such as Iseri, Uyar and Ilhan [7] examined the accessibility of the Cyprus island municipal websites and, Ismailova and Inal [8] analyzed the ministry websites accessibility of the Kyrgyz, Azerbaijan, Kazakhstan and Turkey.

Ethiopia is one of the world's oldest countries that today cover 1,119,683 square kilometers. Ethiopia has an estimated 2019 population of 112 million [9] where the GDP per capita income is \$772 [10]. According to the World Report on Disability from 2011 of the World

Health Organization (WHO) 17.6 percent of the population in Ethiopia have disabilities [11]. Ethiopians are ethnically diverse, with more than 80 different languages with up to 200 different dialects spoken [12]. Ethiopia is a Federal Democratic Republic composed of 9 autonomous regional states (Afar, Amhara, Benishangul-Gumuz, Gambella, Harari, Oromia, Somali, Southern Nations Nationalities and People Region-SNNPR, and Tigray) and two city administrations (Addis Ababa and Dire Dawa). Although there are various studies on the governmental websites and online services of the Ethiopia [13-17] there is no published research on their web accessibility.

The objective of this study is to evaluate the accessibility and standards compliance of the governmental websites in Ethiopia and aiming to raise awareness about web accessibility. The rest of the paper is organized as follows: Section 2 describes the methodology, Section 3 presents the results, Section 4 contains discussions and conclusion is take place in the final section.

2. Methodology

The research methodology that used to evaluate the Ethiopia’s governmental websites presented in this section. The research method identified and selected applicable for the research objectives. Consequently, quantitative research method used to interpret and analyze the results

that got from the evaluation of the Ethiopia’s government websites on basis line of web accessibility guidelines. The steps of the Ethiopia’s government web sites accessibility evaluation process performed as in Figure 1.

2.1 Identification and Selection of the Ethiopia’s Governmental Websites

Ethiopia government use websites to offer service and information to the citizens and business easily in different sectors for education, management, social and etc. Measuring of the accessibility of the web sites essential to confirm it is accessible to the people or not. Ethiopia structured in federal and regional levels so there are websites provide information and service to the government and people at the federal and the regional level. Consequently, decided to conduct the research on governmental websites provides service at the federal levels. These websites are managing and controlling by government minister levels and agency levels. Therefore, in this work the authors identified the governmental websites that gives information and or online services for different purposes.

The 44 websites identified that were not working due to different problems. Therefore 38 available government web sites were selected to evaluate in this study which are listed in Table 1.

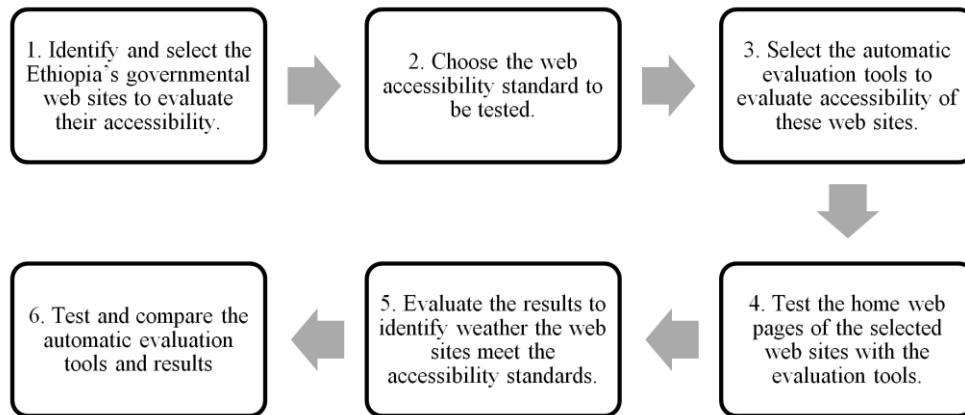


Fig. 1 Web accessibility evaluation process.

2.2 Selection of the Web Accessibility Standard

There are several different accessibility guidelines, standards and governmental laws such as WCAG 1.0,2.0

and 2.1, Section 508 (U.S. federal procurement standard), Stanca Act (Italian accessibility law), BITV (German government standards), JIS (Japanese Industry Standards) X 8341-3, and Irish National IT Accessibility Guidelines. The W3C Web Accessibility Initiative (WAI) Accessible Rich Internet Applications Suite (WAI-ARIA) defines a way to make the content of webpages and web applications with dynamic content and advanced user interface controls developed with Ajax, JavaScript and etc. accessible [2].

The European Commission has adopted the WCAG 2.0 compliance level AA in 2010 [18] and all governmental websites in European Union (EU) have to be designed in compliancy with it. In this work W3C WCAG 2.0 and Level AA analysis level selected to evaluate the Ethiopia's government websites.

2.3 Selection of the Evaluation Tools

The selection of automated testing tools differs from one to the other researcher that depends on personal interest and features of these tools. Some of the WCAG guidelines can only be checked by human. Automated evaluation tools can help to identify potential issues but can't check all accessibility aspects. There are different automatic web evaluation tools those have different functionality and features.

The WAI gives a list of the web accessibility evaluation tools and advised about selection of them in their website [2]. Each organization, web designer/developer/content author, project and team has differing needs for different features to take into account when selecting evaluation tool. There are several works that analyzes web accessibility evaluation tools [19, 20].

In this work a combination of tools that were used previously in several researches are selected to evaluate the web accessibility of Ethiopia government web sites homepages. These tools that named as TAW [21], Achecker [22], WAVE [23] and EIII Page Checker (Tingun Checker) [24] are also evaluated by themselves and in each other to check their home page accessibility. In this study websites evaluated with WCAG 2.0 and Level AA analysis level options of these tools.

TAW is an online tool for the accessibility analysis of web sites based on the WCAG 2.0 with analysis level option A, AA and AAA. The TAW reports the accessibility issues in three categories:

	Board of Ethiopia	
2	Addis Ababa City Government	www.addisababa.gov.et
3	Agricultural Trans. Agency	www.ata.gov.et
4	Armauer Hansen Research Institute (AHRI)	ahri.gov.et
5	Benishangul-Gumuz	benishangulgumuz.gov.et
6	Central Statistical Agency	www.csa.gov.et
7	Dire Dawa City Adm.	dire-dawa.gov.et
8	Ethiopia E-Service	eservices.gov.et
9	eVisa Portal	www.evisa.gov.et
10	Ethiopia's Intellectual Property Office	eipo.gov.et
11	Ethiopia's Investment Commission	investethiopia.gov.et
12	Ethiopia's Public Health Inst.	ephi.gov.et
13	Ethiopia's Roads Authority	www.era.gov.et
14	Ethiopian Biodiversity Inst.	ebi.gov.et
15	Ethiopian Food and Drug Ad.	fmhaca.gov.et
16	Ethiopian Institute of Agricultural Research	www.eiar.gov.et
17	Ethiopian National Archives and Library Agency	www.nala.gov.et
18	Ethiopian Pharmaceuticals Supply Agency	epsa.gov.et
19	Federal Cooperative Agency	fca.gov.et
20	Industrial Parks Development Corporation	ipdc.gov.et
21	Ministry of Agriculture	www.moa.gov.et
22	Ministry of Finance	www.mofed.gov.et
23	Ministry of Health	www.moh.gov.et
24	Min. of Innovation and Tech.	www.mcit.gov.et
25	Min. of Mines and Petroleum	www.mom.gov.et
26	Ministry of Peace	www.mop.gov.et
27	Ministry of Revenues	mor.gov.et
28	Ministry of Science and Higher Education	moshe.gov.et
29	Ministry of Transport	www.motr.gov.et
30	Ministry of Water, Irrigation and Electricity	mowie.gov.et
31	Ministry of Women, Children and Youth	www.mowca.gov.et
32	National Bank Of Ethiopia	nbe.gov.et
33	National Edu. Assessment and Examination Agency	neaea.gov.et
34	National Meteorology Agency	www.ethiomet.gov.et
35	Office of the Prime Minister	pmo.gov.et
36	Policy Studies Institute (PSI)	https://www.psi.gov.et
37	Water Resources Development Fund	wrdf.gov.et
38	e-government portal	www.ethiopia.gov.et

- Problems
- Warnings (a human review is necessary)
- Not reviewed (a fully manual review need)

Table 1: Selected governmental websites

No	Name of the Organization Paper	URL
1	Accounting and Auditing	aabe.gov.et

The results are given based on 4 principles of WCAG, Perceivable (P), Operable (O), Understandable (U) and Robust (R) and a detailed report that shows the problems based on WCAG guidelines.

The accessibility of web pages based on different accessibility guidelines (WCAG 1.0 & 2.0, BITV 1.0, Section 508, and Stanca Act) also HTML and Cascading Style Sheets (CSS) errors can be check by AChecker. The tool also gives the option to choose results report format as “View by Guideline” and “View by Line Number”. In this work government web sites evaluated with WCAG 2.0 Level AA, enabled HTML validator, enabled CSS validator, and the “Report Format” as “View by Guideline” option of this tool. The results are identified as:

- Known problems
- Likely problems (probable barriers identified, require a human decision)
- Potential problems (cannot identify, require a human decision)
- HTML (number of errors identified)
- CSS (number of errors identified)

European Internet Inclusion Initiative (EIII) Page Checker (Tington Checker) provides services to web pages and PDF documents for accessibility. The tool covers a part of WCAG 2.0 requirements tests. The grading chart of the EIII Page Checker is given in Figure 2.

Grade graphic	Score (range)	Explanation of grade
■	100	No tests failed
■	95 through 99	A few tests failed
■	85 through 95	Some tests failed
■	70 through 85	Many tests failed
■	0 through 70	Most tests failed

Fig. 2 Grading chart of the EIII Page Checker.

WAVE evaluates the web sites accessibility automatically and offers graphic feedback of the web sites that were evaluated. This evaluation tool evaluates the following:

- Errors
- Alerts
- Features
- Structural elements
- HTML5 and ARIA
- Contrast errors

3. Results

In this section the results of the Ethiopia’s governmental websites that tested automatically with automatic evaluation tools were given.

Figures 3, 4 and 5 show the numerical data obtained from the evaluation Ethiopia’s governmental websites with TAW.

The testing results of the Ethiopia government web sites with AChecker are shown in Figures 6 and 7.

The government web sites testing results of the Ethiopia with EIII Page Checker are shown are shown in Figure 8 and 9.

The government web sites testing results of the Ethiopia with WAVE are shown in Figures 10 and 11.

Figure 12 shows the total problems based on the guideline numbers found by TAW, AChecker and EIII Page Checker. The testing results of the evaluation tools with themselves and with each other are given in Table 2.

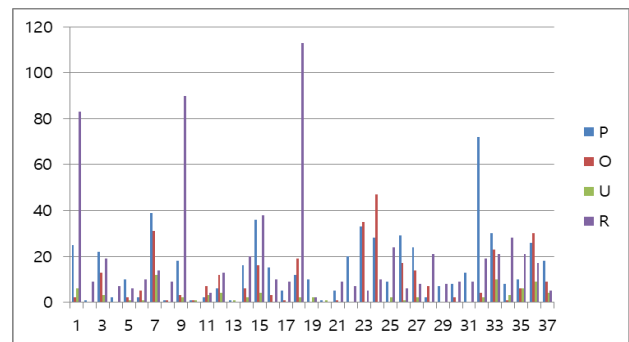


Fig. 3 TAW test results in Problem category.

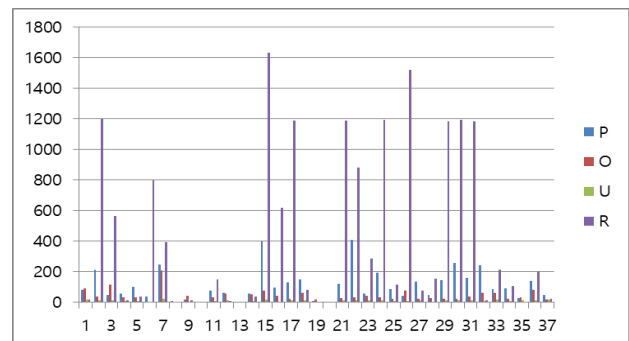


Fig. 4 TAW test results in Warning category.

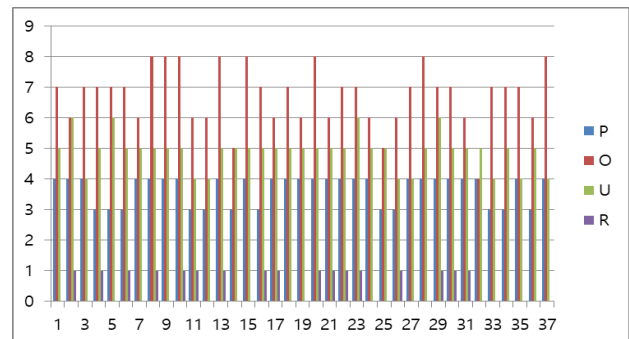


Fig. 5 TAW test results in Unverified category.

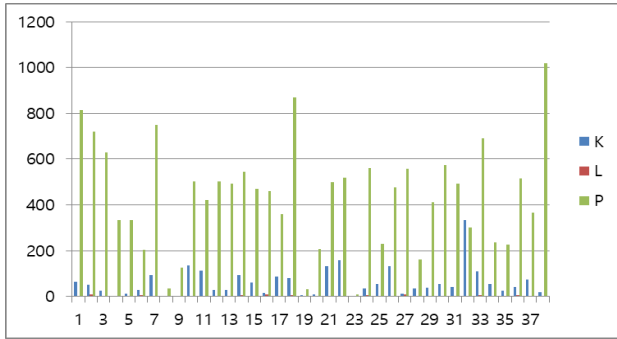


Fig. 6 Known (K), Likely (L) and Potential (P) problems results of Achecker tests.

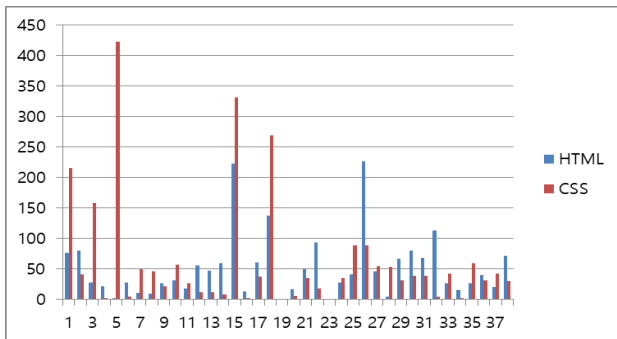


Fig. 7 HTML and CSS error results of Achecker tests.

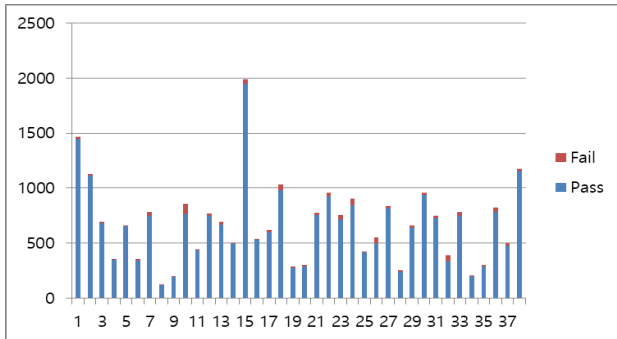


Fig. 8 Number of (pass+fail) applied tests of EIII Page Checker.

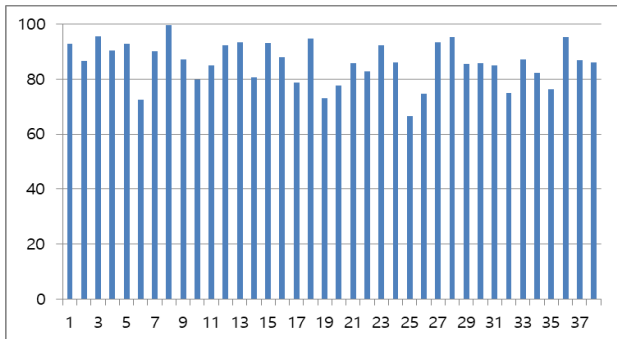


Fig. 9 Score results of EIII Page Checker tests.

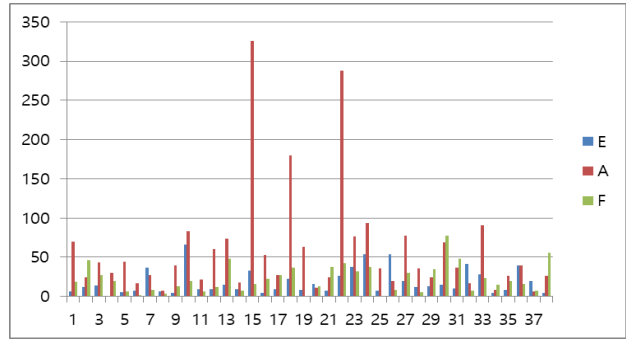


Fig. 10 Errors (E), Alerts (A) and Features (F) results of WAVE tests.

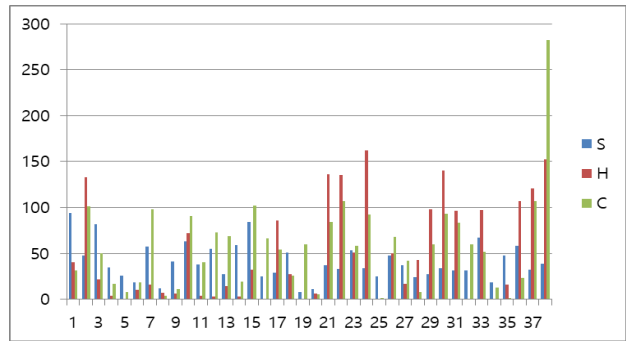


Fig. 11 Structural Elements (S), HTML5 and ARIA (H), and Contrast Errors (C) results of WAVE tests.

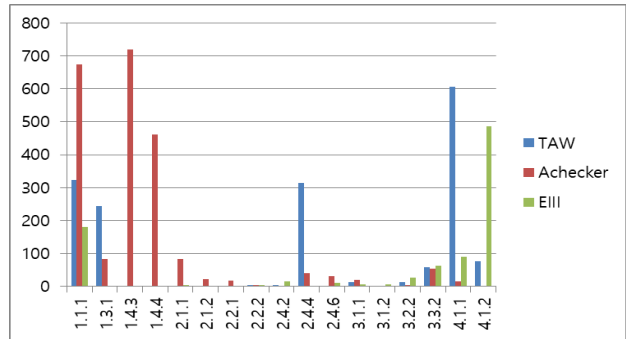


Fig. 12 Total problems based on the WCAG guideline numbers.

Table 2: Comparison of evaluation tools

		TAW	Achecker	WAVE	EIII Page Checker
TAW	Problem	1	16	2	11
	Warnings	42	87	40	51
	Not reviewed	17	13	16	16
Achecker	Known Problems	12	0	0	2
	Likely Problems	2	0	0	1
	Potential Problems	194	211	50	95
	HTML Validation	0	5	0	13
	CSS Validation	11	1	3	3
WAVE	Errors	0	0	0	1
	Alerts	18	12	1	4
	Features	18	34	3	4
	Structural Elements	23	12	2	10
	HTML5 and ARIA	11	0	2	9
	Contrast Errors	26	0	1	2
EIII Page Checker	Fail Test	3	17	0	1
	Verify Test	0	0	0	0
	Pass Test	279	227	31	140
	Test Total	282	244	31	141
	Score (/100)	96.43	92.97	100	90.91
TAW	Problem	1	16	2	11
	Warnings	42	87	40	51
	Not reviewed	17	13	16	16

4. Discussions

None of the websites meet the minimum requirement of web accessibility conformance guidelines and no website was detected as error free according to the TAW results. Detailed problem results indicate that all of the websites meet some of the accessibility success criteria. The government web sites that have the most problems are Ethiopian Pharmaceuticals Supply Agency with 146 problems, followed by Accounting and Auditing Board of Ethiopia and Ethiopia's eVisa Portal websites. The government websites that have fewer problems are Industrial Parks Development Corporation and Ethiopia's Roads Authority with two problems followed by Ethiopia's Intellectual Property Office website with 3 problems. 11 websites have more than 1000 warnings. Ethiopian Food and Drug Administration website has the most warning followed by Ministry of Peace and Ministry of Water, Irrigation and Electricity websites.

As the testing results indicated that generated from Achecker most of the websites has an accessibility problem. 7 websites has more than 100 known problems. National Bank of Ethiopia website has the most known errors with 335 followed by Ministry of Finance and Ethiopia's Intellectual Property Office websites. Achecker results reveal that the most common errors are lack of text content and compatibility, followed by operable errors. 5

On the other hand 3 websites have more than 100 errors. Only 5 websites out of 38 tested websites have less than 10 errors. Most common errors are lack of text content and compatibility, followed by navigable and labeling errors.

web sites have less than 5 known errors. AHRI web site has zero known error, followed by Ethiopia E-Service with one known error. All web sites have only few likely problems.

The average EIII Page Checker score of the evaluated government web sites is 83.63 where the minimum score is 66.63 and the maximum score is 99.44. None of the evaluated website has passed from all the tests, only 13.2% have failed the few tests, 54.6% have failed some of the tests and 28.9% of the websites has failed from most of the tests. Ethiopia E-Service webpage has the highest score, followed by Agricultural Transformation Agency and Policy Studies Institute web sites. The government website that has the lowest score is Ministry of Mines and Petroleum The web site of the Industrial Parks Development Corporation could not be analyzed with EIII Page Checker.

According to the WAVE evaluation results of the Ethiopia's government web sites, the AHRI website has the lowest error with only one error followed by Ethiopia's eVisa Portal, Ethiopian Institute of Agricultural Research, National Meteorology Agency and e-

government portal websites with four errors. Government websites with the highest number of errors are Ethiopia's Intellectual Property Office followed by Ministry of Innovation and Technology and Ministry of Peace. Ministry of Mines and Petroleum and Office of the Prime Minister web sites has only one contrast error. e-Government portal has the worst contrast error result with 282, followed by Ministry of Finance and Water Resources Development Fund websites which both of them have 107 contrast errors. Due to the complexity of determining errors by automated tools each tool found different number of errors on most of the web sites and even on their own web sites. Interestingly TAW and EII page checker found error on their own web sites. This is in consistent with the TAW and Achecker detailed result that is while TAW revealing that the most common errors are lack of text content and compatibility, followed by navigable and labeling, Achecker results are lack of text content and compatibility and operable errors. Achecker found the most number of errors in criteria 1.4.3 and TAW found in 4.1.1. While Achecker found errors in certain criteria 1.4.4, 2.1.1, 2.1.2 2.2.1 and 2.4.6, TAW did not found any errors in these criteria. Likewise TAW found errors in criteria 4.1.2 that Achecker did not found any errors.

5. Conclusion

The governmental information and public services should be accessible by everyone including people with disabilities. In this work, the accessibility of the homepages of 38 Ethiopia government websites evaluated based on the WCAG 2.0 and AA analysis level using TAW, Achecker, WAVE and EIII Page Checker online automated testing tools. Each tool targets different audiences so each tool gave different results for the same webpage. This study aimed at creating awareness about the degree of accessibility of the Ethiopia government web sites based on the WCAG. The results showed that most of the tested web sites do not meet the requirements of the guidelines. The most common problems are contrast, non-text content, compatible, resize text and link purpose. The accuracy of the automated tools also tested. Every tool found problems in other's and/or their own home pages. For further accessibility evaluation manual test need.

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References

- [1] D. Bhavneet, N. Malika and C. Kavita, "Benefits and Challenges of E-Governance Portal," *Int. J. of Soft Computing and Engineering*, 3(5), 2013. ISSN: 2331-2307.
- [2] Web Accessibility Initiative (WAI) website. Retrieved from <https://www.w3.org/WAI>
- [3] S. Lewthwaite, "Web accessibility standards and disability: Developing critical perspectives on accessibility," *Disability and Rehabilitation*, 36(16), pp.1375-1383, 2014. DOI:10.3109/09638288.2014.938178.
- [4] D. Sloan and S. Horton, "Global considerations in creating an organizational web accessibility policy," *Proc. of the 11th Web for All Conf. on - W4A 14*, 2014. DOI:10.1145/2596695.2596709.
- [5] World Wide Web Consortium (W3C) website. Retrieved from <https://www.w3.org>
- [6] M. Vigo and G. Brajnik, "Automatic web accessibility metrics: where we are and where we can go," *Interacting with Computer*, 23 (2), pp.137-155, 2011. DOI: 10.1016/j.intcom.2011.01.001
- [7] E.I. Iseri, K. Uyar and U. Ilhan, "Accessibility of the Cyprus Island Municipal Websites," *Proc. of the 9th Int. Conf. on Computational Intelligence and Communication Networks (CICN 2017)*, pp.72 -76, Girne, Cyprus, 2017. DOI: 10.1109/CICN.2017.8319359
- [8] R. Ismailova and Y. Inal, "Web site accessibility and quality in use: a comparative study of government Web sites in Kyrgyzstan, Azerbaijan, Kazakhstan and Turkey," *Universal Access in the Information Society*, 16(4), pp.987-996, 2017. DOI: 10.1007/s10209-016-0490-z
- [9] United Nations Population Division, *World Population Prospects 2019; Total Population - Both Sexes XLSX file*. Retrieved from [https://population.un.org/wpp/Download/Files/1_Indicators %20\(Standard\)/EXCEL_FILES/1_Population/WPP2019_P OP_F01_1_TOTAL_POPULATION_BOTH_SEXES.xlsx](https://population.un.org/wpp/Download/Files/1_Indicators%20(Standard)/EXCEL_FILES/1_Population/WPP2019_POP_F01_1_TOTAL_POPULATION_BOTH_SEXES.xlsx)
- [10] The World Bank, *World Development Indicators, Ethiopia XLSX file*. Retrieved from <http://api.worldbank.org/v2/en/country/ETH?downloadformat=excel>
- [11] World Health Organization (WHO), 2011 World report on disability. Retrieved from [http://whqlibdoc.who.int/publications/2011/9789240685215 _eng.pdf?ua=1](http://whqlibdoc.who.int/publications/2011/9789240685215_eng.pdf?ua=1)
- [12] Ethiopian Investment Commission website. Retrieved from <http://investethiopia.gov.et>
- [13] M. Belachew, "E-government initiatives in Ethiopia," *Proc. of the 4th Int. Conf. on Theory and Practice of Electronic Governance (ICEGOV '10)*, Jim DAVIES and Tomasz JANOWSKI (Eds.). ACM, New York, NY, USA, pp.49-54, 2010. DOI: 10.1145/1930321.1930332
- [14] M. Belachew and R. K. Shyamasundar, "Public private partnerships (PPP) in the e-government initiatives for developing nations: the case of Ethiopia," *Proc. of the 7th Int. Conf. on Theory and Practice of Electronic Governance (ICEGOV '13)*, Tomasz JANOWSKI, Jeanne HOLM, and Elsa ESTEVEZ (Eds.). ACM, New York, NY, USA, pp.42-45, 2013. DOI: 10.1145/2591888.2591895
- [15] F. Woldehanna, W. Mulugeta, S. Getaneh and M. Debebe, "Legal Framework for Implementation of m-Government in

Ethiopia: Best Practices and Lessons Learnt,” Zede J of Ethiopian Engineers and Architects, 32, pp.41-46, 2014.

- [16] L. Lessa, S. Anteneh, R. Klischewski, and M. Belachew, “Towards a conceptual framework for pledging sustainable e-Government success: The case of G2G in Ethiopia,” Proc. of the IEEE AFRICON 2015, pp.1-5, 2015. DOI:10.1109/AFRCON.2015.7332017
- [17] D.M. Yehuala, “Critical Success Factors and Key Performance Indicators for e-Government Projects-Towards Untethered Public Services: The Case of Ethiopia,” in: Mekuria F., Nigussie E., Dargie W., Edward M., Tegegne T. (eds) Information and Communication Technology for Development for Africa. ICT4DA 2017. Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering, 244. Springer, Cham, 2018.
- [18] European Commission (EC) Web Accessibility. Retrieved from http://ec.europa.eu/ipg/standards/accessibility/index_en.htm
- [19] V.L. Centeno, C.D. Kloos, J.A. Fisteus and L.A. Álvarez, “Web Accessibility Evaluation Tools: A Survey and Some Improvements,” Electronic Notes in Theoretical Computer Science 157(2), pp.87-100, 2006. DOI:10.1016/j.entcs.2005.12.048
- [20] J. Lopez-Zambrano, J. Moreira-Pico and N. Alava-Cagua, “Methodology to value and classify web accessibility evaluation tools,” E-Ciencias de la Información 8(1), pp.172-189, 2018. DOI:10.15517/eci.v8i1.30012.
- [21] TAW online web service. Retrieved from <http://tawdis.net/ingles.html?lang=en>
- [22] Achecker website. Retrieved from <http://achecker.ca>
- [23] WAVE Accessibility Tool website. Retrieved from <http://wave.webaim.org>
- [24] EIII (European Internet Inclusion Initiative) Page Checker website. Retrieved from <http://checkers.eiii.eu>



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