WEB ACCESSIBILITY OF THE ETHIOPIAN GOVERNMENTAL WEBSITES

A THESIS SUBMITTED TO THE GRADUATE SCHOOL OF APPLIED SCIENCES
OF
NEAR EAST UNIVERSITY

By
GEZAHEGN MULUSEW DELELE

In Partial Fulfillment of the Requirements for the Degree of Master of Sciences in Software Engineering

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**Approval of Director of Graduate School of
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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original of this work.

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ABSTRACT

Now a day the technology becomes more advanced and powerful for communication, to transmit and access the information all over the world. Governmental organizations all over the world use electronic government systems to perform the activities automatically rather than manual methods because these electronic government systems enables the citizens and government save their time and resources. Therefore, websites are applicable to provide easy and efficient service to the public and to enables; they retrieve information and manipulate the data provided by the government. There are a number of governmental websites were developed to make the government electronic information systems in Ethiopia. However, to address the information to all people without any exceptionality the websites should be accessible by any peoples, because all citizens should have equal right of access the information from governmental portals. This work evaluates the accessibility of 23 Ethiopian governmental websites based on WCAG 1.0 as well as WCAG 2.0 procedures via using automatic website accessibility evaluation tools. Therefore, towards define accessibility of the websites, the Ethiopian governmental websites evaluated. The results showed that most of Ethiopian governmental websites does not meet the minimum requirement of web accessibility standards. This indicated that the websites did not develop according to web accessibility guidelines or standards of accessibility. The most common problems were detected by evaluation tools are lack of alternative texts, lack of distinguishability and lack of adaptability.

*Keywords***:** Web accessibility; governmental websites; websites evaluation; people with disabilities; evaluation tools

ÖZET

Günümüzde, teknoloji tüm dünyanın her yerindeki bilgiye erişmek ve bilgileri iletmekte daha gelişmiş ve güçlü hale geliyor. Dünyanın her yerindeki devlet teşkilatı faaliyetlerini manuel yöntemlerden ziyade otomatik olarak yerine getirmek için elektronik devlet sistemlerini kullanıyor, çünkü bu elektronik devlet sistemleri vatandaşların ve hükümetin zamanlarını ve kaynaklarını tasarruf etmelerini sağlıyor. Bu nedenle, web siteleri halka kolay ve verimli hizmet vermeği bilgi almayı ve devlet tarafından sağlanan verileri manipüle etmeği mümkün kılmak için uygulanabilir. Etiyopya'da devleti elektronik bilgi sistemleri haline getirmek için çok sayıda resmi web sitesi geliştirilmiştir. Ancak, bilgileri istisnasız bütün insanlara hitap etmek için, web sitelerinin herhangi bir halk tarafından erişilebilir olması gerekir, çünkü tüm vatandaşların bilgiye devlet kurumlarından gelen bilgilere eşit erişim hakkı olmalıdır.. Bu çalışmada, Etiyopya'nın 23 devlet web sitesinin erişilebilirliğini hem WCAG 1.0 hem de WCAG 2.0 standardlarında otomatik web erişilebilirlik değerlendirme araçlarını kullanarak değerlendirmiştir. Değerlendirme sonuçları, Etiyopya resmi web sitelerinin çoğunun asgari web erişilebilirliği gereksinimlerini karşılamadığını göstermiştir. Bu, web sitelerinin web erişilebilirliği kurallarına veya erişilebilirlik standartlarına göre geliştirilemdiğini göstermektedir. Değerlendirme araçlarıyla tespit edilen en sık karşılaşılan sorunlar; alternatif metin eksikliği, ayırt edilebilirlik eksikliği ve uyum sağlama eksikliği oldu.

Anahtar Kelimeler: Web erişilebilirliği; devlet web siteleri; web siteleri değerlendirme; engelli insanlar; değerlendirme araçları

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LIST OF ABBREVIATIONS

CCS:	Cascading Style
E-government:	Electronic Government
GUI:	Graphical User Interface
HTML:	Hypertext Markup Language
UNCRPD:	United Nations Convention on the Rights of Persons with Disabilities
URL:	Uniform Resource Locater
US:	United State
W3C:	World Wide Web Consortium
WAVE:	Web Accessibility Evaluation Tool
WCAG:	Web Content Accessibility Guidelines
ISO:	International Standards Organization

CHAPTER 1

INTRODUCTION

Now a day most of the information or the services processed by using electronic government (e-government) systems. That means it enables to improve the service provides to the public sector by using resource efficiently and save the time to accomplish the service. In which e-government is convenient useful for the following area of the e-government. These exist to enhance government processes: eAdministration, connecting citizens: eCitizens, eServices, and Constructing outside communications: eSociety (Alshehri and Drew, 2011). Hence the e-government enhance the manual administration of the government into electronic based administration by implementing or using different supportive technologies for the e-government system, helps to build the paperless offices and the aim of this is to increase the organization performance and productivity. Moreover, eAdministration applicable for the communication takes place in within the organization and outside the organization or the communication perform in more than one organizations. Therefore, when the communication or the information diversified it brings accountability and transparency within the organization and the people (Bhavneet et al., 2013). In addition to that e-government encourage the citizen to use information technology and internet to get different services in different organizations instead of using manual methods to access different information, services and the citizen participate in politics, society and government. Digital services provided by the e-government websites serve the citizens by digital way and feed information easily (Zhiyuan, 2002). Another way of provide e-government services is eServices. In which eService offer service to the citizens like e tailing, customer support, and service delivery. All these have different implementation and a collection of different stakeholders like service provider, service ginner who gain services and the last one is the medium that used to transmit the information or the technology used to deliver the services (Gupta et al., 2018). EService most of the time used to business to customer transaction to sale the product online over the internet during this it saves time and resource wastes to access and get the product traditionally.

Website accessibility is the information or the resource in the e-government websites available is access by different stakeholder to get services by following the procedure to access the resource. In which the websites designed and developed to provide equal chances of access for the people to get the information and the functionality of websites. Therefore, when people use the e-government websites they can identify the information needed. They can understand the information or application perform in details to feed and get accurate information. Traverse from one page to other pages to access the desired information, they can interact to the websites to get information by using different interaction way like GUI, audio, text and etc. They can add data or information to the websites; it may be need to fill some desired fields from the user to process the requested operation. The website should be collection of different types of data format because different people or user of the system wants in different format or the people with disabilities does not understand or accesses every type of data format, so to make the websites accessible by every user without disabilities and with disabilities should include different formats. So the website accessibility should include auditory, cognitive, physical, speech and visual (Lewthwaite, 2014).

Website accessibility evaluation is the process of evaluating or testing the accessibility of the websites to identify the accessibility weather, it is accessible by different peoples with disabilities and without disabilities (Lewthwaite, 2014). In which this web accessibility evaluation used to identify the accessibility problem and fix the problem early before the problem hinder the accessibility of the websites. Therefore, e-government websites give service for the people everywhere, that means it is accessible in everywhere without any restriction therefore to test the accessibility of the websites it is mandatory to use accessibility evaluation tools and evaluate the accessibility. So, when evaluate the websites it has two ways of evaluating the first and the recommended one is during development phase when the design of the websites is under construction and the second one is after the development or deployment the websites or after the development of the websites is finalized. In order to evaluate the web accessibility developers can use website accessibility evaluation tools. By using these tools can evaluate and determine the content of the web whether it meet the accessibility guideline of the system. This web availability assessment apparatuses are program or online application used to determine the

accessibility of the Ethiopian governmental websites. Therefore, this tools identify accessibility issues of the websites and can use this in all steps of the development of the websites like in design and implementation phase and this tools are can check the accessibility automatically and can review it manually. Generally, e-government websites accessibility evaluation is important to identify the websites has accessibility problem and to fix it in order to provide fast and wider e-government services to all peoples.

1.1 Problem of Statement

E-government websites should be accessible to all peoples and universally everywhere without missing the content. In which most of Ethiopian governmental websites are not accessible in everywhere or it is not usable universally so evaluation of the Ethiopian governmental websites is important to identify the problem which factors hindered the accessibility of websites and to rank the e-government websites according to their accessibility and improve the problem face the accessibility issue of the websites. In addition to that, the governmental websites do not satisfy the people needs. Therefore, to identify the problem of this it is necessary to evaluate the e-government websites, to address, and to fix the accessibility problem of the e-government websites (Lewthwaite, 2014). Now a day the technology becomes more advances that make the websites easy to access by implementing different alternatives. However, the Ethiopian e-government websites still in the problem of accessibilities so to identify the problem of accessibility it is better to evaluate the websites automatically by using testing tools to troubleshooting the problem of accessibility weather it is HTML, CCS etc.

1.2 Motivation of the Study

We motivated to evaluate Ethiopian governmental websites because now a day the need of the people to use governmental services and universal accessibility of the governmental portals becomes critical community problems that should be evaluate and report the result for confirmation almost the baffling reality that most e-government websites not assembly the fundamental availability standards. Therefore, we try to identify the problem whether the Ethiopian e-government system is accessible universally by all people with disability and without disability and to prioritize the government portals grounded on the results of

accessibility. In which, widespread availability of portals the e-government information and electronic service is mainly significant. Hence, some Ethiopian e-government systems are not universally accessible due to different problem and the list ranked in the world e-government index so e-government accessibility is one criterion to measure the e-government system. Therefore, the researcher motivated to evaluate the accessibility of the Ethiopian governmental websites.

1.3 Objective of the Study

The general objective of the study is to evaluate the Ethiopian governmental websites those gives service for the people.   To achieve this following specific objectives are essential.

1. Review related literatures on the area of e-government evaluation for a better understanding and further awareness focusing on previously conducted researches for other websites.
2. Find Ethiopian governmental websites.
3. Evaluate the accessibility performance of the governmental websites using different testing tools.

1.4 Research Questions

The objective of the study is to evaluate the accessibility of Ethiopian governmental websites for the people. These are the research questions to address.

1. What is the current accessibility of Ethiopian governmental websites?
2. How many governmental websites are accessible to the people?
3. What are the common types of websites accessibility problem found?

All of the above research questions addressed after the compilation of the study. So this study generally designed to answer the above question properly after the finding was be achieve.

1.5 Scope of the Study

The scope of this proposed study is to evaluate the accessibility of the Ethiopian governmental websites those giving service currently to the people. In this study, the minister office websites and some agency websites those manly managed or organized at the federal levels evaluated. That means this study will not be evaluate websites except this because there are a number of websites giving service at regional levels governmentally and there are private websites giving service at the regional and federal levels. Therefore, such type of websites will not be including the accessibility evaluation of the websites under this study. Therefore, this study evaluated the accessibility the Ethiopian Governmental websites at federal level.

1.6 Literature Review

1.6.1 E-Government and Its Advantages

E-government is the means of communication between the government and the people by using different technologies as apparatus (Mohammed and Steve 2010). In which the people use the e-government websites to get service from the government offices by using electronic devices and websites to enhance the way of communication feeding and getting fast and reliable information. That means this used to provide services to the user within short period and the right information according to people requests or interest. Therefore, this saves time and resources because no need of wastes time to move and resource for traveling and other type of resources. In addition to that, the aim of the e-government is to make the information or the service easy to accesses to the citizens, enables the governments effective and efficient by delivering good and fast services and increases the responsiveness of the government to the citizens (Xia, 2017). In which the e-government systems have the above aims so this aims implement effectively it makes the government transparent and accountable or it increase transparency and accountability of the government. The user of the e-government system is the people with disabilities and without disabilities. Therefore, should be give equal opportunities to all peoples and gives different alternatives for the people with disabilities and without disabilities. They can access the e-government system everywhere because now a day the people use the internet and the technology to access different information and performer the transaction.

It Implies that e-government is plays a vital role for the development of one country (Mohammed and Steve 2010).

1.6.2 Web Accessibility

The technology, way of communication and transaction are advanced and use websites to performer the activities so to interact people with the websites those gives services, accessibility is one criteria to measure how it satisfy the people interest. Web accessibility initiatives define accessibility is the means that the designed web is access by the individuals with inabilities. Moreover, without disabilities, people interact with web easily, move from one page to the other or navigate in different pages, the people understand the web how to use, why to use such like things should be understanding by peoples and the people interact with the web. The people with disabilities should participate equally with other people without any discrimination like social, economic and political issue, therefore the websites should accessible by disabilities people, but some of the websites accessibility affects the people with disabilities because it doesn't give different alternatives of accessibility (Abuaddous et al., 2016). However, if the websites make accessible by people with disabilities, the people with disabilities can accesses the websites effectively. There are a number of people with disabilities and the type of disabilities varies from one person to the other persons. So, to address the websites accessible to every disability it should be includes the following way of accessibilities visual, auditory, physical, speech, cognitive and neurological, therefore, the design of the web accessibility should consider the above type of disability (Mohammed et al., 2017). In addition, web accessibility provides uses for the institute and the people without disabilities. To measure and confirm the accessibility of the Websites, flexibility is the main standard to measure web accessibility because flexibility used to measure weather it meets user requirements, condition and preferences. Web accessibility depends on different mechanisms of websites development like the one the software used to development tool and the people who develops the websites (Sánchez-Gordón et al., 2014).

1.6.3 Web Evaluation

Evaluation is the process that performs in websites or web application to test the accessibility of the websites to isolate the problem that hinder the accessibility problem happen. So to separate the accessibility problem of the e-government websites evaluation accessibility evaluation plays a vital role in the testing process of the system. In which the accessibility evaluation conducts in two ways. The first, way of conducting the evaluation is during the development of the websites, in this phase of evaluation the accessibility of the websites should evaluate at the development stages. Simultaneously before the development phase close down and the other stage start and the second way of conducting the evaluation testing after the development phase has finished or the development phase close down and the system deployed and open to use for the people (Mohammed et al., 2017). So by using the following way of evaluation, the e-government websites accessibility can be evaluating. There are two types of accessibility evaluation, the first evaluation is manual evaluation methods and the second is automatic evaluation method. Manual based websites accessibility evaluation is the way of evaluating the websites without using any automatic tools that means the experts can evaluate the web accessibility by reviewing the development deeply. So this type of evaluating should be evaluating by experienced and expert persons to investigate the problem clearly and deeply unless and otherwise the accessibility problem of the e-government websites does not discover properly. However, the automatic accessibility method is the process that used to evaluate automatically by using tools without human judgment. Hence, it is like that no need of human involvement at general because it is not alone by itself; it needs human to give input such like activities needs human interaction. Tools are the software applications that used to evaluate the accessibility of the Websites automatically and generate the result and the current problem hindered the e-government websites accessibility (Pandey, 2015).

1.7 Methodology

Methodology refers to the general procedures that used to follow to evaluate the Ethiopian governmental websites accessibility and use the necessary techniques and tools explicitly

elaborate in clear manner in this paper. It is the mechanisms settled in systematic manner to achieve the objectives of this work more appropriately.

1.7.1 Literature review

In order to gain deep understanding about evaluating the Ethiopian governmental websites accessibility methods, tools and techniques apply to use and the way interpret and rank the e-government websites according to the result gained during evaluation should review the related work.

1.7.2 Evaluation

Governmental websites should be evaluating in terms of accessibility performance conformance, this refers evaluation in testing phase is important to identify the government system which has accessibility problem and not (Mohammed and Steve 2010). In this experiment or evaluation, the researcher was performing automatic accessibility evaluation method to identify the accessibility issue of the government system automatically by using automatic accessibility evaluation tools. In addition, after the evaluation the government system that has accessibility issues identified according to the result gain from automatic evaluation tools.

1.8 Significance of the Study

When the researcher evaluates the accessibility of the governmental websites, the evaluation identifies the accessibility problem of the websites and address to the problem or the accessibility problem of the websites to the concerned body. Therefore, the study significant to different stakeholder, the first beneficiary is the people because when the e-government websites make accessible, they can access websites easier to find information, use successfully and they can access it. The second beneficiary of the study is for the organization. That means, when the e-government websites accessible. The people can access the information easily so during that the audience of the organization increase and the increase effectiveness of the e- government system. The third beneficiary of this study is the developer, in this study, the developer of the system can get the list of the websites those have accessibility problem and the developer can

easily fix it and if the websites more accessible it decreases the maintenance cost like resource and time.

1.9   Time Table

To accomplish this research, researcher needs six months. This duration study accomplished properly according to the tasks. Based on the methodologies the researcher used a schedule to accomplish the research in proper way for achieving the desired goal. Firstly, prepare an action plan of this research in a good way. Then based on the action plans performed sequentially to get the best result. The Gantt chart of this research that shows activities (tasks and/or events) displayed against time given in Figure 1.1.
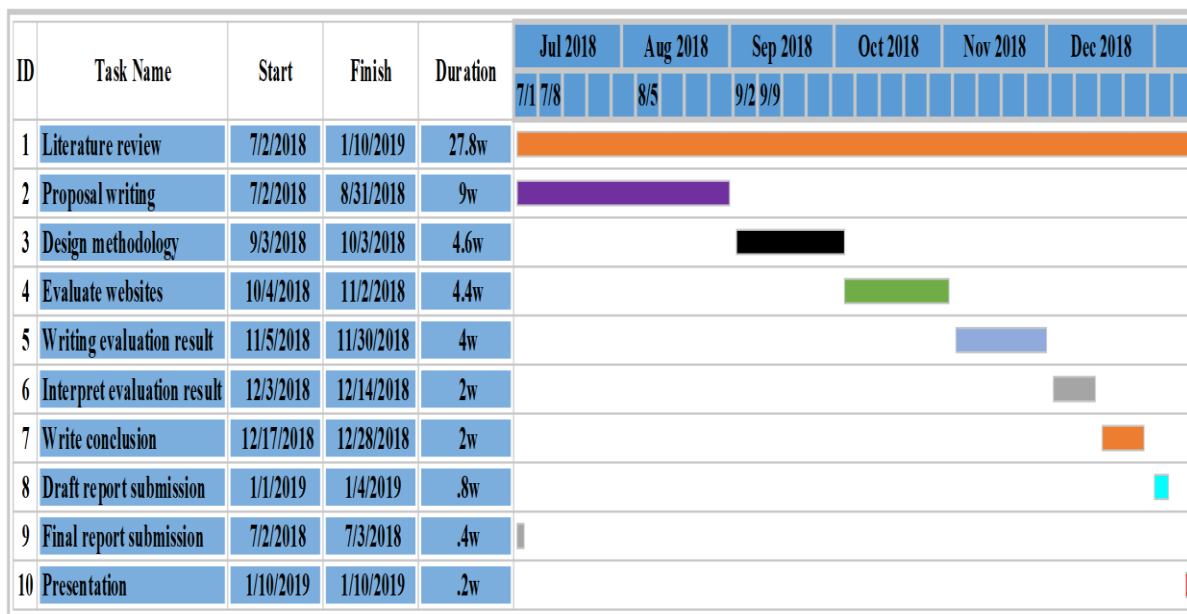
ID	Task Name	Start	Finish	Duration	Jul 2018	Aug 2018	Sep 2018	Oct 2018	Nov 2018	Dec 2018	
					7/1 7/8	8/5	9/2 9/9				
1	Literature review	7/2/2018	1/10/2019	27.8w							
2	Proposal writing	7/2/2018	8/31/2018	9w							
3	Design methodology	9/3/2018	10/3/2018	4.6w							
4	Evaluate websites	10/4/2018	11/2/2018	4.4w							
5	Writing evaluation result	11/5/2018	11/30/2018	4w							
6	Interpret evaluation result	12/3/2018	12/14/2018	2w							
7	Write conclusion	12/17/2018	12/28/2018	2w							
8	Draft report submission	1/1/2019	1/4/2019	.8w							
9	Final report submission	7/2/2018	7/3/2018	.4w							
10	Presentation	1/10/2019	1/10/2019	.2w							

Figure 1.1: Gant chart

CHAPTER 2

LITERATURE REVIEW

2.1 Web Accessibility

Web makes people life easy by giving different service and assist the user by feeding information to access easily. People use web in all over the world to transfer message from each other for communicate each other when they live apart. For education may be they follow the learning process by using e-learning method, for shopping they buy goods online by using online marketing system, for working they work their job by using different assistive technology and for voting citizen vote by using web technologies and for e-Governance the government govern by using web (Furuholt and Wahid, 2008). That means the government use web to handle and transfer information and give decision and information for the citizen by using the web. So according to this now a day the people make the web one apparatus to do their activities easy by saving their time and resources. The government uses the web to process their activities easily without any discrimination during that the way of transmit and doing the activities becomes efficient and effective. The web should be universal because all people without any discrimination weather they have disability or not, without physical capacity discrimination, gender and race (Kurt, 2018) should access that. In which when the developers design the web sites they should consider different options and alternatives in different perspective, develop different option for the user, and make the web universally accessible and gives equal opportunities for user for those live in diversified area. Therefore, when the web meets universality principles of the web accessibility without any limitation it meets the goal of web and it gives equal chances of access for user. Therefore, to access the web information without any exception, the content and websites should design and present in fashion that does not differentiate one user from another.

Web accessibility means a broad exercise that ensures, gives equal access for the user without any barrier of service for the user. Everyone including the people with disabilities may access the web easily. So this indicates that webs are correctly designed, technologically advanced and

amended, generally it can make functionality and information of the web access by all user of websites (Restrepo and Normand, 2010). Sometimes the people temporarily become disability like army broken during this time the web should include assistive technology to replace the mouse by other ways, but most websites have assistive barriers (Emmanuel, 2018). Web should be universally accessible by all users to meet web accessibility principles.

2.2 Importance of Web Accessibility

Web accessibility gives greater advantages and has important role in different sector. Web gives different service for different organization with different objectives and roles. This is important for the following user of the web individuals, organization, business and society. UNCRPD defined the rights of the people with disabilities and this right includes the rights of access the information from the web and uses the technologies for different purposes (Hackett and Parmanto, 2009). Since, web can be equally accessible for all people without any decimation weather they are with disability and without disability because everybody has the right to access the information equally, no race difference and face. In which when the web can be more accessible by the user and the business stakeholder the business sector become more effective because the people access the site easily during this time, it increases benefits of the business sector by increase the number of user and efficiency of the website or it becomes more useable. For example, the business sector can get more benefit because it gets more access or user and the education sector can have got more students because if the web is accessible, the students can easily access the web so it increases the benefit of the organization. In addition to that web accessibility technically essential to the organization by reducing the site improvement time and repairs time, reduce load of the server and bandwidth of the information to be transfer, well-matched to different browser, and enable the content access by different device and operating systems like mobile, screen reader etc. Furthermore, the web accessibility legally meets the conformance of the country requirement and in addition to the country legislation; it should be meets the W3C principles or legislation. In which if the web accessible for everyone without any limitation, it is legally accepted by the country and web accessibility guidelines developer organization (W3c_wai, 2018). Meanwhile, web should be meets the minimum requirements of the web accessibility principles and legislation of the country and should be accessible by the

people with different race, physical, face and with disability and without disability and by different device those are applicable to access the web. Therefore, the web accessibility plays a vital role in different sectors for different purpose and it is important to make the life easy by feed the information. Generally, the web accessibility important to access the information without discrimination and important to different stakeholder becomes beneficially by saving cost, time, resource and technically feasible to the organization.

2.3 Guidelines of Web Accessibility

The guidelines of web accessibility are important to design and develop the websites that meets the accessibility principle of the web. It used to measure the accessibility of the web by follow the guidelines published in formal and organized way by the organization of World Wide Web (Tollefsen and Ausland, 2017). WAI and W3C prepared a set of guidelines to makes web easily accessible for those the people unable to access the web easily without assistance (disabled) and for other user also. The first web accessibility guidelines published in 1999 and it is specifically call WCAG 1.0. These guidelines prepared to makes websites easily accessible and how the developers make it accessible. These includes the principles of accessing websites for disabilities people and without disabilities, because the people should be treated equally without any exception this implies they have equal rights of access the websites and getting equal information, job opportunities and services from different sectors. In addition to that, these guidelines of web accessibility give base lines for web designer and developer to design and develop the websites that meets the web accessibility requirements. This indicates that the designer and developer are beneficiary from this guidelines during the development phase of the web if they are follows this guideline. Since, as this entails the objectives of WCAG intended to meets web accessibility requirements for all people. Whenever, the designer and developer uses WCAG, indirectly the people becomes beneficial because the web fulfill the accessibility guidelines so it allows the user can access the websites easily. In addition, these guidelines do not prohibit the developers form including different contents on the web like video, image, etc. Rather make clear how to make multimedia file supplementary accessible to get an extensive viewer (Tollefsen and Ausland, 2017). After the WCAG 1.0, standards that used since 1999 the second version (WCAG 2.0) of the web accessibility guidelines published in December 11,

2008. Both of the versions designed to confirm the web accessibility, qualified by the ISO, and became internationally accepted to use as a basement for the web development and measure the accessibility of the websites. When testing conducted to achieve standards, it conducted into a combination of manual evaluation methods and automated evaluation methods. The manual evaluation needs experts to evaluate the websites by considering the standards of the accessibility. Because there are no automated tools used to assist the human, so manual method should performed by experienced or expert personnel. And the automatic way of web accessibility evaluation is conducted automatically because there are already designed and developed tools to evaluate according to the pre-defined standards and display the errors according to guidelines by identified which guidelines were missed or doesn't confirmed. The guidelines designed and prepared to confirm the interest of all people with different disabilities and the other users free from disabilities. The conformance of the accessibility of the web measures the minimum requirement for websites accessibility. WCAG 2.0 principles are benchmarks used to measure the ease of access of the websites for the people in different cases and ways. WCAG 2.0 has three levels of checking the accessibility of web and different priorities in different section by different categories (Tollefsen and Ausland, 2017). Therefore, WCAG 2.0 has better feature rather than the previous web accessibility standards. The current web standards used to measure the web accessibility is WCAG 2.0. Therefore, the norms include in the version 1.0 is included in the version 2.0. That means the content that meets 2.0 is should confirm the content the police or the guideline 1.0 (Tollefsen and Ausland, 2017). However, this WCAG 2.0 is available in Achecker software application used to evaluate the websites without human intervention automatically, so for this study Achecker used to measure Ethiopian governmental websites. During of the design phase of web content accessibility guidelines different stakeholders participated for example individuals, organization, developers of web and other software and professionals. WCAG is mainly intended for, designers of the web, who develop web, automatic evaluation tool developer and for others who wants to web accessibility standards. WCAG 2.0 established for methodological standard of web accessibility measurement, which used to measure the accessibility of web (W3C WAI, 2018). Accordingly, the contents of the web ease of access guidelines are the bases to test ease of functionality of

websites. In addition, web contents availability for all people without any exceptional case for with disabilities and without disabilities. Moreover, it is applicable for developer, designer and organization towards measure the ease of access of the web. According to on, the essential of requirement or guidelines set previously to confirm World Wide Web Consortium (W3C) conformance checking criteria.

2.4 Assistive Technology

Assistive Technology means any device that used to assist or help the people life to make easy. This assistive technology exceptional designed and developed to help disabled people can access and done activities like as people without disabilities. Meanwhile, the disabled and people free from disabled have equal right of access the information from the websites, so people to perform equally, the disable people use assistive technology. Accordingly, assistive technology designed and developed to make the people equal without any exceptional cases. In this case the technology developed to help the people who unable to access the web easily without assistance, so this can make the web accessible without any limitation or hindered, with the same as the people free from disabilities. In which assistive technology is a tool or a device that gives service to the user of the web to make the life easy. Because there is the user who can't access the web without assistive technology, due to natural problem (they are disabled during birth) or they are accidentally disabled after birth (car accident, chemical…etc.), therefore, this helps the user to access the web by using assistive technology. This enables the people with disabilities can enhance their life by using assistive technology and develop the ability of access the web without any fear. Similarly, assistive technology develops willingness to the people with disabilities, it enables, they to access the web equally with people without disabilities. In addition to that assistive technology conducive working environment to people with disabilities and they can get equal job opportunities the same as to people without disabilities. The people with disabilities can get various benefits from this technology some of this are they can communicate easily, can interact with different people, can enjoy education, entertainment and easy to use computer and access the web easily by using the assistive technology. According, to WHO information and evidence 15% of the population lives with disability but the difficulties of disabilities vary from one person to the other so they need

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different types of assistive technology to support them according to the problem to access the web easily (World Report on Disability, 2018). The people with disabilities benefits from assistive technology listed as follow (Cook and Polgar, 2014).

- ➢ Visual complications
- ➢ Hearing complications and
- ➢ People in various intensities etc.

Assistive technology plays various roles listed in the above; they suffer various complications of disability. This helps in various filed for example it simplifies the getting of information to the people with disabilities, they use technology to facilitate the activities they perform and people with disabilities can perform activities as they need…. etc.

There are different types of assistive technology developed to support the individuals with incapacities can access the web easily and can perform other activities. So in the context of web accessibility the following devices was developed but it should be compatible with different component of the computer parts like, compatible with operating system, input device, output device and software (Cook and Polgar, 2014). Alternative input is one types of assistive technology if there are the people, they cannot able to use keyboard, mouse they need other alternative devices to feed information to the computer. Assistive technology and websites are should designed and develops suitable to the people with disabilities in addition, compatible operating systems and other part of the computer unless it becomes invaluable. Alternative output device is the second types of assistive technology. It assists that if the people with disabilities have problem of recognize normal output of the computer it should be use other assistive technology as alternatives but it should be compatible to every software and devices.

2.5 Automated Web Accessibility Testing

This type of accessibility testing method is a newly established method, which incorporates an unused level of advancement since the distribution of WCAG 1.0 in 1999. The AWAEM points to mechanize the method of assessment and keep websites compliant with web openness

controls (Abduganiev, 2017). According to Abduganiev (2017), the web come to be important to our day to day live activities and user of the web also increasing simultaneously to make the life easy by accessing the web without physical interaction. Hence, the essential of making the net available to all individual with inabilities and without disabilities because the people use web for their day to day life activities. Therefore, to test the accessibility of the web weather it meets the web accessibility standards, use automated web accessibility testing because it automatically checks the accessibility of the websites according to WCAG 2.0 for everybody. Automatic testing certifies much sooner, and gives a good idea of the ease of access. However, there are certain issues that automated testing cannot detect (Pandey, 2015). This gives several advantages some of this are fast and easy to obtain the accessibility problem of the web. In addition, no need of human involvement during accessibility testing of the web and the testing process of the web suitable to web accessibility guidelines. Moreover, Applicable to evaluate large number of web pages at a time and the disadvantages of this 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 (Vigo and Brajnik, 2011).

The automated testing depends on the tools, standards that utilized to assess the availability of web and it should run in different operating system and browser. The selection of automated testing tool differs from one person to the other because it depends on personal interest and features of the tool that has. To select effective tools, the designer or other concerned body should consider the following three criteria. The first one is useful, to determine the weakness and strength of the tools. The second is a viable is used to determine the tools is cost effective, that means it is possible to use it with limited or minimum resource like (time, money etc.) and finally, a repeatable is to determine is the applications or tools is applicable to use repeatedly on different web and by different inspector. Therefore, no common standards that used to select the tool as automatic evaluation tools. Therefore, the evaluator can choose the tool depends on the features he/ she need. Automated testing tools used in different process of the web development phases. The basic phases of the development the tools should be implemented in design phases of the web, development phases of web, maintenance phase of the web development to fix the

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problem and finally use the tool to upgrade the web by adding additional features of the web (Brajnik,2004).

2.6 Manual Web Accessibility Testing

The software program tools not idealized in identifying availability complications, and human inclusion is fundamental on a few courses of action to decide on the off chance that there is truly an ease of get to issue. The program instrument displayed a few of the rules for availability as manual checks. These manual checks hailed as conceivably causing an availability issue. In any case, the human direction is required to decide whether it is an openness issue. To make sure that automated testing can't found every problem of the web, therefor Human involvement is important to identify the problem that didn't detect by automated testing, because the tools depends on the guidelines and its performance Lazar et al., (2003). Manual test is performing to web accessibility testing by expert who recognize and understand all the web accessibility problem of the web. This way of testing helps to meets end to end testing of the web accessibility. Some of the manual testing listed and defined as follow to check the html. The expert validates HTML part of the website, check the heading of the web weather it is on the right or the left or the center of the web, the font size and style, check the contrast, check web include alternative text, captions and transcripts, forms and labels, testing with assistive technology and pdf forms etc. (Pandey, 2015). Generally, this manual testing evaluates so many things.

2.7 Common Web Accessibility Issues

In this section of the study, the common web accessibility issues that recognized by different stakeholders are stated in this part of the study. The stakeholders those detects accessibility problems are web developers, web designers and web authors are identified common web accessibility problems. In addition to those applied on websites, there are various studies conducted on the accessibility issue of the websites and various web accessibility issues was addressed by this study by the researchers (Moss, 2008). Accordingly, the following most common websites accessibility issues or errors was described as follows, the websites missed alt tags for the images contents in the web websites, the explanation of the audios are

unexploited in the websites, the link does not use java script or to hyperlink, the websites link there is no java scripts. The errors listed in the above are the most common errors generated against to web accessibility guidelines WCAG 1.0 and WCAG 2.0. In which the above errors detected in the evolution of the web accessibility this indicates that the websites did not meet the minimum conformance of the websites accessibility, so the websites need minor modification or enhancement to make it accessible to all users of the user of governmental or non-governmental websites (Leitner et al., 2009).

The most common accessibility problems demonstrated in this evaluation are the same as the websites evaluated in this research. Sloan (2010) stated: The governmental portals is suitable to use images and other graphics contents, this graphics are not use only for format the websites, but also to use transmit the information easily because this is graphical user interface and understandable easily to the use. An article that was published by Shawar (2015), surveyed there are significant errors on web accessibility for individuals with inabilities. Meanwhile, web designers and developers do not make their websites accessible by different tools and does not applicable to use assistive technology to make the web accessible for individuals with inabilities. Therefore, the websites developed with out to support tools or different technology unable to use by all people, so websites are not meet the minimum conformance of WCAG guidelines. Nevertheless, in cases where websites are easy to access, they make it probable for individuals with inabilities to make use of the Web (Shawar, 2015).

According to Wentz et al. (2015), unapproachable websites are composed of different errors such as keyboard problem to input data, navigation problems to Travers from one page to the other by using TAB button. Most the reports or the researcher finding shows that, most of the websites faced by similar accessibility problems. The best way to discovery out if there is satisfactory contrast is over and done with the use of a color contrast analyzer (Park and Lim 2016). The common openness issue that influence carousel and slideshow capacities is that they now and then do not have controls, especially the play, and stop, forward and back bolts. In arrange to guarantee that carousels or slideshows can be effectively gotten to by clients, one

must be able to delay, play, move forward and move back by utilizing the buttons on the carousel (Leitner et al., 2015).

2.8 Web Accessibility Policy

Web accessibility policy plays a great role in the development of web accessibility for all people without discrimination, because the designer or the developers of the web consider that policy designed to use as a guideline. Hence, some country develops their own web accessibility polices and as a basement to increase web accessibility. However, I am not included all countries polices in this literature review, so researcher included only the general polices used as common. The existence of disability right legislation makes the people with disabled people have equal right of access the web the same as the people without disabilities. The disability right legislation and digital accessibility reduce the inequality between the disabled people and the people without disabilities, because the technology gives equal access opportunities without inferiority, in case if the user who is disabled and unable to access the website, the technology gives the opportunities to enables the access of the web easy (Sloan, 2014).

Within the US, the advancement of a legal framework adjusted for desires and concerns of crippled persons with regard to web openness viably begin within the 1990s, with the statement of a few pivotal government statutes centered on that issue. To start with, 1990s, American unequivocally precluded segregation and ensured rise to opening for impaired people in work, state-owned, and constrained government administrations, open housing, commercial offices, and transportation (Becker, 2008).

CHAPTER 3

RELATED WORKS

In this Chapter, research works done in the area of web accessibility of governmental websites evaluation and ranking presented. Many researchers conducted research or done many research on web availability assessment of different countries' governmental and non-governmental portals. However, there is no research done until now for accessibility evaluation of Ethiopian governmental websites. Because of this reason, the review focused only on researches done for other countries' web accessibility evaluation. Therefore, the research done for other countries web accessibility evaluation stated as follow.

3.1 Accessibility of Dubai e-Government Websites

In this research, the researcher examines the degree to which accessibility of websites meet taken into consideration in the design and the development of governmental portals. In design part of the study, the researcher identified 21 Dubai governmental website and was evaluated it based on the guideline set be World Wide web by establishing automatic web accessibility tools. The researcher finding discloses that many portals did not meet the lowest W3C ease of access conformance requirements of ease of use. The research finding result implies the portals were evaluated does not confirm or fulfill priority-1 accessibility standards and barriers were identified in this study that related to the lack of script equals to the content that is not typescript features, and the discouragement of the fixed equivalents for go-ahead content to get modernized when the dynamic content changes. Respected understandings to discourse the accessibility barriers also delivered. It mentioned that government organizations and community sector organizations should advance a set of best strategy for ease of use practices in accordance with WCAG guidelines (Mourad and Kamoun, 2013).

Mourad and Kamoun (2013) were tested the Dubai governmental websites automatically and they finalized most of Dubai websites needs enhancement to makes it more accessible and meets the web accessibility guidelines. In addition to this, it should have considered the accessibility

opportunities of the disabled people those unable to access the web without any supporter (they may need additional technologies, alternative contents…etc.).

3.2 Turkey Governmental Websites Accessibility

On the study conducted on Turkey governmental portals, the researchers proposed to estimate ease of access of Turkey governmental portals of gives service to the user. Akgül and Vatansever (2016), measured the availability of 25 government portals and researchers were measured the portals by using application or software tools to measure portals accessibility. The finding of this research indicated that the entire evaluated websites do not meets the accessibility guidelines of the web and desires of the individuals with inabilities. The investigation conducted on portals accessibility, finding result summarized by the researchers the Turkish governmental websites evaluated did not achieve the minimum requirement of the web accessibility standards (Akgül and Vatansever, 2016).

The researchers got difficulty to get Irrefutable outcomes because different automatic testing tools generated different results. Consequently, researchers were confused to say which one of the tested portals fulfills the greatest levels of accessibility and poorest levels of ease of access of websites standard.

As the researcher concluded, the web accessibility faced by the following common problems. The first one is the nonappearance of correspondence script for non-text contents and the additional one is the failure of static equivalence for the dynamic content of the web because to get update when dynamic one changes.

The researcher recommended, different stakeholder of the websites. The first stakeholder recommended by the research is websites designer. They recommended the designer should consider the websites accessibility guidelines because there are different guidelines designed for the web accessibility principles, that guidelines more emphasized for disabled people accessibility therefor, to makes the web enables, and applicable to access for the people those unable to access and to protect the right of gets information for disabled people. Secondly, the researchers recommended to the government develop its particular web accessibility guidelines

or using the guidelines developed by W3C. Finally, the researchers were decided that the organization should take the responsibility to make the net accessible to every individual specially for the people with disabilities because disabled people needs more accessibility than the other due to different problems of accessibility. The disabled peoples should take the responsibility of creating consciousness for the organization they to makes their websites accessible to disabled peoples they are unable to access the web normally without alternatives.

3.3 Web Accessibility of Central Government of Nepal

The investigation conducted in this study by Shah and Shakya (2007) were estimated 27 organizational portals of the Central Government of Nepal. The researchers used webs accessibility evaluation procedures and to measures ease of access of portals and use Bobby tool for testing. This Bobby evaluation tool categorized the evaluation results into 4 pieces: Quality, Accessibility, General, and Privacy. For this paper, the researchers focused only the accessibility part of the result because their objectives were accessibility evaluation of Central Government of Nepal (Shah and Shakya, 2007).

As the evaluation result showed, after the researcher were evaluated the websites merely the Industry Ministry, Ministry Supplies and Commerce meets guidelines of the level "A" and "AA" conformance. Although, the Foreign Affairs Ministry and the Physical Planning Ministry and Works meets only the level "A" conformance of web accessibility. Other organization portals did not fit to any level accessibility conformance of accessibility.

The researchers were concluded according to the result obtained from obtained from the evaluation results web accessibility of Central Government of Nepal is inadequate. According to that, 11.1% of the websites homepages confirmed the level "A" conformance of web accessibility evaluation. That one is essential towards recognized the portal adequate to meet level A because this exists important for web accessibility. The researchers were sated that the governmental websites need more improvement because it does not meet web accessibility conformance.

In arrange to handle web availability issues, the government of Nepal ought to begin with, handle web openness at the approach level, by creating openness rules and controls taken after by enormous mindfulness programs government chairpersons and specialized staff dependable for web improvement. This is vital that technical parts and manual modules of net development and collaboration to work in a group of people in order to be the web accessible, so that government obligation towards citizens reflected on its websites. As the researchers were stated, the government of Nepal gives concentration for the citizens' right of accessibility of the websites (Shah and Shakya, 2007).

3.4 Web Accessibility of   South America E-Government

In this research, the researchers were evacuated the accessibility of the governmental websites of South America. The researchers have been used automatic tools web evaluation to examine the accessibility of the web on the base line of web accessibility guidelines. The reasons the researchers were selected automatic evaluation tools, it evaluates the web quickly and provide quick results according to the evaluation. In addition to that, automatic evaluation can be best to test web accessibility conformance. In this research only the main or homepage of the web evaluated and analyzed according to the evaluation results but totally cannot replaces expert's evaluators decisions. In this study the researchers were got difficulties to concluded which one of the evaluated websites confirmed the best levels of competency and which one of the evaluated websites doesn't meets the levels of competency of the web accessibility guidelines because different evaluation tools generate different results (Lujan-Mora et al.,2014).

As the researchers concluded according to the automatic testing tools results, most South American governmental websites were evaluated do not meet the web accessibility requirements. Consequently, the governments should implement laws to increase the ease of access of the websites and governments have a duty to implement polices to encourage the people and the organization to use electronic governments in order to meet web accessibility principles and to come across the needs of disabled peoples. Finally, the researchers were decided that identify the common problems that hindered the web accessibility problems (Lujan-Mora et al., 2014). Generally, South America governmental websites were evaluated have the

accessibility problems. That means it does not establish and confirm web accessibility guidelines and the peoples with incapacities and without inabilities unable to access web easily. Specially, the people with disabilities do not compute same as the other peoples due to web accessibility complications.

3.5 Web Accessibility of Pakistan Governmental websites for Disabled

In this paper, the targets of the researchers were to evaluate the central government of Pakistan governmental websites. There are 45 governmental websites were identified by Bakhsh and Mehmood (2012) to test the accessibility of the web centered on the groundwork of the web availability conformance guidelines. Researchers were used two freely online available automatic evaluation tools to test the governmental websites. The first tool was used to evaluate the websites weather it meets WCAG 1.0 and WCAG 2.0 ease of use requirement guiding principle or unable to meet it. The succeeding tool used for compare ease of use level centered on percentage of success assessment results (Bakhsh and Mehmood, 2012).

According to Bakhsh and Mehmood (2012) finding results the Central Government of Pakistan should devote greater effort to make the web easier to get for disabled people because the finding indicated that it didn't meets the web accessibility guidelines. The inaccessibility of the web was become the cause of making inequality between people and it unable the government to come across the needs of the individuals with inabilities.

Finally, the researchers were decided according to the finding they got after evaluated the governmental websites Pakistan governmental websites unable to access the information share on the governmental websites because when the web designed and developed doesn't consider and confirm the W3C accessibility standards. Moreover, it makes discrimination between on disabled people and the in disabled peoples on web accessibility. The researchers were wants to expand the evaluation of the web to local governmental websites rather than evaluate only central governmental websites as a farther evaluation of the feature (Bakhsh and Mehmood, 2012).

3.6 An overview of Web Accessibility in Greece

The researchers targeted to assess the accessibility of Greece portal from at begging of the investigation. According to that, 250 public and commercial websites analyzed and selected by the researchers. These 250 websites were the sample size of the web site was tested and it separated into two the first one was governmental websites and the second was private websites that gives different services to the disabled people and without disabilities (Basdekis et al., 2009). The researchers were conducted the evaluation in two times by separated in year. Therefore, the first evaluation performed in 2004 and the second performed in 2008.

The researchers were used automatic evaluation tools to evaluate the web accessibility accordingly predefined standard of W3C.In addition to the automatic evaluation tools the researchers were used manual way of tasting the websites by experts of the web evaluation to makes accurate the results obtained from automatic web evaluation tools.

In this paper, the researchers concluded the accessibility of the web after they got the analyzed results and the conclusion divide into two parts. The first conclusion was the websites evaluated in 2004, the results obtained in 2004 sated as follows, 73 % of the websites tested failed because it does not meet the low levels requirements of W3C guidelines. From the samples were evaluated 1% of the websites fully accessible and meet the minimum requirement of the web accessibility. The second conclusion was the websites evaluated in 2008 after four years of the first evaluation of the websites accessibility. In addition, the results of the second evaluation stated as follow, 85% of the websites were evaluated failed the testing process of the web but the technology was advanced in 2008 but the accessibility of the web decreases unexpectedly. This indicates that most of the websites does not meet the web accessibility guidelines and inaccessible but small number of the websites fulfills the requirements of the web accessibility standards (Basdekis et al., 2009). That means the importance of websites accessibility miss understood.

CHAPTER 4

RESEARCH METHODOLOGY

In this chapter, the research design the proposed automatic web accessibility evaluation of the Ethiopian governmental websites presented. To evaluate the web accessibility, the research designs and techniques defined in this part of the study. The procedures and the techniques essential to gather the information about the research conducted process of the research and select the process and tools for the testing of the web specified and well defined in the research methodology part of study. Therefore, the major component and procedure necessary to this research disused and defined as follows.

4.1 Research Method

As the research objectives defined in the first chapter of the study is to evaluate the accessibility of Ethiopian governmental websites. Therefore, 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 Ethiopian governmental websites on basis line of web accessibility guidelines. Because, this research method expresses the data in number and finalize or analyze the results, essential to specifically measures the problems and applicable to show the results in table form, chart and graph (Rahi, 2017). I used this research method to conduct the web accessibility evaluation and represent the finding of the study according to the results generated by the automatic evaluation tools. In addition, quantitative research method, qualitative research method used to evaluate the websites according to web accessibility policy and guidelines. Therefore, this quantities method is important the measure quality of web accessibility accordance to the conformance of the web accessibility and used for accessibility evaluation of the websites on the base line of W3C guidelines.

4.2 Research Strategy

To conducted this study and achieved the objectives the researcher used experimental research strategy. Meanwhile, this strategy applied to evaluate the websites automatically by using freely online available tools. Tools used to evaluate the websites automatically without the need of human involvements of the testing process and tools evaluated the websites according to W3C guidelines and policy. Experimental strategy essential to measures the accessibility of web for the people or users they need access the websites for different usage (their day to day life activities) without any limitation and the automatic websites testing confirmed weather the websites meets the accessibility principle of the websites or not.

4.3 Research Approach

Depends on the research objectives, this research followed principles of exploratory research rather than the other type of research. This is a research approach and its main aim is expansion the initial understanding about the research problem, awareness about the research problems identified and finally identifies the variables that makes a problem at the begging [40]. Accordingly, researcher used exploratory research approach to understand the web accessibility issues that makes the web inaccessible to the people or users of governmental websites. In the circumstance of automatic web accessibility, evaluation exploratory approach used to investigated and gathered information about the way of evaluation and examines the problem of the webs accessibility. Addition to exploratory approach, case study approach used to define the problem according to the W3C guidelines in depth examination and conformance checking of the accessibility standards of the webs.

4.4 Sample Design

The objective of the investigation is test accessibility of Ethiopian governmental websites. 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 research the researcher was identified all the governmental websites gives service to the people for different purpose and researcher selected all governmental websites to test its accessibility of the web according to web accessibility guidelines. The total numbers of websites provide services for Ethiopian government is 60 websites from these 37 websites are not working due to different problems so the researcher decided that to evaluate 23 governmental websites for the study. These 23 websites selected as the sample size for this research. To select the sample of the websites to be measure the accessibility automatically followed non-probability sampling techniques because first researcher selected and identified the total websites provide services for the government and the people after that discarded the websites that does not work.

4.5 Tool Selection

For this research to achieve the research objectives important, to use web accessibility evaluation tools. Because of this, reason necessary to select automatic webs accessibility evaluation tools. Therefore, way of selecting the tools and process described as followed.

The automatic web evaluation tool is a software program that used to evaluate the accessibility of the websites based on W3C conformance measuring criteria. There are different automatic web evaluation tools those have different functionality and features. Consequently, by considering the cost feasibility to use this tools, availability of the tools to use every time and the reusable of the tools and the accuracy of the tools when generating the evaluation results, Achecker and WAVE were selected to measure the accessibility of the web automatically without human interference.

The reasons Achecker and WAVE selected to this research is both are open source and freely available so it is easy to access and use to evaluate the websites without any requirements. Achecker has a lot of standards and priority to evaluate the websites on the basis line of W3C conformance checking standards. This includes WCAG 1.0 (level A, AA and AAA) and WCAG 2.0 (A, AA, AAA). WAVE is evaluation tool that used to evaluate the accessibility of the websites. It evaluates the websites automatically offers graphic feedback of the websites were

evaluated. In addition, the main features of this evaluation tool is evaluate and detect the contrast errors of the websites explicitly rather than the other tools.

4.6 Website Audit

The objective of this study is to evaluate the accessibility of Ethiopian governmental websites automatically. W3C has designed and released a methodology to evaluate the accessibility of the websites according to conformance checking of W3C. This methodology used to assist the evaluator according to the methods and the evaluator follows the evaluation procedure. In addition, evaluate full part of the websites including different application and websites used by different device like mobile websites so this method is applicable to evaluate the websites in applicable for different compatible devices (Sloan et al., 2002). The Ethiopian governmental websites accessibility was automatically tested by tools and results generated according to W3C guidelines and the result summarized by quantitative approach of the research. Therefore, this methodology is applicable to measures the accessibility of the governmental websites identified in the sample design part of the research.

4.7 Data Analysis

In this research, the data analyzed according to the evaluation result generated from automatic evaluation tools. The tools used to evaluate the webs accessibility display the results in different sections with its problems so according to that results got from the tools analyzed by considering W3C accessibility standards and criteria to check whether it meets accessibility guidelines or not.

CHAPTER 5

WEBSITE EVALUATION & RESULTS

In this chapter the evaluation of the Ethiopian governmental websites tested automatically by using automatic evaluation tools. In the above chapters, so many issues reviewed and clarified that used to as abasement for the website accessibility evaluation. Some of the issues were disused as literatures reviewed related to important of web accessibility, how the web accessibility measures, guidelines used to evaluate the websites, different country web accessibility evaluation and the methods used to evaluate the accessibility of the webs. The methodology part of this research included so many contents like how to select the sample size, research approaches, how to select the tools and how to analysis the results. After the above chapter and contents addressed the evaluation of the Ethiopian governmental websites evaluation performed as followed, before the evaluation conducted the procedure of evaluation stated as followed below.

5.1 Procedures of Web Accessibility Evaluation

To meets the objectives of this research, the evaluation of the web performed in this part of the research, so to measures the accessibility of the websites procedure of the web evaluation is important.

Procedure of automatic web accessibility evaluation

1. First, identify and select the websites to measures the accessibility.
2. Select automatic evaluation tools to evaluate accessibility of the websites. For this research, Achecker and WAVE automatic testing tools selected.
3. Enter the URL or the address of the websites to evaluate on the automatic tools.
4. The tool evaluates the websites to identify weather the websites meets the WACG 2.0 conformance requirements.
5. The tool generates the result of the evaluation.
6. Finally, the report written in organized format.

5.2 Description of Sample Websites Used for Evaluation

Ethiopian government use websites to offer service and information to the citizen easily in different sectors for education, business, management and social. Measuring of the accessibility of the websites essential to confirm it is accessible to the people or not. So in order to test the ease of access of the website the following 23 websites were selected form 60 websites because the others were not accessible and applicable to measure the its accessibility on November 2018 . Hence, selected websites listed as followed in Table 5.1.

Table 5.1: Selected governmental websites

No	Name of Organization	Websites Address
1	Agency for Government House	http://www.agh.gov.et/
2	Central Statistical Agency	http://www.csa.gov.et/
3	Commercial Bank of Ethiopia	https://www.combanketh.et/
4	Documents Authentication & Registration Office	http://www.daro.gov.et/
5	Ethio ICT Village	http://www.ethioictvillage.gov.et/
6	Ethio telecom	http://www.ethiotelecom.et/
7	Ethiopia E-Service	https://www.eservices.gov.et
8	Ethiopia main portal	http://www.ethiopia.gov.et/
9	Ethiopian eVisa Portal	https://www.evisa.gov.et
10	Ethiopian Intellectual Property Office	http://www.eipo.gov.et/
11	Ethiopian Investment Commission	http://www.investethiopia.gov.et/
12	Ethiopian Public Health Institute	https://www.ephi.gov.et
13	Ethiopian Revenues and Customs Authority	http://www.erca.gov.et/
14	Ethiopian Roads Authority	http://www.era.gov.et/
15	Ethiopian Shipping and Logistics Services Enterprise	http://www.ethiopianshippinglines.com.et

16	Ethiopian Space Science and Technology Institute	http://www.essti.gov.et
17	Federal Transport Authority	http://www.transportauthority.gov.et
18	Ministry of Communication and Information Technology	http://www.mcit.gov.et/
19	Ministry of Defense	http://www.fdremod.gov.et/
20	Ministry of Science and Technology	http://www.most.gov.et/
21	National Bank Of Ethiopia	https://www.nbe.gov.et/
22	National Educational Assessment and Examination Agency	http://www.app.neaea.gov.et
23	Public Procurement and Property Administration Agency	http://www.pppds.gov.et

5.3 Study Results

5.3.1 Study results of Achecker WCAG 1.0

To evaluate the Ethiopian governmental websites Achecker tool used to evaluate the websites automatically and the results described as follow. Table 5.2 show the automatic testing results of the Ethiopian governmental websites evaluated by Achecker WCAG 1.0 tool on November 2018. The table contains six columns; the second column shows the name of the organization. The third column shows the evaluation result of WCAG 1.0 priority 1 or level A, the fourth column shows the testing results of WCAG 1.0 priority 2 or level AA. The fifth column shows the testing results of WCAG 1.0 priority 3 or level AAA and the sixth column shows the average results of the evaluation results.

Table 5.2: Accessibility evaluation results of Achecker WCAG 1.0

No	Name of Organization	WACG 1.0			
		Level A	**Level AA**	**Level AAA**	**Average**
1	Agency for Government House	3	5	24	10.67
2	Central Statistical Agency	3	1	3	2.33
3	Commercial Bank of Ethiopia	36	38	49	41
4	Documents Authentication & Registration Office	2	2	7	3.67
5	Ethio ICT Village	4	3	5	4
6	Ethio telecom	15	2	3	6.67
7	Ethiopia E-Service	2	2	3	2.33
8	Ethiopia main portal	15	1	35	17
9	Ethiopian eVisa Portal	2	1	3	2
10	Ethiopian Intellectual Property Office	36	33	53	40.67
11	Ethiopian Investment Commission	4	1	2	2.33
12	Ethiopian Public Health Institute	5	3	9	5.67
13	Ethiopian Revenues and Customs Authority	0	1	11	4
14	Ethiopian Roads Authority	3	3	36	14
15	Ethiopian Shipping and Logistics Services Enterprise	9	12	23	14.67
16	Ethiopian Space Science and Technology Institute	19	6	11	12
17	Federal Transport Authority	0	0	1	0.33
18	Ministry of Communication and Information Technology	13	1	31	15
19	Ministry of Defence	0	1	2	1
20	Ministry of Science and Technology	43	40	50	44.33

21	National Bank Of Ethiopia	33	69	73	58.33
	National Educational Assessment and				
22	Examination Agency	7	3	7	5.67
	Public Procurement and Property				
23	Administration Agency	4	0	1	1.67
	Total	**258**	**228**	**442**	
	Mean	**11.22**	**19.00**	**19.22**	

The above Table 5.2 shows the accessibility evaluation results of Ethiopian governmental portals using Achecker WCAG 1.0 tool. According to the results generated automatically by the testing tool, Federal Transport Authority did well in priority 1 spot check with 0 errors were detected,0 error were detected in priority 2 spot check and 1 error were detected in priority 3, and this indicates that this website closest to the minimum requirement of web accessibility in WCAG 1.0. And the second website close to this result is Ministry of Defense, as the result indicated in the above Ministry of Defense did well with priority 1 spot check with 0 error detected, 1 error was detected in priority 2 and 2 error was detected in priority 3. Moreover, the third website close to the minimum requirements of accessibility is Ethiopian Revenues and Customs Authority in priority 1 and 2 because automatic evaluation tool detected zero and one in priority 1 and 2 respectively. Evaluation results of the finding imply that most of the websites does not confirm the accessibility guidelines of WCAG because the testing tools generated the problem that was defects the accessibility of Ethiopia governmental websites. Therefore, the result of tested websites generated in three parts divided by levels, such as level A, level AA and level AAA. Based on levels the websites tested in each of three levels and results generated in each level. Due to this, reason the analysis of the finding analyzed in different perspectives.

The first perspective of analyze the results of the testing is using the single values in each levels. Subsequently, as the evaluation results indicated in the first level A, most of the portals did not confirmed the lowest level of accessibility conformance. However, three websites meet the minimum requirement of web accessibility conformance and zero errors detected and generated

for each website in level A. The websites that meet the requirement of accessibility guidelines is Federal Transport Authority, Ministry of Defense and Ethiopian Revenues and Customs Authority. In addition, there are some websites closest to the minimum requirements of web accessibility conformance. In which the finding indicated that some websites are more accessible than the other when those compared to each other in level A. Level AA is the guidelines used to measure the accessibility of the websites, accordingly, the websites evaluated by this level and the results were generated. As the testing results indicated that generated from level AA most of the websites has an accessibility problem that means unable to satisfy the need of the people because evaluated websites did not confirm the minimal level of competency for accessibility. Depends on the results, Federal Transport Authority, and Public Procurement and Property Administration Agency websites generated 0 errors from the whole websites were evaluated in level AA guidelines. Nevertheless, Public Procurement and Property Administration Agency website did not meet the level AA conformance measurement guidelines because to say the portals confirm level AA, all priority 1 and 2 should be meet, but based on the results showed in the above table does not meet priority 1 checkpoints. Unfortunately, the remaining websites were not satisfied the level AA accessibility conformance standards, so the people will find difficulty when they try to access the websites. Moreover, the third level of accessibility evaluation is level AAA, in this level of accessibility evaluation, Ethiopian governmental websites evaluated and the results listed in the above table. The results indicated that there are no websites satisfied the minimum priority checkpoints of competency, but there are some websites near to the minimum levels of accessibility and the other websites found in the opposite side of some particular websites.

The second perspective of analyze the results of the testing is using the mean values of the evaluation results in each levels. The Ethiopian governmental websites evaluated in three level of priority and mean values of each level of results were included after calculation of the total errors detected. Accordingly, the mean results of each level stated as follows. The mean results of levels A is **11.22** level AA is **19** and level AAA is **19.22**. Because of mean show, the websites more accessible for priority 1 than priority 2 and 3, and the websites more accessible for priority 2 than priority 3. The most accessible problems detected by Achecker WCAG 1.0 accessibility

evaluation tools defined as follows. These are there was no text equivalent provided for every non-text element. This indicated that the image missing attribute alt, the document does not validate to publish in formal grammar, header-nesting problem because the header follows incorrect format, the scripts are not keyboard accessible. Hence, it missed the input device independents principle, content missed in the websites. It does not provide metadata to add semantic information, there is no tab orders given for links, objects and controls and adjacent links not separated properly. Therefore, it is difficult to use assistive technology. Generally, the websites have different types of accessibility problems in each level but degree of problems are differing from one levels to the others.

The third perspective of analyze the results of the testing is using the average error values of each website in entire levels. In this point of view, identify the websites that generate the smallest results in average columns of the result because this average is the sum of the results generated from every level. Therefore, the **0.33** is the smallest values in the average and **58.33** the largest values. Therefore, this indicated that there are accessibility issues in each of Ethiopia governmental websites and it did not meet the accessibility standards so the people will get difficulty when they try to access the websites. The results of the evaluation generated by automatic testing tool represented in graph as follow.
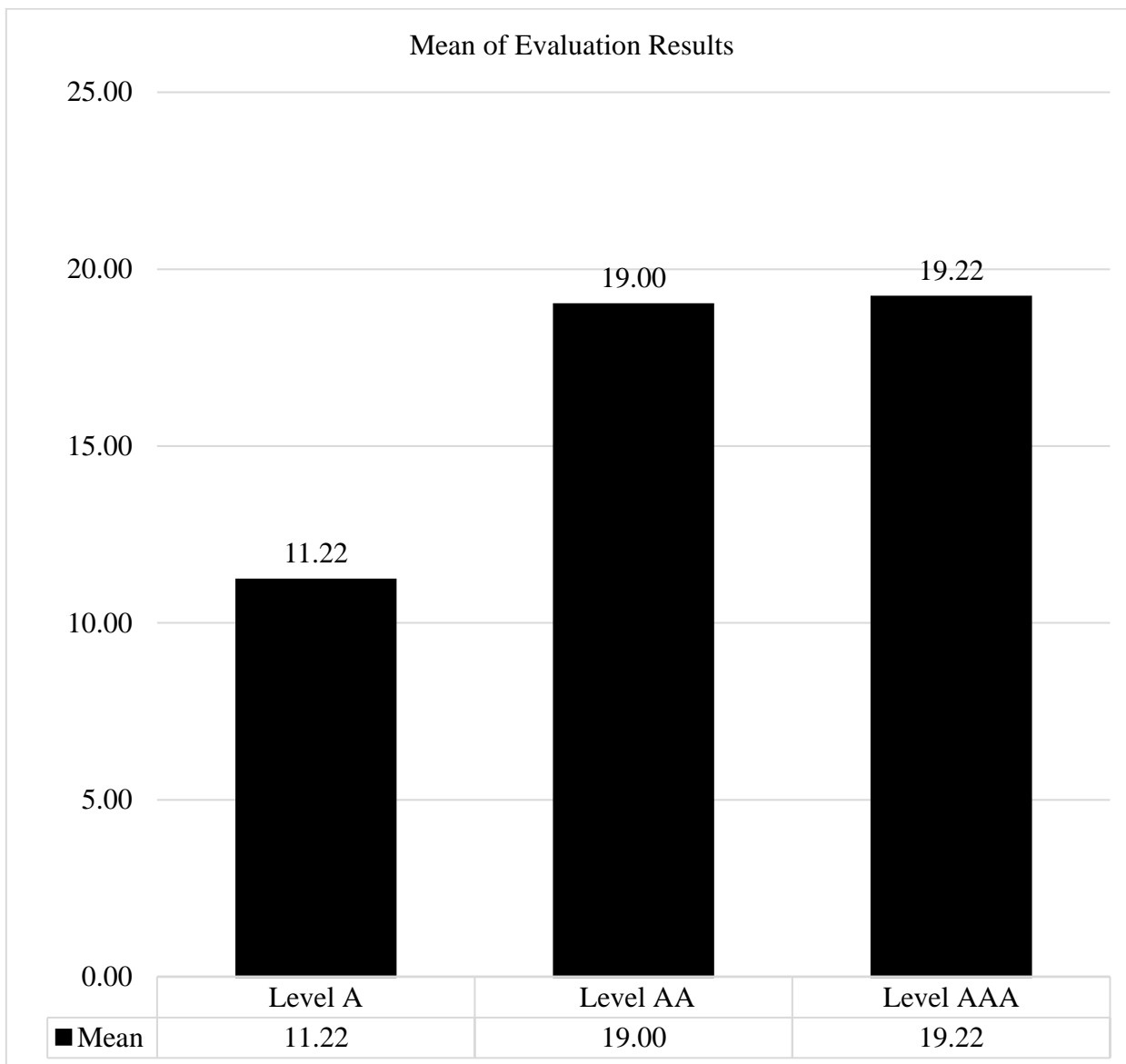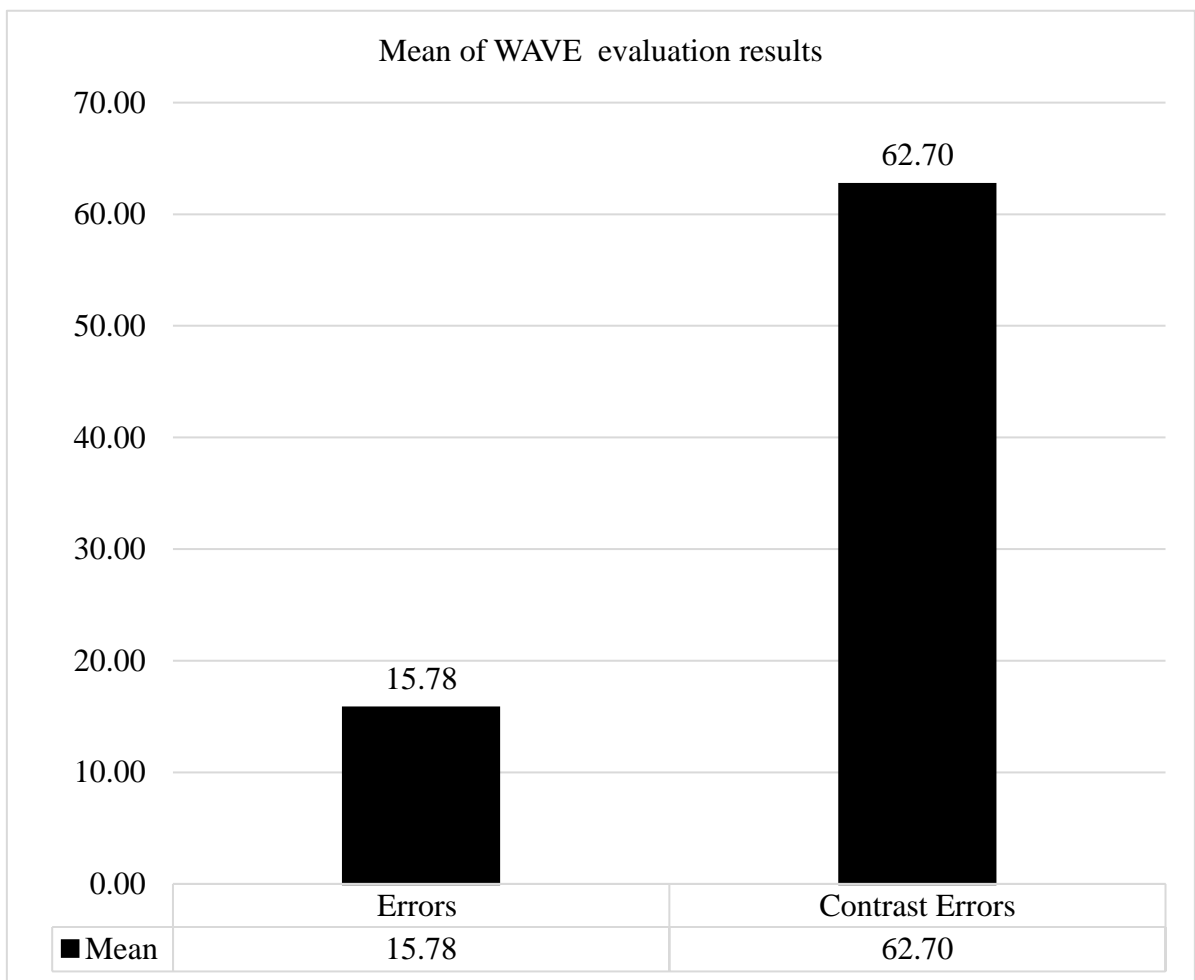
Figure 5.1: Mean of WACG 1.0 evaluation results

The above Figure 5.1 shows that the mean errors of Ethiopian governmental websites generated by automatic evaluation tool in WCAG 1.0 priority levels. The total mean values of detected issues classified in different levels and mean score sated as follow in each level, the mean in level A is **11.22,** in level AA **19.00** and **19.22** in level AAA.
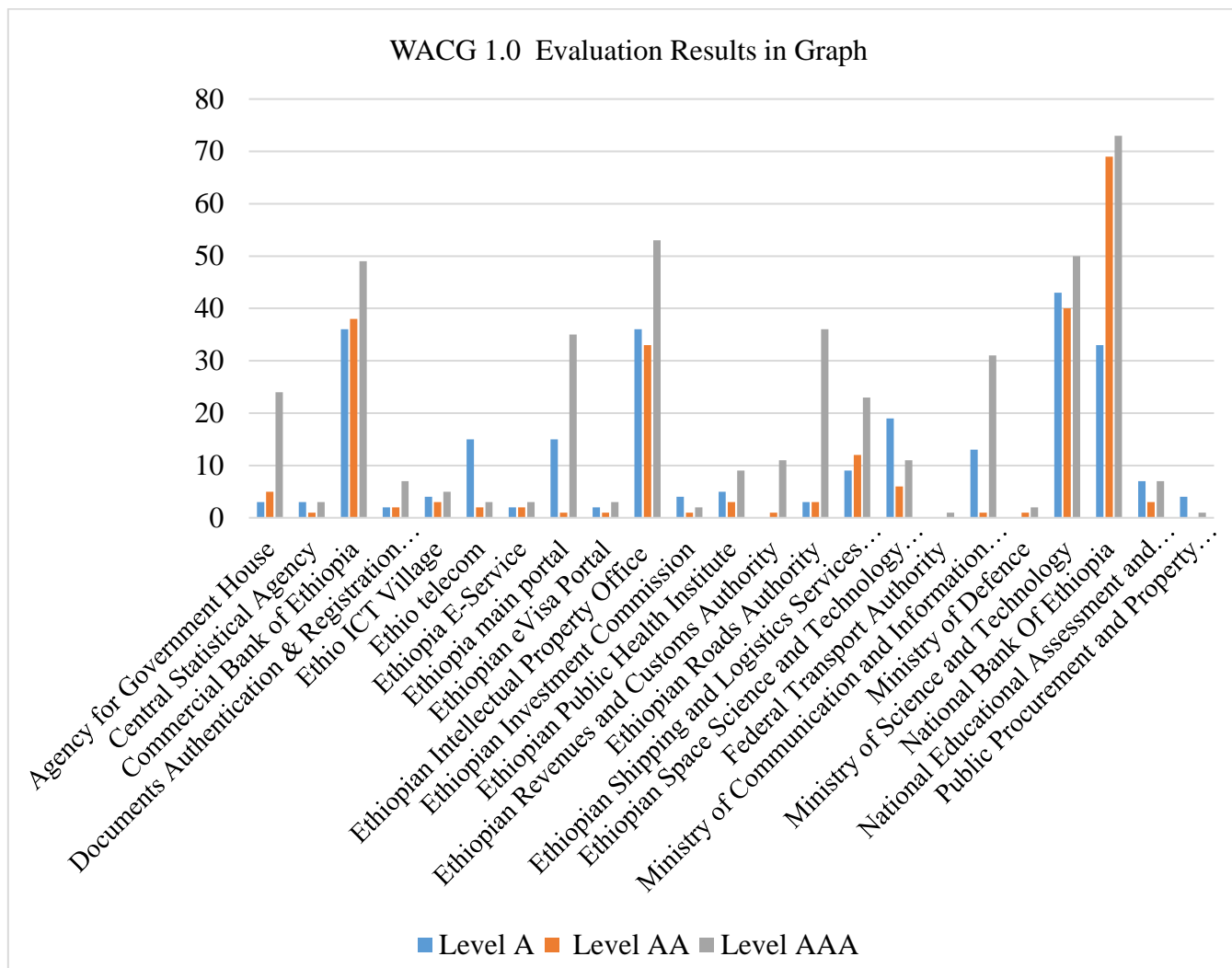
Figure 5.2: Mean of WACG 1.0 evaluation

The above Figure 5.2 shows the automatic evaluation results of Ethiopian governmental websites in each levels using Achecker WCAG 1.0. The result classified in three levels such as level A, AA and AAA. Results represent in different colors according to their levels.

5.3.2 Study results of Achecker WCAG 2.0

Table 5.3 shows the automatic testing results of the Ethiopian governmental websites in November 2018 evaluated by Achecker WCAG 2.0 tool. The table contains six columns; the

second column shows the name of the organization. The third column shows the evaluation result of WCAG 2.0 priority 1 or level A, the fourth column shows the testing results of WCAG 2.0 priority 2 or level AA. The fifth column shows the testing results of WCAG 2.0 priority 3 or level AAA and the sixth column shows the average results of the evaluation results.

Table 5.3: Evaluation result of Achecker WCAG 2.0

No	Name of Organization	WACG 2.0			
		Level A	Level AA	Level AAA	Average
1	Agency for Government House	14	35	43	30.67
2	Central Statistical Agency	6	23	23	17.33
3	Commercial Bank of Ethiopia	43	311	311	221.67
4	Documents Authentication & Registration Office	7	76	88	57
5	Ethio ICT Village	3	19	76	32.67
6	Ethio telecom	1	11	11	7.67
7	Ethiopia E-Service	1	1	1	1
8	Ethiopia main portal	4	20	21	15
9	Ethiopian eVisa Portal	2	2	2	2
10	Ethiopian Intellectual Property Office	40	132	132	101.33
11	Ethiopian Investment Commission	0	2	109	37
12	Ethiopian Public Health Institute	14	24	24	20.67
13	Ethiopian Revenues and Customs Authority	10	13	13	12
14	Ethiopian Roads Authority	18	33	31	27.33
15	Ethiopian Shipping and Logistics Services Enterprise	13	21	21	18.33
16	Ethiopian Space Science and Technology Institute	14	37	37	29.33
17	Federal Transport Authority	11	91	11	37.67
18	Ministry of Communication and Information Technology	8	31	34	24.33

19	Ministry of Defense	0	0	0	0
20	Ministry of Science and Technology	47	113	113	91
21	National Bank Of Ethiopia	40	326	326	230.67
22	National Educational Assessment and Examination Agency	3	8	8	6.33
23	Public Procurement and Property Administration Agency	19	59	59	45.67
	Total	**318**	**1388**	**1494**	
	Mean	**13.83**	**60.35**	**64.96**	

The above Table 5.3 shows the automatic web accessibility results of Ethiopian governmental websites evaluated by using Achecker WCAG 2.0. The evaluation of the websites categorized into three levels with different priority. Therefore, based on the results were generated in the automatic evaluation tool the analysis of the study classified into three perspectives the same as to the analysis of Achecker WCAG 1.0 evaluation results.

The first perspective of analyze the results of the testing is using the single values in each levels. Subsequently, as the evaluation results indicated in the first level A, most of the portals did not confirmed the lowest level of accessibility conformance. However, two websites meet the minimum requirement of web accessibility conformance guidelines and 0 errors were detected and generated for each website in level A. The websites that meet the requirement of accessibility guidelines is Ethiopian Investment Commission, and Ministry of Defense. In addition, there is some website closest to the minimum requirements of web accessibility conformance but not meet. In which the finding indicated that some websites are more accessible than the other when is compares each other in level A. Level AA is the guidelines used to measure the accessibility of the websites, accordingly, the websites evaluated by this level and the results were generated. As the testing results indicated that generated from level AA most of the websites has an accessibility problem, which means it is unable to satisfy the need of the people because evaluated websites did not confirm the minimal level of competency for accessibility. Depends on the results, only Ministry of Defense websites generated 0 errors

from the whole websites were evaluated in level AA guidelines. Interestingly, Ministry of Defense websites did meet the level AA conformance measurement guidelines because to say the portals confirm level AA, all priority 1 and 2 should be meet, so based on the results showed in the above table does meet priority 1 and 2 checkpoints. Meanwhile, the rest of websites were not satisfied the level AA accessibility conformance standards, so the people will find difficulty when they try to access the websites. Moreover, the third level of accessibility evaluation is level AAA, in this level of accessibility evaluation, Ethiopian governmental websites evaluated and the results listed in the above table. The results indicated that only Ministry of Defense websites satisfied the minimum priority checkpoints of competency by scoring 0 error, this implies the websites meet the priority 1, 2 and 3 checkpoints of web accessibility, but there are some websites near to the minimum levels of accessibility and the user face different difficulty when they will access the websites. Therefore, all the Ethiopian governmental portals need greater enhancements to increase the accessibility.

The second perspective of analyze the results of the testing is using the mean values of the evaluation results in each levels. The Ethiopian governmental websites evaluated in three level of priority and mean values of each level of results were included after calculation of the total errors detected. Accordingly, the mean results of each level stated as follows. The mean results of levels A is **13.83,** level AA is **60.35** and level AAA is **64.96**. Because of mean show, the websites more accessible for priority 1 than priority 2 and 3, and the websites more accessible for priority 2 than priority 3. The most accessible problems detected by accessibility evaluation tools. These are there was no text equivalent provided for every non-text element. This indicated that the image missing attribute alt, the document does not validate to publish in formal grammar, header-nesting problem because the header follows incorrect format, the scripts are not keyboard accessible. Hence, it missed the input device independents principle, content missed in the websites. It does not provide metadata to add semantic information, there is no tab orders given for links, objects and controls and adjacent links not separated properly therefore, it difficult to use assistive technology. Generally, the websites have different types of accessibility problems in each level but degree of problems are differing from one level to the others.

The third perspective of analyze the results of the testing is using the average error values of each website in entire levels. In this point of view, identify the websites that generate the smallest results in average columns of the result because this average is the sum of the results generated from every level. Therefore, the **0** is the smallest values in the average error of evaluated portals and **101.33** the largest values. Therefore, this indicated that there are accessibility issues in each of Ethiopia governmental websites and it did not meet the accessibility standards so the people will get difficulty when they try to access the websites. The results of the evaluation generated by automatic testing tool represented in graph as follow.

Mean of Evaluation Results

	Level A	Level AA	Level AAA
■ Mean	13.83	60.35	64.96
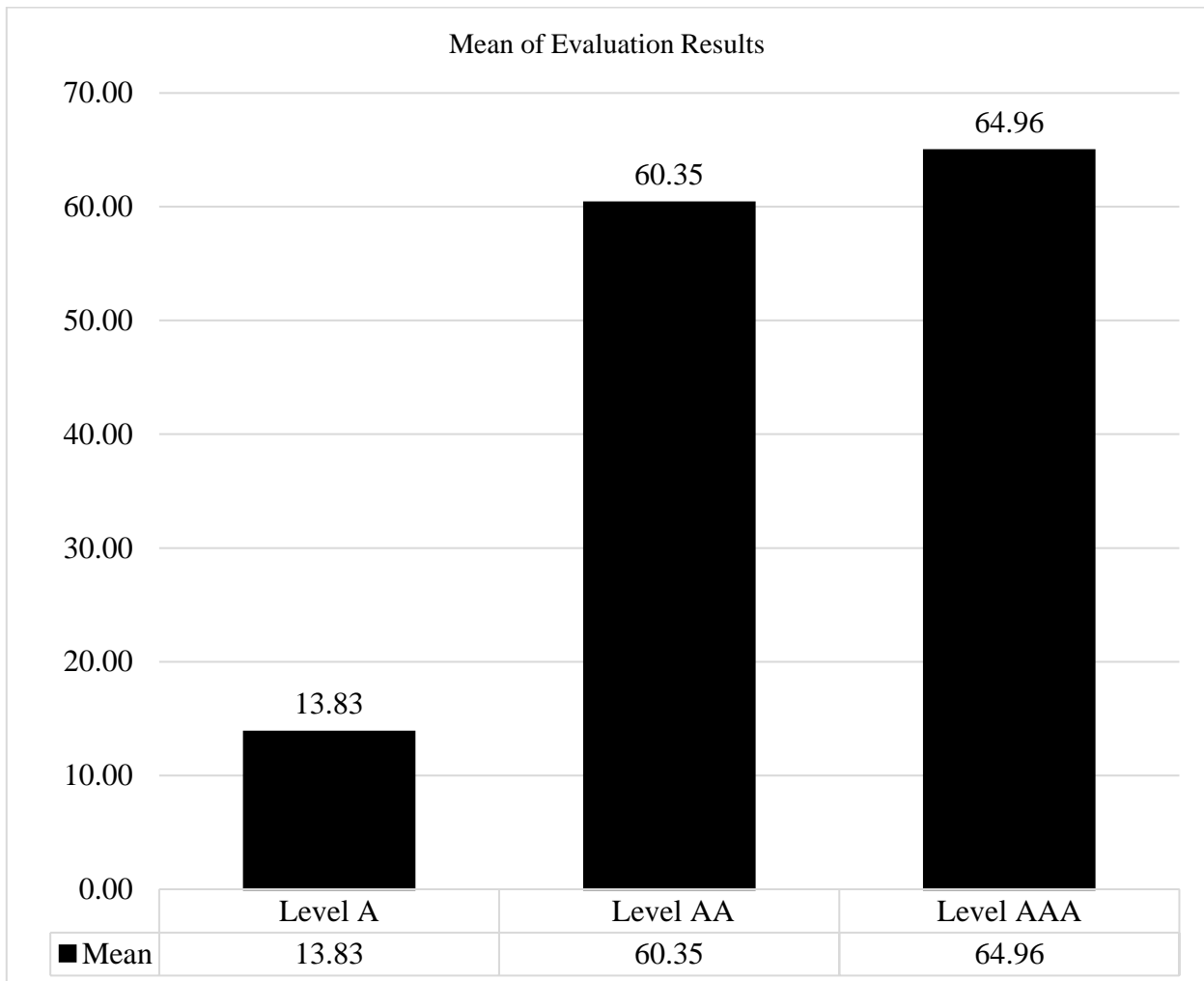
Figure 5.3: Mean of WACG 2.0 evaluation

The above Figure 5.3 shows that the mean errors of Ethiopian governmental websites generated by automatic evaluation tool in WCAG 2.0 priority levels. The total mean values of detected issues classified in three levels and mean score sated as follow in each level, the mean in level A is **13.83,** in level AA **60.35** and **64.96** in level AAA.

WACG 2.0 Evaluation Results in Graph

■ Level A   ■ Level AA   ■ Level AAA
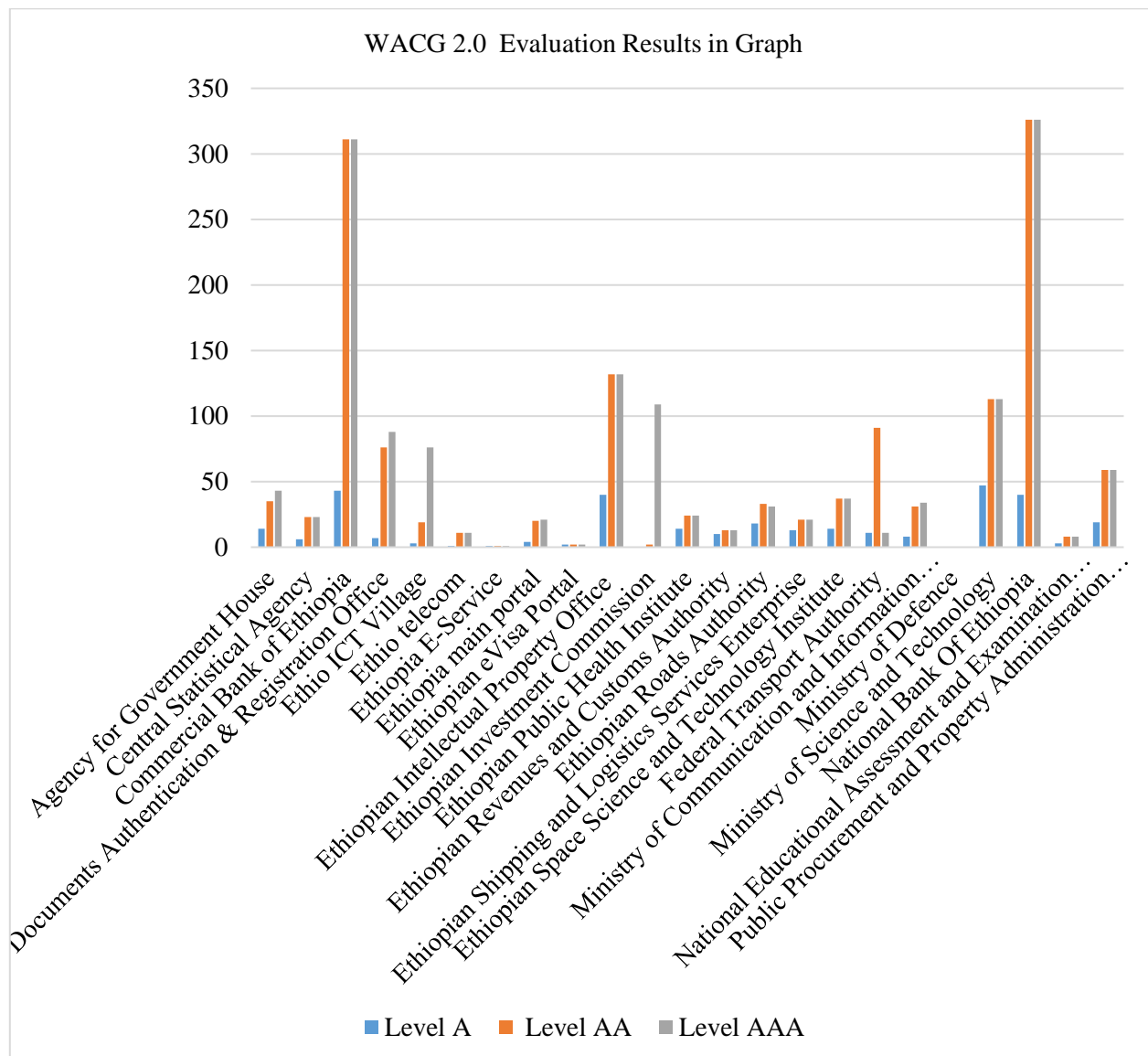
Figure 5.4: Evaluation results of WACG 2

The Figure 5.4 shows the automatic evaluation results of Ethiopian governmental websites in each levels using Achecker WCAG 2.0. The result classified in three levels such as level A, AA and AAA. Results represent in different colors according to their levels.

5.3.3 Study results of WAVE

Table 5.4 illustrates the automatic testing results of the Ethiopian governmental websites in November 2018 evaluated by WAVE tool. The table contains four columns; the second column shows the name of the organization. The third column shows the evaluation errors of the websites accessibility results and the forth column shows the contrast errors results of the websites.

Table 5.4: Evaluation results of WAVE

No	Name of Organization	WAVE	
		Errors	Contrast Errors
1	Agency for Government House	3	42
2	Central Statistical Agency	6	18
3	Commercial Bank of Ethiopia	37	123
4	Documents Authentication & Registration Office	14	14
5	Ethio ICT Village	9	21
6	Ethio telecom	3	52
7	Ethiopia E-Service	6	12
8	Ethiopia main portal	4	286
9	Ethiopian eVisa Portal	1	1
10	Ethiopian Intellectual Property Office	42	63
11	Ethiopian Investment Commission	9	40
12	Ethiopian Public Health Institute	11	138
13	Ethiopian Revenues and Customs Authority	16	41
14	Ethiopian Roads Authority	12	68
15	Ethiopian Shipping and Logistics Services Enterprise	12	55

16	Ethiopian Space Science and Technology Institute	18	68
17	Federal Transport Authority	12	128
18	Ministry of Communication and Information Technology	37	94
19	Ministry of Defense	4	37
20	Ministry of Science and Technology	54	63
21	National Bank Of Ethiopia	40	59
22	National Educational Assessment and Examination Agency	2	0
23	Public Procurement and Property Administration Agency	11	19
	Total	**363**	**1442**
	Mean	**15.78**	**62.70**

The sample Ethiopian governmental websites selected evaluated by two automatic evaluation tools and the second evaluation tools used to evaluate is WAVE tool. The evaluation tool was tested the websites and the results shows errors and contrast errors in the above Table 5.4. Therefore, based on the results were generated there is no single websites that meets the minimum requirement of the web accessibility because all of the websites were evaluated detected by the accessibility issues. When the results analyzed according to the results by classifying into two such as errors and contrast errors. The reason that errors and contrast errors were included in the report is these directly related to the accessibility problems of the websites. Moreover, contrast errors does not found in the other automatic evaluation tools. Therefore, that is why the researcher was included contrast errors in Ethiopia governmental evaluation results using WAVE tool. The errors of the evaluated websites better than the contrast errors because when researcher compared, most of the results of errors less than contrast errors except one websites. This indicated that most of the websites has contrast problems; it is unable or difficult to for the users with different situations. The mean of the errors detected for accessibility errors is **15.78** and for contrast, error is **62.70**. Therefore, as the result shows all the Ethiopian governmental websites measured according to the accessibility guidelines have accessibility problems. Base on the results were generated the three best accessible websites identified those are Agency for Government House, Ethiopian eVisa Portal and National Educational

Assessment Examination Agency. Due to this problem the people get difficulty when try to access the websites and for people with disabilities more disadvantageous than the other because they are need more concentration and accessibility of the portals. To express and shows the results easily represents in graphs according to different category as follows in below.

Mean of WAVE evaluation results

	Errors	Contrast Errors
■ Mean	15.78	62.70

Figure 5.5: Mean of WAVE evaluation results

The above Figure 5.5 shows that the mean errors of Ethiopian governmental websites generated by automatic evaluation tool using WAVE. The total mean values of detected issues classified in two categories in this report (errors and contrast errors) and mean score sated as follow in each category, the mean in errors is **15.78** and in contrast errors **62.70**.
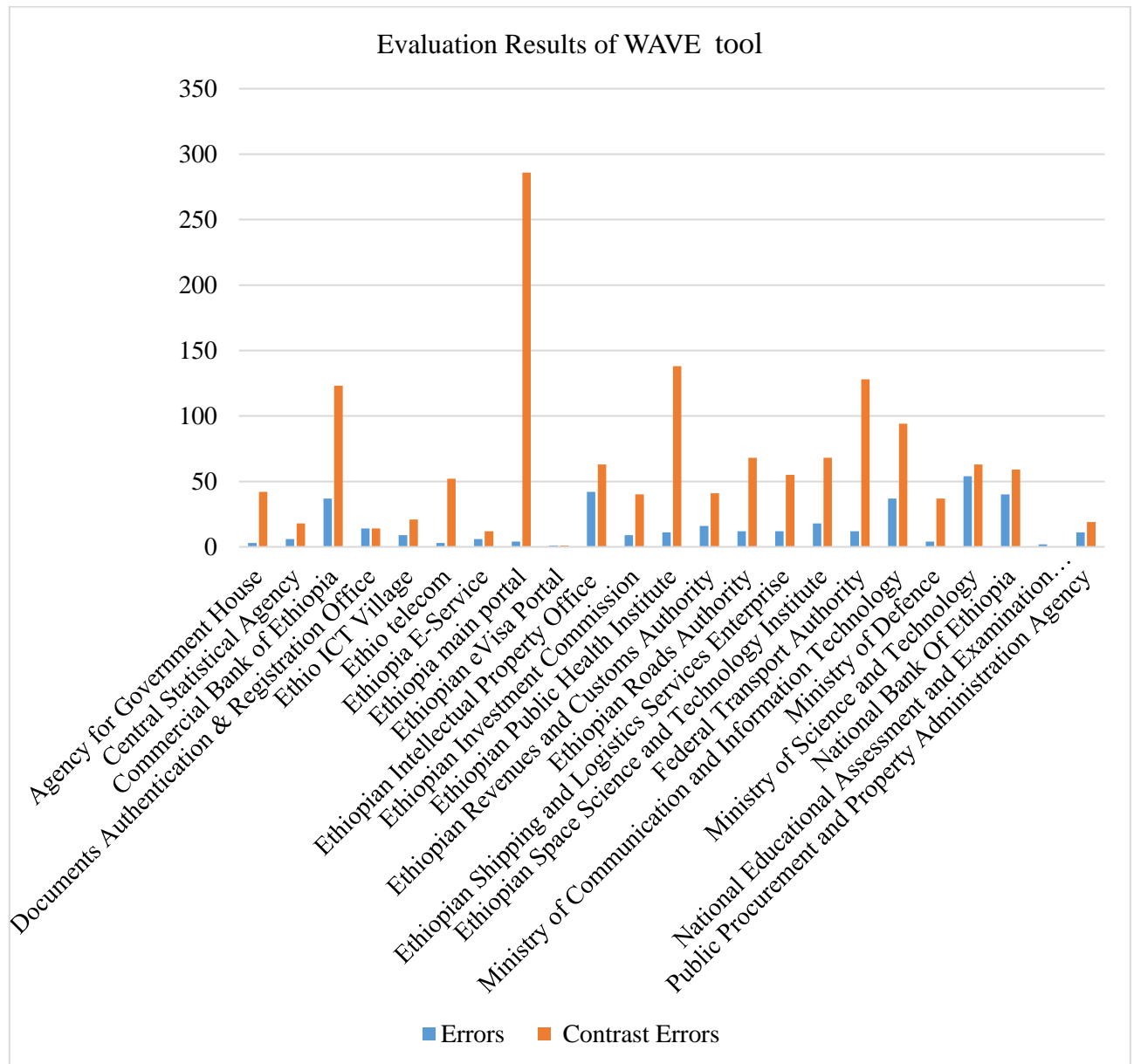
Figure 5.6: Evaluation results of WAVE

This the above Figure 5.6 shows the automatic evaluation results of Ethiopian governmental websites in two categories. The results classified into two such as errors, and contrast errors of every evaluated website. Results represent in different colors according to their classification.

CHAPTER 6

CONCLUSION & RECOMMENDATIONS

6.1 Conclusion

In this investigation, the researcher has designed, identified the websites to be test and tested the accessibility of Ethiopian governmental websites automatically via evaluation tools. After the evaluation, the evaluation applicable for delivered information about accessibility status of Ethiopian governmental websites. The different country's web accessibility papers reviewed and websites accessibility guidelines used for Ethiopian governmental websites accessibility evaluation. 23 Ethiopian governmental websites were selected and tested by using websites accessibility testing applications. Achecker as well as WAVE selected towards measure Ethiopian governmental websites accessibility because; they are freely available and have better features than the others have freely available tools.

Depend on automatic ease of access testing tools of website; the results were generated shows that all Ethiopian governmental websites address the problems of websites accessibility. Accordingly, the results found in the evaluation tools that the majority of the Ethiopian governmental websites does not fit the lowest level of websites accessibility standards. The Ethiopian governmental websites evaluation results indicated that there are some hurdles in the enhancement of the accessibility of Ethiopian governmental websites. Hurdles that limits the accessibility are such as lack of ongoing testing during the development phase, there is no accessibility policy developed by the country, end users are not participated in the development of the websites and lack of expert developers and designers of governmental portals.

The major common problems that detected interrelated to lack of alternative texts to provide alternatives for non-text contents of the websites, lack of distinguishability to make the websites to the easier to see and hear the contents. Moreover, lack of navigable to help the users to move from one link to the other, find the content and to determine where the content found, there is no input assistance to make the users avoid and right mistakes. Lack of adaptability to create the content that represents via different formats without minus its information and the websites are

not robust to create contents that interpreted by different user and compatible with different assistive technology. Overall, evaluation results demonstrate factors that affect accessibility problems of websites and Ethiopian governmental websites does not confirm the minimum level of accessibility conformance guidelines.

6.2 Recommendations

Based on the automatic evaluation tools results with the issues detected during the evaluation recommended as follow to concerned stakeholders for future works. The researcher recommends the websites designers and developers to improve the accessibility of Ethiopian governmental websites, because they play the greater role on accessibility of the websites. Therefore, the designers and developers have to encourage using W3C web accessibility guidelines to develop the websites that meets the accessibility principles and makes accessible to all users. In addition to that they have to suggested to use ongoing testing of the accessibility of websites during development before release the products to users, because easier to detect the defects in this phase. Moreover, they have to suggest giving the chances the end users participate in development phase of the websites because it is applicable to design and develop according to the user's expectation about accessibility of the websites. Secondly recommended to Ethiopian governmental organizations should controls and monitors the accessibility of their websites weather it is accessible by all users without any exceptionality to meet the desires of people and to make the portals accessible to all.

Finally, the government should follow the W3C web accessibility guidelines or develop their own accessibility guidelines that fit with their contexts or standards and W3C guidelines. In addition, the government should develop a policy to design and develop websites that meet the accessibility requirements of the website. Nevertheless, the policy should be follow W3C accessibility guidelines and consider the right of people with disabilities to access the information. The people with disabilities should be responsible to spread up the awareness of the organization to makes the websites accessible for the people with disabilities.

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APPENDICES

APPENDIX 1
SCREEN SHOTS OF THE WEB ACCESSIBILITY EVALUATION RESULTS WITH ACHECKER

Figure A1.1: Achecker evaluation tool

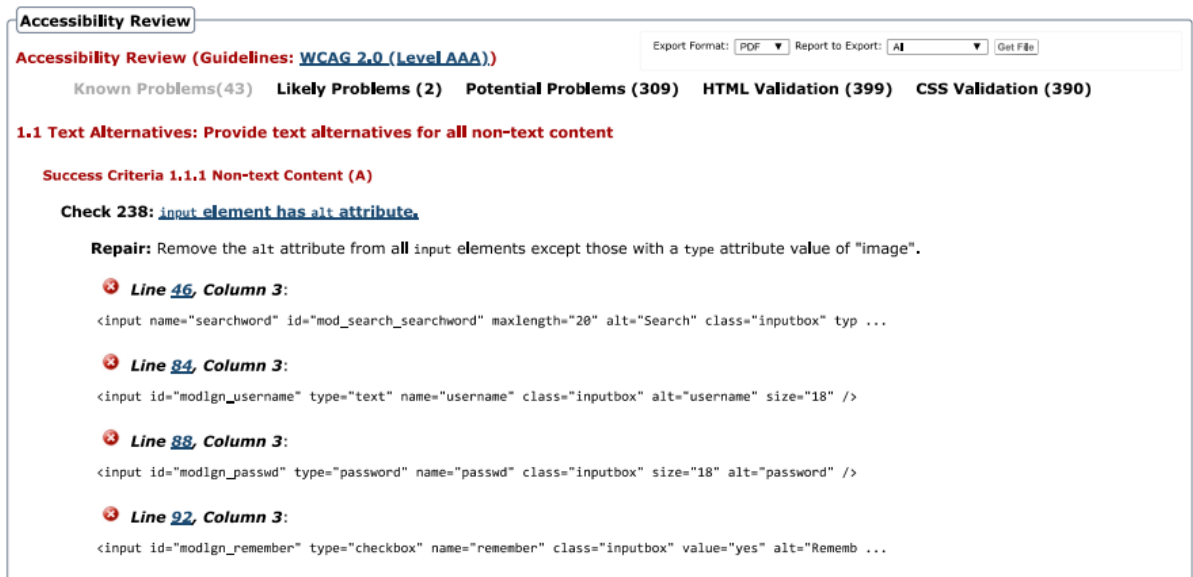**Figure A1.2:** WCAG 1.0 A evaluation result of agency for government house with achecker

Figure A1 .3: WCAG 1.0 A evaluation result of central statistical of Ethiopia with achecker

Figure A1.4: WCAG 1.0 A evaluation result of commercial bank of Ethiopia with achecker

Figure A1.5: WCAG 1.0 A evaluation result of documents authentication with achecker

Figure A1.6: WCAG 1.0 A evaluation result of Ethiopia ICT village with achecker

Figure A1.7: WCAG 1.0 A evaluation result Ethiopia telecom with achecker

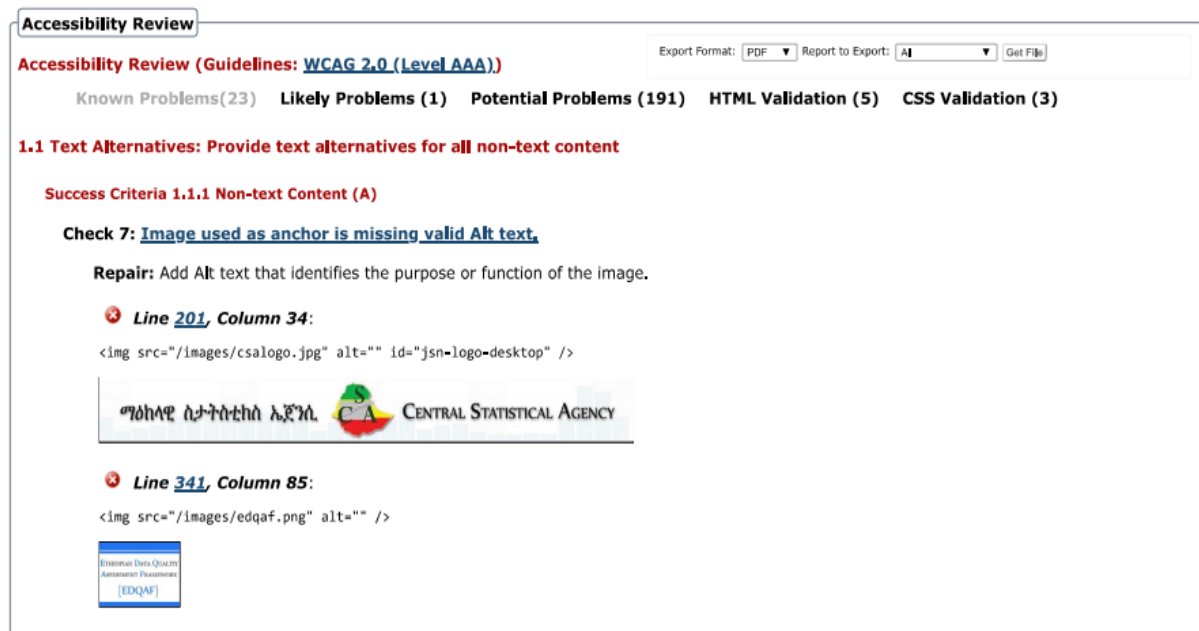**Figure A1.8:** WCAG 1.0 AA evaluation result of agency for government house with achecker
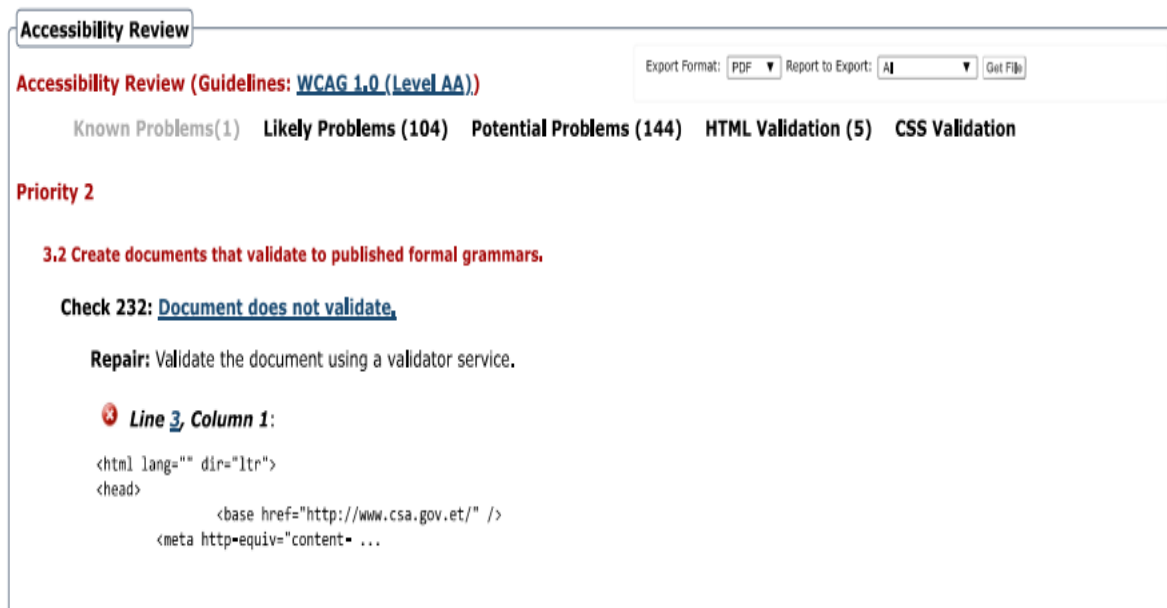
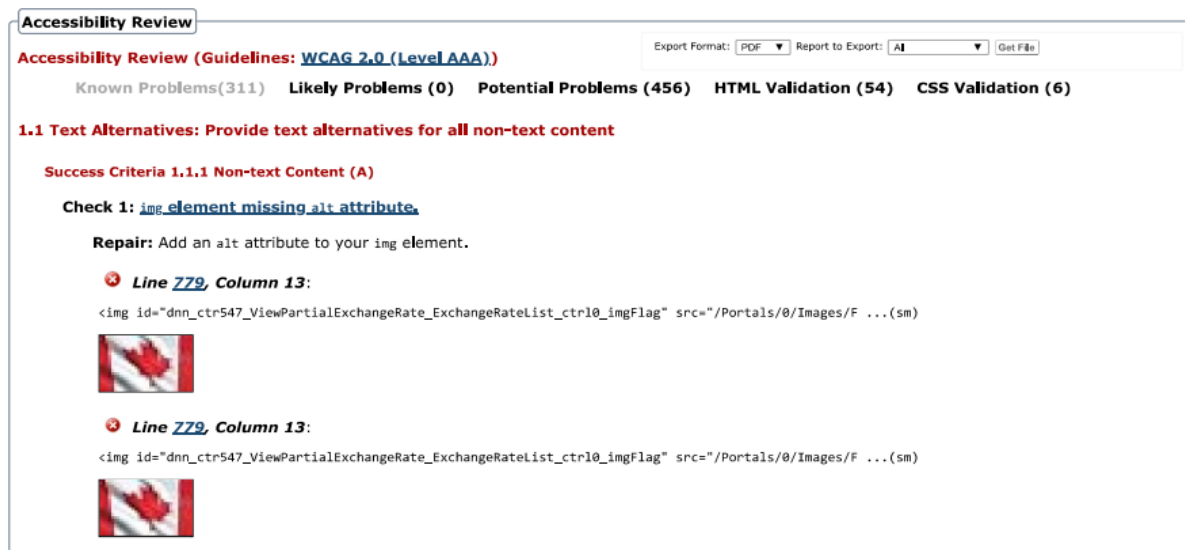**Figure A1.9:** WCAG 1.0 AA evaluation result of Central Statistical with achecker
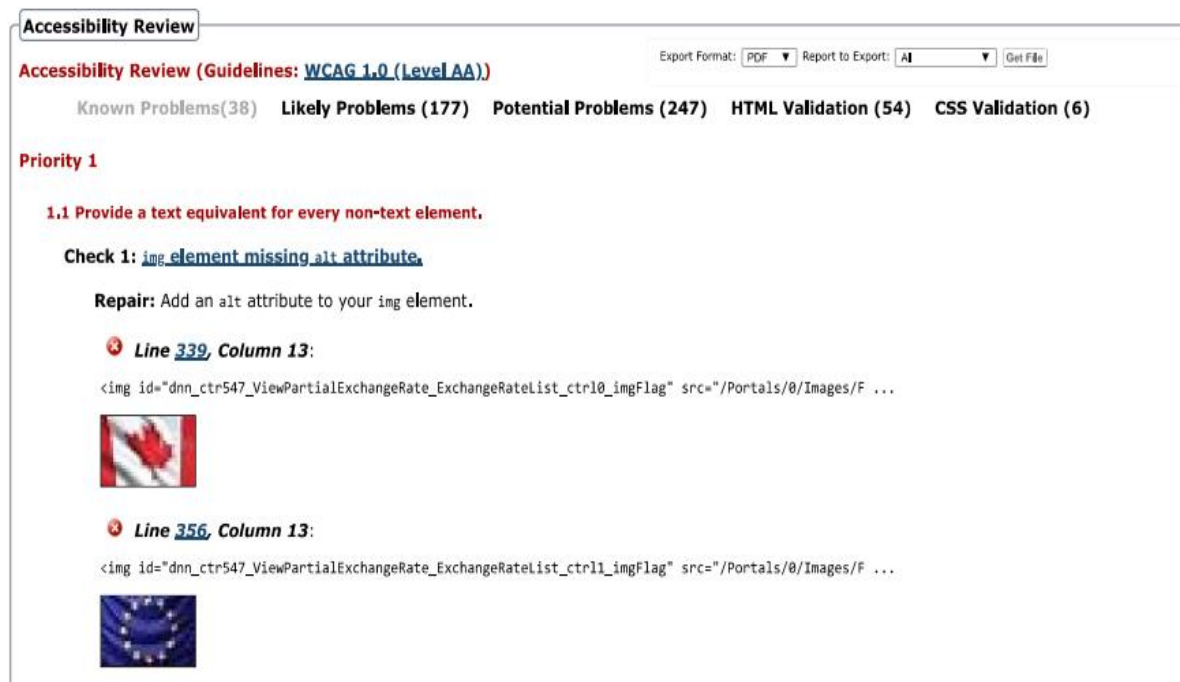
Figure A1.10: WCAG 1.0 AA evaluation result of commercial bank of Ethiopia with achecker

Figure A1.11: WCAG 1.0 AA evaluation result of documents authentication with achecker

Figure A1.12: WCAG 1.0 AA evaluation result of Ethiopia ICT village with achecker
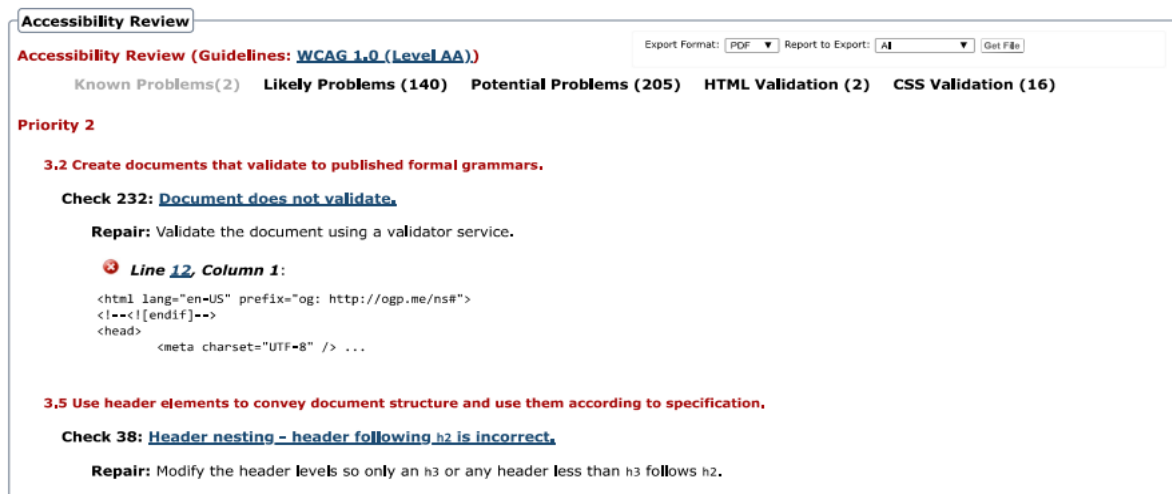
Figure A1.13: WCAG 1.0 AA evaluation result of Ethiopia telecom with achecker
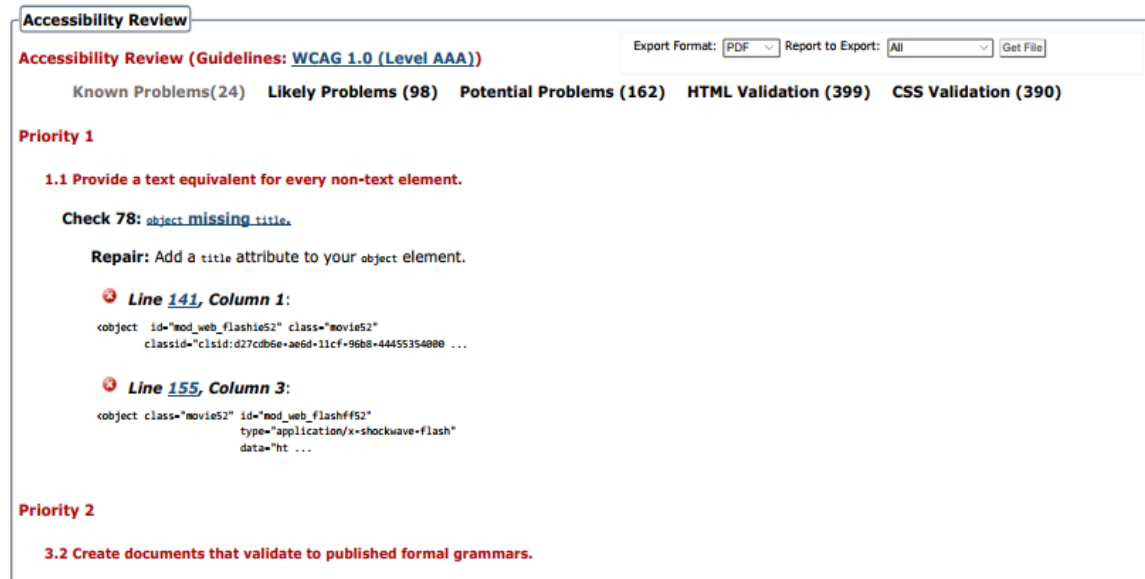
Figure A1.14: WCAG 1.0 AAA evaluation result of Agency for government house with achecker
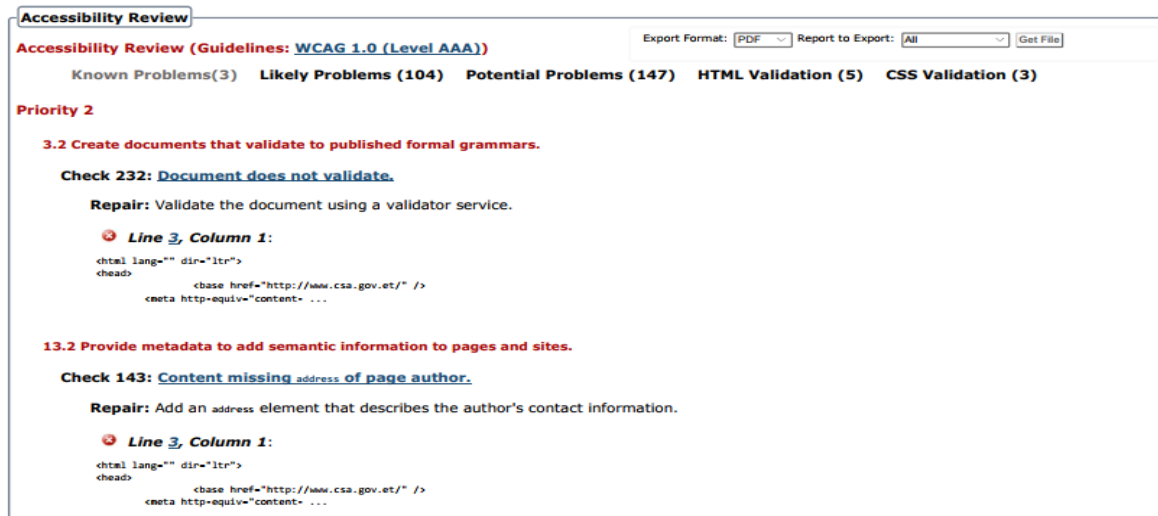
Figure A1.15: WCAG 1.0 AAA evaluation result of central Statistical with achecker
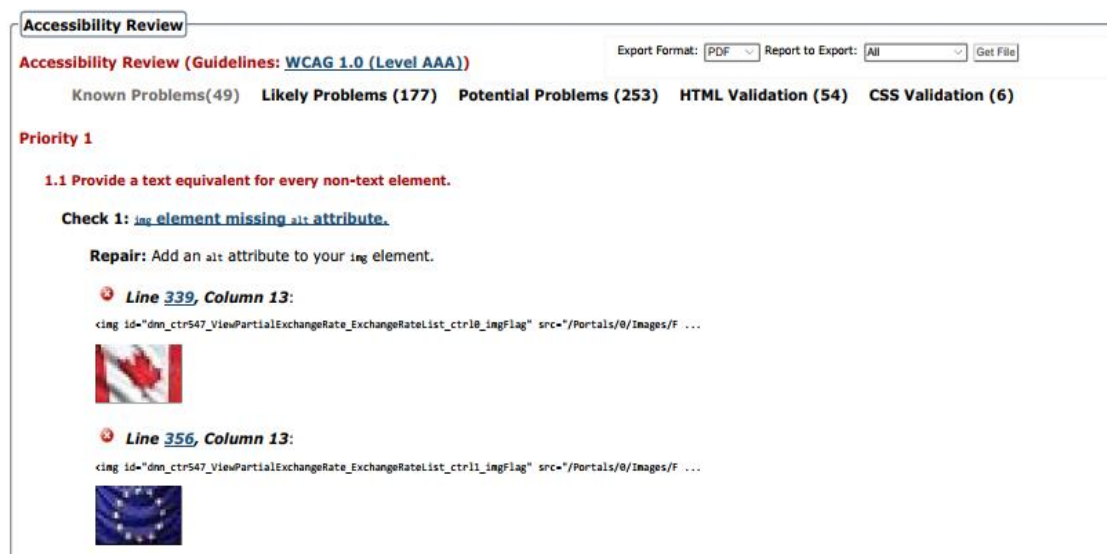
Figure A1.16: WCAG 1.0 AAA evaluation result of commercial bank of Ethiopia with achecker

Figure A1.17: WCAG 1.0 AAA evaluation result of document authentication with achecker

Figure A1.18: WCAG 1.0 AAA evaluation result of Ethiopia ICT village with achecker

Figure A1.19: WCAG 1.0 AAA evaluation result of Ethiopia telecom with achecker

Figure A1.20: WCAG 2.0 A evaluation result of agency for government house with achecker
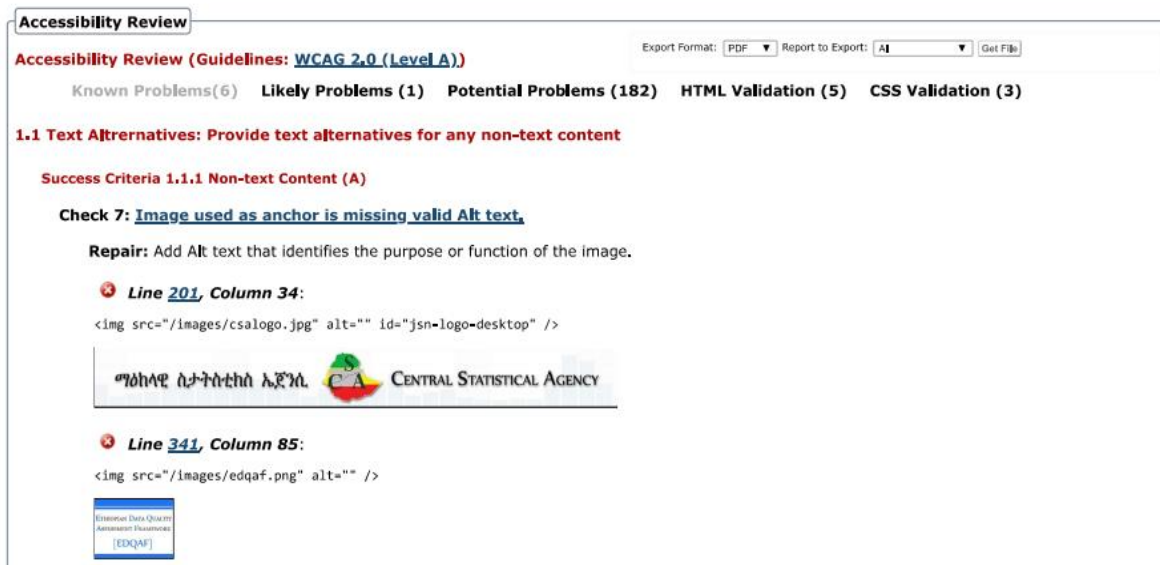
Figure A1.21: WCAG 2.0 A evaluation result of central statistical with achecker
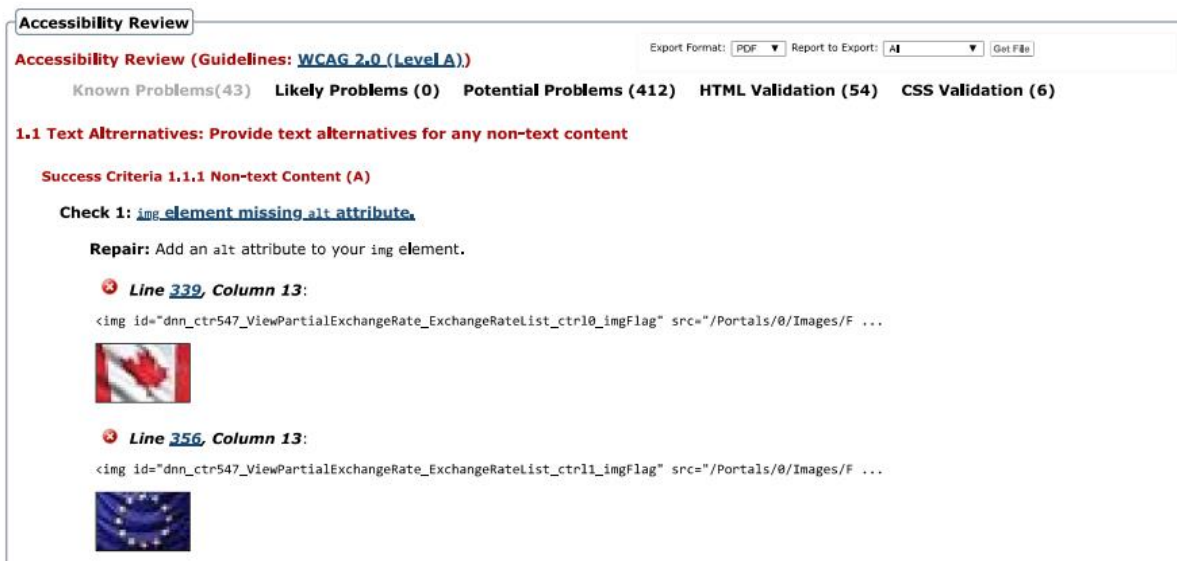
Figure A1.22: WCAG 2.0 A evaluation result of commercial bank of Ethiopia with achecker

Figure A1.23: WCAG 2.0 A evaluation result of document authentication with achecker

Figure A1.24: WCAG 2.0 A evaluation result of Ethiopia ICT village with achecker

Figure A1.25: WCAG 2.0 A evaluation result of Ethiopia telecom with achecker

Figure A1.26: WCAG 2.0 AA evaluation result of agency for government house with achecker
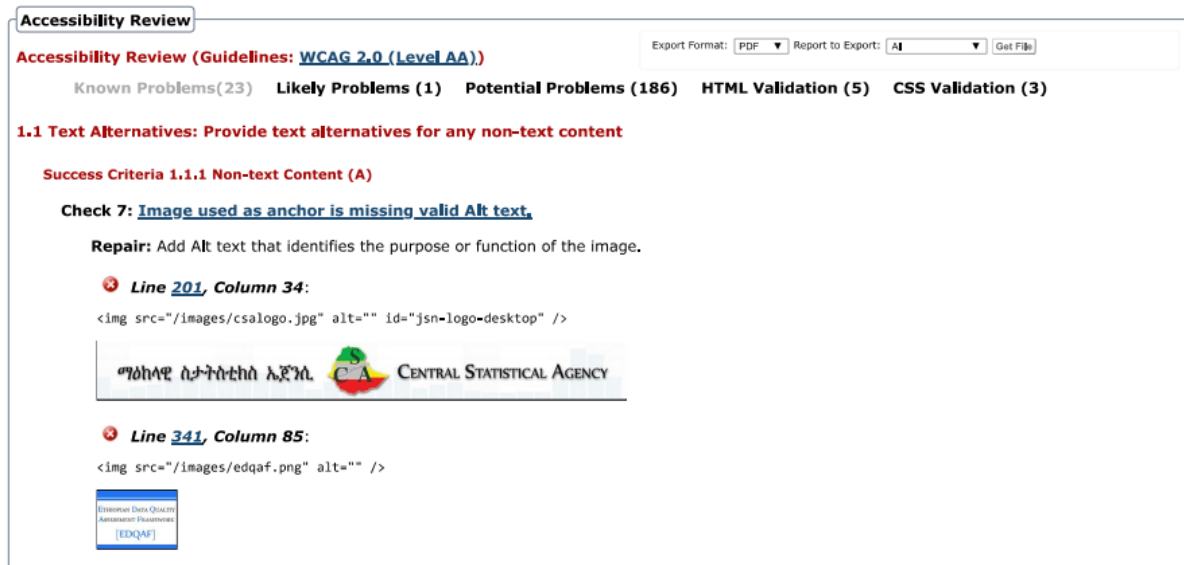
Figure A1.27: WCAG 2.0 AA evaluation result of central statistical with achecker
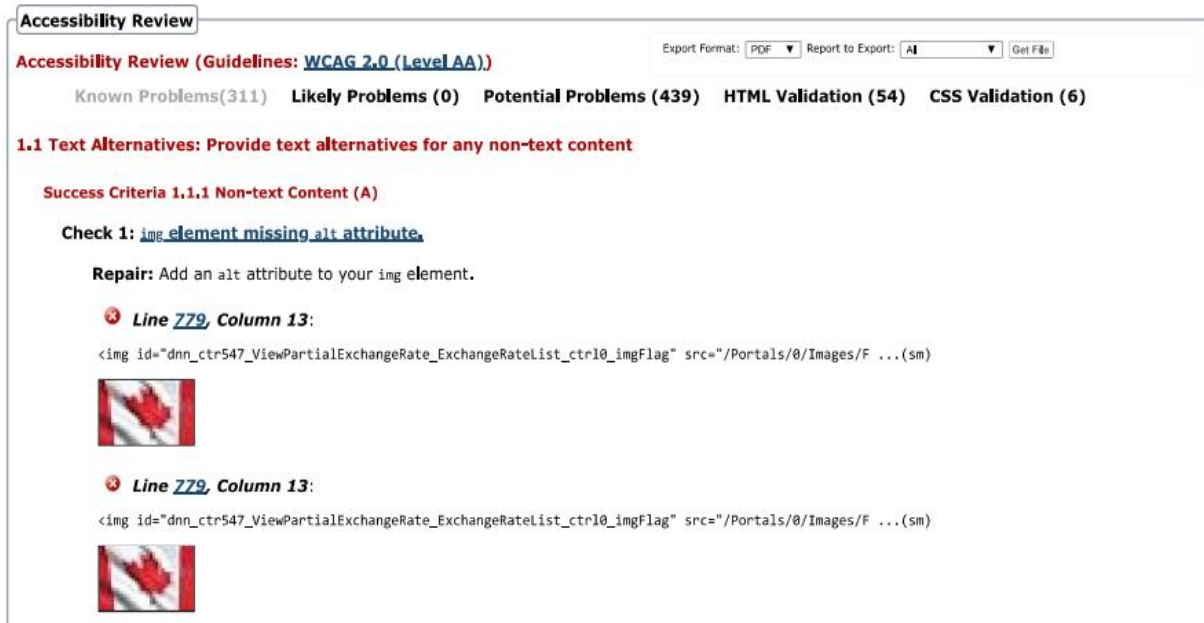
Figure A1.28: WCAG 2.0 AA evaluation result of commercial bank of Ethiopia with achecker

Figure A1.29: WCAG 2.0 AA evaluation result of document authentication with achecker

Figure A1.30: WCAG 2.0 AA evaluation result of Ethiopia ICT village with achecker
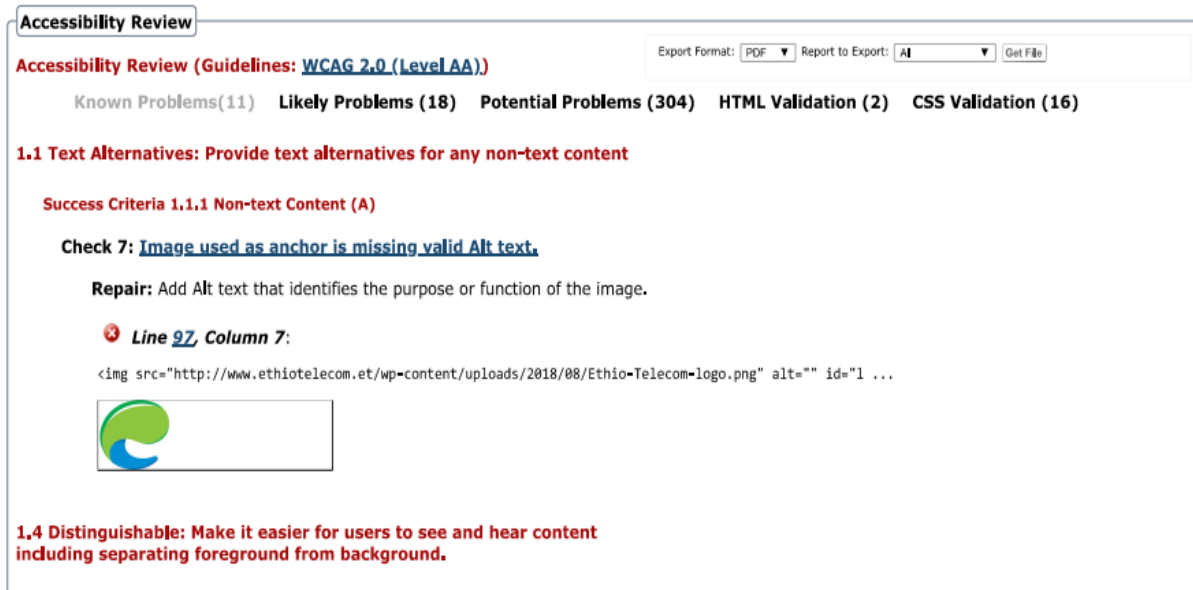
Figure A1.31: WCAG 2.0 AA evaluation result of Ethiopia telecom with achecker

Figure A1.32: WCAG 2.0 AAA evaluation result of agency for government house with achecker

Figure A1.33: WCAG 2.0 AAA evaluation result of central statistical with achecker

Figure A1.34: WCAG 2.0 AAA evaluation result of commercial bank of Ethiopia with achecker

Figure A1.35: WCAG 2.0 AAA evaluation result of document authentication with achecker

Figure A1.36: WCAG 2.0 AAA evaluation result of Ethiopia ICT village with achecker

Figure A1.37: WCAG 2.0 AAA evaluation result of Ethiopia telecom with achecker

APPENDIX 2
SCREEN SHOTS OF THE WEB ACCESSIBILITY EVALUATION RESULTS WITH WAVE
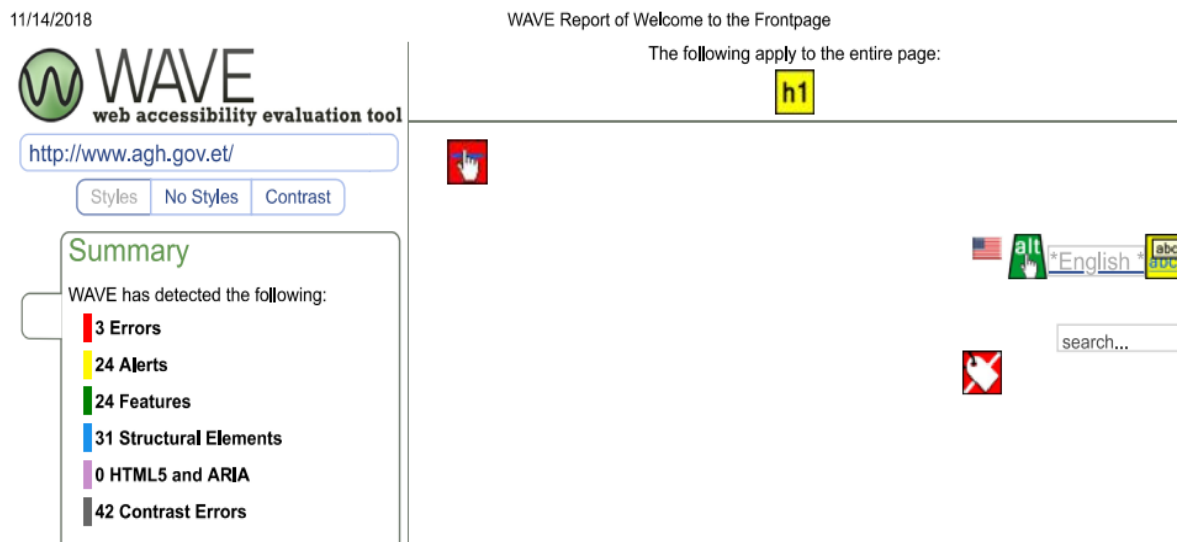

Figure A2.1: WAVE evaluation tool

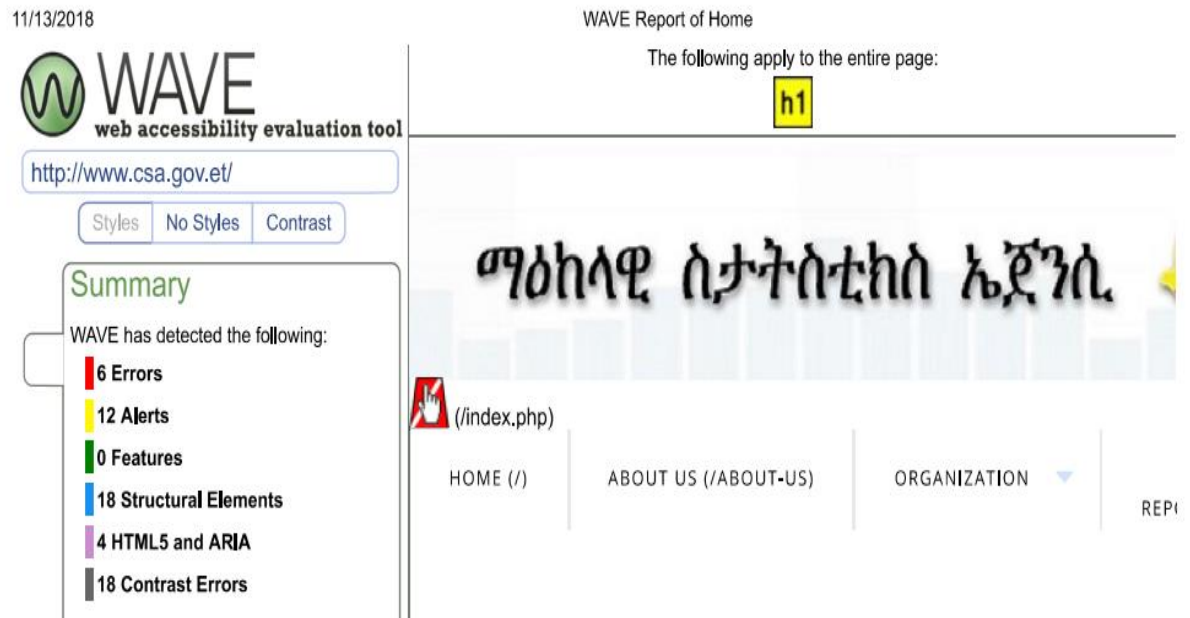**Figure A2.2:** Evaluation result of agency for government house with WAVE

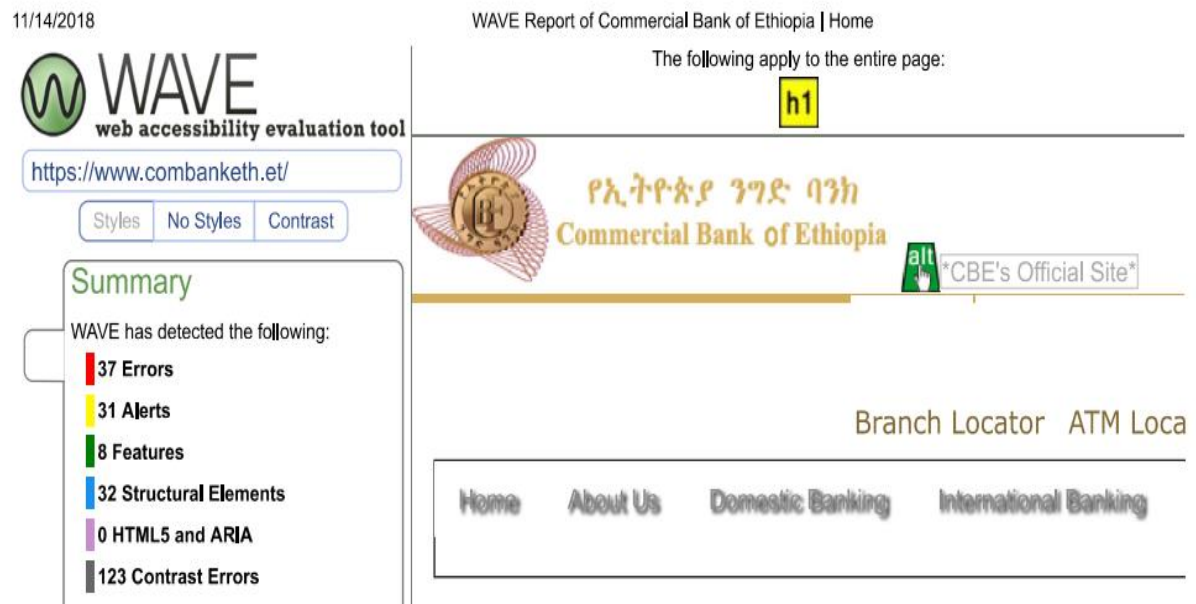**Figure A2.3:** Evaluation result of central statistical with WAVE

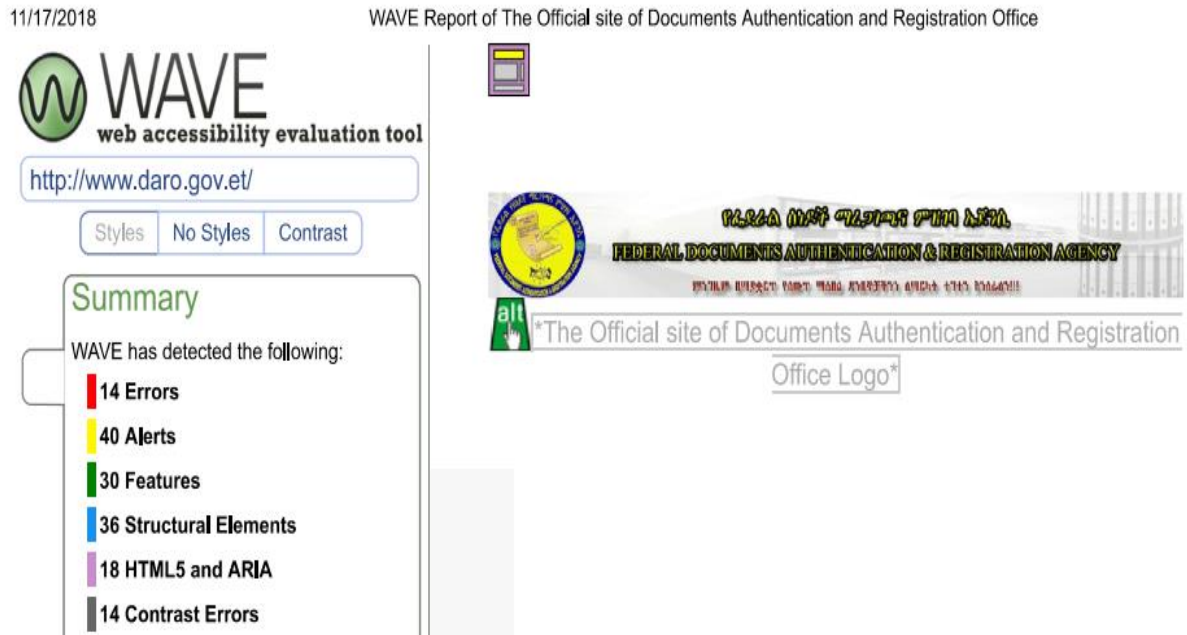**Figure A2.4:** Evaluation result of commercial bank of Ethiopia with WAVE

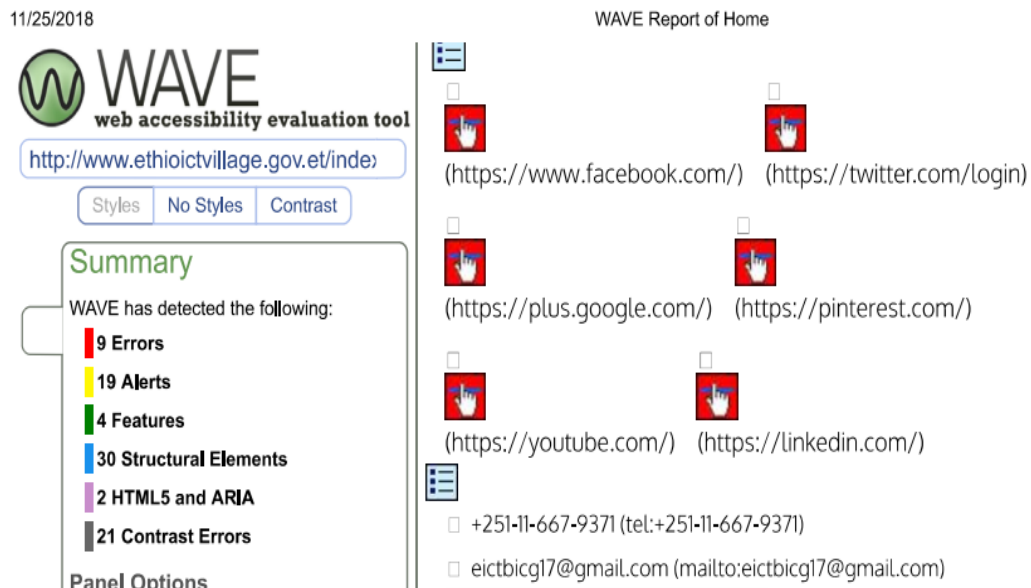**Figure A2.5:** Evaluation result of document authentication with WAVE

Figure A2.6: Evaluation result of Ethiopia ICT village with WAVE

WAVE
web accessibility evaluation tool

http://www.ethiotelecom.et/

Styles | No Styles | Contrast

Summary

WAVE has detected the following:

3 Errors

46 Alerts

8 Features

29 Structural Elements

4 HTML5 and ARIA

52 Contrast Errors

Panel Options

The following apply to the entire page:

h1

Figure A2.7: Evaluation result of Ethiopia telecom with WAVE