

# Web Accessibility and Web Developer Attitudes towards Accessibility in Mozambique

Suraj Gupta<sup>1</sup>[0000-0002-2174-0919], Terje Gjøsæter<sup>1,2</sup>[0000-0002-1688-7377] and

G. Anthony Giannoumis<sup>1</sup>[0000-0001-7939-6340]

<sup>1</sup> Oslo Metropolitan University, Oslo, Norway

<sup>2</sup> University of Agder, Kristiansand, Norway

surajgupta8393@gmail.com, terjeg@uia.no, gagian@oslomet.no

**Abstract.** People with disabilities are found to be severely affected by barriers in websites and other web services. This paper aims to study the web accessibility issues in Mozambique and to review the factors that contribute to it. The case study is based on results from 2 perspectives: first, automatic evaluation of five prominent national websites, and second through fieldwork, interviewing and interacting with web developers in Mozambique. The study found that none of the websites are WCAG 2.1 compatible and the web developers, in general, do not consider web accessibility in their products and services. The underlying factors responsible for web inaccessibility are found out to be extrinsic.

**Keywords:** Web Accessibility, Assistive Technology, Web (WWW), Mozambique, WCAG 2.1, people with disabilities, Web Developers.

## 1 Introduction

The essential element of the web is to allow its users, irrespective of any disability, easily access and share the information on it. In this universality lies the power of the web, once said by Tim Berners-Lee, W3C Director and inventor of the World Wide Web [1]. With the growing number of users (including traditionally marginalized groups such as people with disabilities) interacting the web over time, the increased adequacy of web accessibility has become more relevant as to represent all of them [2]. “Web accessibility is the concept of providing web content that is universally accessible to different machines and people with different ages, skills, education levels, and abilities” [3]. However, the prevalence of web accessibility is found to be lacking when it comes to countries in Africa [4], where around 40 percent of the total population suffers from sort of disability, according to the World Health Organization (WHO) [5]. According to the statistics from the National Census in Mozambique [6], the country estimates 727620 of its population to have some sort of disability, representing approximately 2.7 percent of the total population in Mozambique. Not even adequately being able to use the web causes people with disabilities in Mozambique isolated from society, education, health services, and other fundamentals deescalating further in their life [6]. On a similar note, this research work presents a case study of Mozambique with an

aim to learn, why the web remains inaccessible for these population groups in Mozambique.

The research attempts to analyse the case by empirically basing the undiscovered factors for the analysis. For this, the report chooses different models in the form of research questions to gather information. Since websites, by far, are considered the most prominent exponent form of web services, first research question thus in our report aims to find the level of accessibility in the most used five different purposed websites currently being used in Mozambique. The websites are checked against the WCAG 2.1 guidelines. This follows:

1. To what level do the top five most-used websites in Mozambique meet the web accessibility standards (in particular WCAG 2.1)?

There exist tools and practical guidelines recommended by W3C through their Web Accessibility Initiative (WAI) on web accessibility. These are responsible for regulating and developing web technologies [7]. These are a widely accepted prerequisite for the web makers, when practicing web accessibility to address the inaccessibility in web for various user groups. The most accepted and recognized website accessibility guidelines in place are WCAG 2.1 [8]. The WCAG v.2 has four principles: Perceivable, Operable, Understandable, and Robust. There are further 12 more specific guidelines under each of these principles. And along with each guideline, there are requirements primarily known as testable success criteria. These success criteria are categorized in three different yet interrelated and dependent conformance levels namely A (lowest), AA (mid), AAA (highest). Thus, satisfying the specific conformance level in the websites fulfils the requirements for the given specific circumstances [8]. There exist design approaches such as User-Centred Design (UCD), User-Sensitive Inclusive Design (USID), Design for User Empowerment (DUE), Ability-Based Design (ABD), Universal Design (UD) to address the accessibility challenges faced by the people with disabilities in web [9].

2. What are the factors that influence the web developers'<sup>1</sup> current practice and approach towards web accessibility in Mozambique?

The second research question aims to understand the knowledge and skills the web developers in Mozambique have in regard with these accessibility specific tools, guidelines, technologies, regional or universal regulations and policies, and design approaches. It also aims to discover their approaches and practices towards web accessibility and what factors drive them, through interviews and interactions.

With the results of above mentioned two distinct research questions our research will learn and analyse the web accessibility situation in Mozambique. Through the combined analysis from these, we shape our discussion part. The methodologies used for these research questions are separately discussed in detail in the methodology section.

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<sup>1</sup> In this paper we use the term “web developers” to collectively refer to software developers, web developers, web programmers, web designers, webmasters, web makers etc. used as the research participants in this research.

## 2 Literature Review

### 2.1 Disability, Web Accessibility and Mozambique.

Users with disabilities use various forms of assistive technology to allow them to browse web sites. Assistive technology supplements the reduced ability of the users. These different types of assistive technologies include both hardware and software such as screen readers, voice recognition, alternative pointing devices, alternate keyboards, and refreshable Braille displays [10]. A report work [11] have shown that the use of assistive technologies among people with disabilities<sup>2</sup> in Mozambique is lowest among assistive technologies used in other fields. A similar study by [12], in low-GDP-per-capita countries aimed at blind web users in Nepal, the authors argues that it is challenging to provide access to appropriate assistive technology in low GDP-per-capita countries.

Not all websites are compatible with the usage of Assistive Technology. Only a compatible website with various assistive technology can be used by users with disabilities. A web site that is compatible enough to these assistive technologies is considered an accessible website [13]. There exists a common misunderstanding that accessibility is only for people with disabilities. Leaping beyond this misconception lies the fact that accessible web is very helpful for people without disabilities. The prominent reasons for web accessibility are to create web services that are flexible to meet and address different types of users irrespective of disabilities, their preferences, the situations they are in [14]. The people with disabilities are often hit hard because of inaccessible physical environments, transportation, and information and communications (ICT) systems and are the causes of deprivation to participate in the society [15].

The National Institute of Statistics of Mozambique, INE is also responsible for census reporting [6]. Sida [6], have argued that INE lacks specific instructions and funding to collect information regarding disability and the different studies results reflect the absence of a commonly agreed definition<sup>3</sup> of disability and poor data collection methods. Sida is a government agency working on behalf of the Swedish Parliament and Government to reduce poverty in the world [6]. The new census report of 2017 of Mozambique reads the total country's population as 26,899,105 with 727620 of them suffering from some form of disability, representing 2.7 percent of the entire population [16].

Though the initiative of CRPD along with its optional protocol was first adopted on 13 December in 2006, Mozambique signed the CRPD and its Optional Protocol later on 30 November 2010, and subsequently ratified both on 31 December 2010 [17], [18]. Looking away from CRPD, the provision in the Article 37 of the Mozambican Constitution states that "citizens with a disability shall fully enjoy the rights enshrined in the

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<sup>2</sup> The disability or functional limitations, or disablement process is the result produced between the exchange of individual restricted functional abilities with the demands of the society and environment [11].

<sup>3</sup> The definition of disability differs from the social model to the medical model to other models in practice. Neither in this report nor my wider disability research, do I reject the idea that disability is powerfully shaped by social forces.

Constitution, and shall be subject to the same duties, except those which their disability prevents them from exercising or fulfilling.” Article 125 and its subsections further explain the provisions facilitating people with disability with article 125.3.b especially focusing on the ‘creation of appropriate conditions to prevent them from becoming socially isolated and marginalized’ [17]. In addition, FAMOD (Forum of the Mozambican Associations for the Disabled) established in 1998 is one of popular organization often functions as an umbrella for other 20 DPOs (Disable people Organizations) in Mozambique. FAMOD, independently or in collaboration with other organizations which work for various types of disabilities and covers all geographical areas in Mozambique, serves people with disabilities [17], [18]. The study also finds that the DPOs implementations often fail in Mozambique because of lack of funding, related recourses, qualified personnel, political will and inept awareness of disability issues in society. Mozambique is seen as not realizing and is often late in embracing Disability rights. It is said that it was DPOs' engagement and involvement that helped the country to achieve the ratification of the CRPD. The authorities in the ministry responsible for addressing disabilities blames unstable country movement and civil war as the key reason for erratic and delayed developments in addressing disability [17], [18].

Universal Design<sup>4</sup> (UD) is sometimes interchangeably perceived as Accessible Design in the field of web. More products will be accessible to and usable by everyone if people with disabilities are routinely included by user experts in usability tests and if Universal design principles are applied by product designers [19]. Universal design benefits everyone. Hence, universally designed web content, websites, and applications not only alleviates the hard experience faced by people with disabilities but also benefit all users [20]. Universal design holds a key for improved accessibility where the needs of all user types can be incorporated as it is inclusive, flexible and cost-effective [21].

## **2.2 Related Work on National Legislation and Policy Making, Promoting Web Accessibility.**

Article 9: Accessibility, of UN’s CRPD resolution requires its state parties<sup>5</sup> (including Mozambique) to facilitate the measures to identify and eliminate obstacles and barriers to accessibility in Information, communications and other services, including electronic services [22], [23]. The UN refers to Information and Communication Technology (ICT) as an umbrella term to include any information and communication devices, applications or its content [23]. Further, Article 21 in The United Nations CRPD defines access to information, as human rights and specifies responsibilities to the government

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<sup>4</sup> “Universal Design is the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. “Universal design” shall not exclude assistive devices for particular groups of persons with disabilities where this is needed [40]”.

<sup>5</sup> A list of state parties to UNCRPD, can be found at [https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg\\_no=IV-15&chapter=4](https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=IV-15&chapter=4).

and related authorities in relation to those rights. Availing accessible web information to people with disabilities<sup>6</sup>, therefore, becomes a mandatory aspect on the web.

There have been instances where many nations have acted with national laws for promoting accessibility in ICT. With different practices and approaches, ICT including the web is been addressed with an increasing number of national laws and policies over time [24]. W3C provides a list of laws and policies that some countries have enacted upon [25]. Many European countries have legislation that requires government websites to be accessible [4]. The study from [1] have shown that the Anti-Discrimination Act has improved the accessibility concerns on the web, in South Korea. The successive progression of The American with Disability Act (ADA) over the Rehabilitation act of 1973, to meet the then State's requirement in the United States by addressing and promoting unbiased and equivalent participation of the citizens in programs, activities and services [26].

While many countries have developed their own legislations for accessibility, some developing countries do not have it protecting people with disability's rights [27]. Developing countries in Africa don't have stricter web accessibility legislations mandating governmental websites to be accessible [28]. In the case of Mozambique, the Mozambican government established a national ICT policy commission in 1998. This facilitated the latter in adopting a national ICT policy, simultaneously supplementing its PARPA (Poverty Reduction Strategy Paper), an Action Plan for the Reduction of Absolute Poverty in 2002. In doing so, Mozambique became the first country in southern Africa implementing such act. This was then done mainly to focus on their priority areas of education, human resource development, health, universal access, national ICT infrastructure, and governance to improve and achieve their development goals further [29]. As a gradual realization of ICT policy, currently, many ICT initiatives have taken place in the areas of e-government, e-health, digital divide [30]. Mozambique have shown some promising steps in the field of ICT since then, with major IT project Initiatives throughout the country and African regions which can be found under the URL <http://www.ist-africa.org/home/default.asp?page=doc-by-id&docid=5563> [30].

We have found inadequate study indicating the web master's practices in web accessibility<sup>7</sup> in Mozambique. The few peripheral studies in regard to web master's practices in web accessibility are either quite old or represent different geographical locations than Mozambique with different participants/user scope. For example [31] can be referred in a similar context in Uganda.

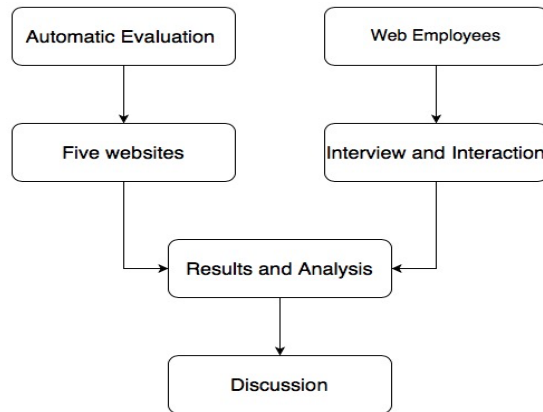
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<sup>6</sup> "Disability is an evolving concept and that disability results from the interaction between persons with impairments and attitudinal and environmental barriers that hinders their full and effective participation in society on an equal basis with other" [15]. The current convention proposed by the UN emphasizes to "promote, protect and ensure the full and equal enjoyment of all human rights and fundamental freedoms by all persons with disabilities, and to promote respect for their inherent dignity" [15].

<sup>7</sup> Web accessibility means that people with disabilities can use the Web. More specifically, web accessibility means that people with disabilities can perceive, understand, navigate, and interact with the Web [41].

### 3 Methodology

This section explains the methodological process involved in achieving the above-mentioned research questions. The evaluation methods of websites using automated tools and interviews and interactions sessions with web professionals in Mozambique. This is a qualitative research work, during the 3 months of fieldwork in Mozambique. The research uses the random sampling technique [32], to study few users as the research subject which represents the whole user group of its kind [33]. The interviews are carried with the web professionals living in Maputo, the capital of Mozambique. The diagram below shows how the report mixes different approaches to illustrate whole process of methodology to derive the discussion.



**Fig. 1.** Methodological approaches of the study.

The research study follows a hybrid assessment approach as it includes automated testing for websites and semi-structured interviews with web developers.

#### 3.1 Website Evaluation (Automatic Testing).

The websites are evaluated against the web accessibility requirements, WCAG 2.1, conformance level AA. Five prominent websites of different categories are chosen from SimilarWeb.com for the Mozambique region. SimilarWeb.com<sup>8</sup> as quoted on its website, it provides “Website ranking, an estimate of a website’s popularity among other websites using online competitive intelligence tool that provides traffic and marketing insights for the website”. The selected 5 websites of its kind records for highest web traffic and highest popularity in Mozambique. The list of prominent websites used popularly in Mozambique are as follows:

- A. <http://www.portaldogoverno.gov.mz/> (governmental website.)
- B. <https://www.olx.co.mz/> (shopping website)

<sup>8</sup> <https://www.similarweb.com/>

- C. <https://www.bci.co.mz/> (finance and banking)
- D. <https://www.movitel.co.mz/> (travel, hotel and accommodation)
- E. <https://www.mmo.co.mz/> (news and media).

The 3 evaluation tools used in the research to test for the major AA compliance levels in the websites are:

1. Web Accessibility Checker (achecker)<sup>9</sup>: This tool checks the HTML pages of the website for conformance with accessibility standards. With customization, the tool is systemized to match our testing areas of WCAG AA conformance levels. The checks it provides are coding errors (semantic code), standard compliance issues, accessibility problems, missing images, or its alt tags or broken links any many more.
2. SortSite Tool<sup>10</sup>: This web service checks WCAG and Section 508 guidelines. The home website for SortSite reads as the tool, used by federal agencies, Fortune 100 corporations, and independent consultancies.
3. WAVE, Web AIM Online Tool<sup>11</sup>: It checks the inaccessibility of the website and generates the inaccessible web content results.

Table 1 below shows the major AA compliance level, which is at least needed to pass the accessibility benchmark as suggested by WCAG2.1. We check the following guidelines as parameters for each website through the above-mentioned automated tool.

**Table 1.** Major AA compliance level of WCAG2.1.

| WCAG 2.1 (AA conformance level) | Guidelines          |
|---------------------------------|---------------------|
| 1.1                             | Text Alternative    |
| 1.2                             | Time-Based Media    |
| 1.3                             | Adaptable           |
| 1.4                             | Distinguishable     |
| 2.1                             | Keyboard Accessible |
| 2.2                             | Enough Time         |
| 2.3                             | Seizures            |
| 2.4                             | Navigable           |
| 3.1                             | Readable            |
| 3.2                             | Predictable         |
| 3.3                             | Input Assistance    |
| 4.1                             | Compatible          |

<sup>9</sup> <https://achecker.ca/checker/index.php?lang=eng> [42].

<sup>10</sup> <https://www.powermapper.com/products/sortsite/checks/accessibility-checks/> [43].

<sup>11</sup> <https://wave.webaim.org/> [44].

### 3.2 Interview and Interaction with Web Developers.

Firstly, the companies are selected based on good ratings over the internet, having decent reputation for their work. The web professionals chosen for the research have a job in the role of software developer, web developer, web designer, webmasters. The paper assumes these web developers are supposed to pose more or less knowledge about web accessibility as the nature of their job explicitly requires them contribute to the web development products or services. Interviewing these web developers holds a key to understand what practices they follow for web accessibility and what influences them to follow this. This factor will help us know about their web accessibility approaches they incorporate in their web design and development, which makes the report come closer to fathom the answers to understand if exists any, how their approach is directly or indirectly affecting people with disabilities in Mozambique in web accessibility. influences them to follow this. This factor will help us know about their web accessibility approaches they incorporate in their web design and development, which will help the paper to understand if exists any, how their approach is directly or indirectly affecting people with disabilities in Mozambique in web accessibility. A total of fifteen web developers were chosen from six different companies.

**Table 2.** Naming web developers anonymously.

| Companies      | A  | B  | C  | D  |    |    | E  |    |    | F  |    |    |    |    |    |
|----------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Web Developers | A1 | B1 | C1 | C2 | D1 | D2 | D3 | E1 | E2 | E3 | E4 | F1 | F2 | F3 | F4 |

To investigate the web developer's perception and approach towards web accessibility, a set of interview questions focusing to elicit their knowledge, experiences, and practices were asked. The set of interview questions for web developers are as follows.

1. How old are you in this profession of web technology?
2. What are your academic qualifications in the field of web Technology?
3. Are you aware of any state obligations, regulations and policies put in place for web accessibility?
4. Are you aware of web accessibility and the tools and guidelines for it?
5. Do you practice any approach to make your web products accessible? And how many projects you have worked with had web accessibility implementation in it.
6. Are you or any other employee in this company is responsible to ensure the products are designed accessible or review the product for accessibility before releasing?
7. Do you think implementing web accessibility is important?
8. How important do you think is a topic web accessibility is in regard to the people with disability in Mozambique?
9. Do you think implementing Web accessibility is a difficult and challenging task?
10. Do you think the user base for the web products or services would increase when web accessibility is practiced more frequently?
11. What do you think are the reasons behind web inaccessibility in Mozambique?



**Ethical Consideration.** Research is a sensitive process. Ethical considerations are vital in research to increase resistance to the false response of the data and encourage the pursuit of valid and reliable data that aids the primary goal of the research [34]. As specific to this research work, all the research participants are signed a pre-written consent form to validate their participation in the interaction and interview process, as an informed consent. A good procedure for the research in attaining consent for the human subject research in low income and rural African settings is obtained from [35]. It explains the importance of consent material in participants home language and parents (guardian, if required) involvement in the consent process, and/or need for community leader or representative approval. However, it is worth noting that, when comprehensively providing proper information to participants in lower income countries, critical challenges can arise in achieving valid consent [36]. All the rights, potential benefits and risks associated with the informed consent form were explained to the participants. To make the process more comfortable and easier the interviewees are entrusted with the right to terminate the interview if they deem at any point of time. The anonymity of the participants is protected to address their confidentiality and to their information at hand. This is done by assigning virtual names namely, participant A, participant B and so on in the report to maintain the confidentiality of the participants. However, it is important to note that the report only analyses the data and information given by the subject but not gathers or processes any personal data.

#### 4 Results and Analysis.

As we identify and collect data for results, this section will form the basis for discussion later. The results from each website evaluation tools for all five websites are presented systematically in the tables 3, 4 and 5 below. Pass (P) and Fail (F) describes the accessibility test of the website and holds true for each conformance level test according to results from the tools. ‘N/A’ in the table represents the data not available for that section.

Table 3 below shows the results from Achecker website evaluation tool. It shows 4 out of 5 websites utterly failed to pass 1 or 2 accessibility tests for the web accessibility requirement. The only web accessibility guidelines to be achieved were just 3 websites at most, and these were readability and compatibility of the web content. The website that performed the best was [www.olx.co.mz](http://www.olx.co.mz) with 8 web accessibility guidelines and worst were [www.portaldogoverno.gov.mz](http://www.portaldogoverno.gov.mz) and [www.bci.co.mz](http://www.bci.co.mz) with just 1.

**Table 3.** Table showing the test results of websites from “Achecker” automatic evaluation tool.

| WCAG 2.1 (AA)  | 1.1 | 1.2 | 1.3 | 1.4 | 2.1 | 2.2 | 2.3 | 2.4 | 3.1 | 3.2 | 3.3 | 4.1 |
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <a href="http://www.portaldogoverno.gov.mz">www.portaldogoverno.gov.mz</a> | F   | N/A | F   | F   | F   | N/A | F   | F   | F   | F   | F   | P   |
| <a href="http://www.olx.co.mz">www.olx.co.mz</a>                           | P   | P   | F   | P   | P   | P   | P   | F   | F   | F   | P   | P   |
| <a href="http://www.bci.co.mz">www.bci.co.mz</a>                           | F   | N/A | F   | F   | F   | N/A | F   | F   | P   | F   | F   | F   |
| <a href="http://www.movitel.co.mz">www.movitel.co.mz</a>                   | F   | N/A | F   | F   | F   | N/A | F   | F   | P   | F   | F   | P   |
| <a href="http://www.mmo.co.mz">www.mmo.co.mz</a>                           | F   | N/A | F   | F   | F   | N/A | F   | F   | P   | F   | F   | F   |

Table 4 below shows the results from SortSite, website evaluation tool. As compared to Achecker tool, SortSite showed many other passes. Except, [www.portaldogoverno.gov.mz](http://www.portaldogoverno.gov.mz) governmental website all other 4 websites ticked additional web accessibility guidelines requirement. However, the changes for websites, except [www.olx.co.mz](http://www.olx.co.mz) were still not convincing as more web accessibility guidelines met failed remarks that those met for pass remarks. None of the websites meet the web accessibility guidelines for text alternative, distinguishable and adaptability. During the test, the website that performed best was [www.olx.co.mz](http://www.olx.co.mz) with 7 web accessibility guidelines and worst was [www.portaldogoverno.gov.mz](http://www.portaldogoverno.gov.mz) with none.

**Table 4.** Table showing the test results of websites using SortSite website evaluation tool.

| WCAG 2.1 (AA)  | 1.1 | 1.2 | 1.3 | 1.4 | 2.1 | 2.2 | 2.3 | 2.4 | 3.1 | 3.2 | 3.3 | 4.1 |
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <a href="http://www.portaldogoverno.gov.mz">www.portaldogoverno.gov.mz</a> | F   | F   | F   | F   | N/A | F   | F   | F   | F   | F   | F   | F   |
| <a href="http://www.olx.co.mz">www.olx.co.mz</a>                           | F   | P   | F   | F   | P   | P   | P   | F   | F   | P   | P   | P   |
| <a href="http://www.bci.co.mz">www.bci.co.mz</a>                           | F   | N/A | F   | F   | P   | P   | F   | F   | P   | F   | F   | F   |
| <a href="http://www.movitel.co.mz">www.movitel.co.mz</a>                   | F   | F   | F   | F   | N/A | F   | F   | F   | P   | F   | F   | P   |
| <a href="http://www.mmo.co.mz">www.mmo.co.mz</a>                           | F   | N/A | F   | F   | P   | P   | P   | P   | P   | P   | F   | P   |

Table 5 below shows the test results from the WAVE evaluation tool. It showed all the website's increase in meeting more web accessibility guidelines than those from the tools used for evaluation before. The web accessibility guidelines for readable web content were met by all the websites whereas the web accessibility guidelines for adaptability of the web content to simpler layout or ways appropriate for the device being used to access web content and navigating or finding the web content were found to fail for all the websites. During the test, the website that performed best was [www.olx.co.mz](http://www.olx.co.mz) meeting with 10 web accessibility guidelines and worst was [www.movitel.co.mz](http://www.movitel.co.mz) and [www.portaldogoverno.gov.mz](http://www.portaldogoverno.gov.mz) with just 3.

**Table 5.** Table showing the website test results of using WAVE website evaluation tool.

| WCAG 2.1 (AA)  | 1.1 | 1.2 | 1.3 | 1.4 | 2.1 | 2.2 | 2.3 | 2.4 | 3.1 | 3.2 | 3.3 | 4.1 |
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <a href="http://www.portaldogoverno.gov.mz">www.portaldogoverno.gov.mz</a> | F   | F   | F   | F   | N/A | N/A | P   | F   | F   | P   | F   | P   |
| <a href="http://www.olx.co.mz">www.olx.co.mz</a>                           | P   | P   | F   | P   | P   | P   | P   | F   | P   | P   | P   | P   |
| <a href="http://www.bci.co.mz">www.bci.co.mz</a>                           | F   | N/A | F   | F   | P   | P   | P   | F   | P   | P   | F   | F   |
| <a href="http://www.movitel.co.mz">www.movitel.co.mz</a>                   | F   | F   | F   | F   | N/A | F   | P   | F   | P   | F   | F   | P   |
| <a href="http://www.mmo.co.mz">www.mmo.co.mz</a>                           | F   | N/A | F   | F   | P   | P   | P   | F   | P   | P   | F   | P   |

#### 4.1 Summarization of results from all three Automatic Testing Tools.

For any given website evaluated through different web evaluation tools showed the different results in web accessibility guidelines. This is because each web evaluation tool

exhibits a unique benchmark level to evaluate web accessibility guidelines. Some are built with more serious and strictness evaluation benchmark levels and some with loose ones, meaning the website tested through the former can filter for more fails in the web accessibility guidelines than the latter. The pass remarks for any website for a given web accessibility guidelines can be reclaimed with a failure remark with a stronger and strictly built benchmark evaluation tool [37].

**Table 6.** Summarized Results of Automated Testing

| WCAG 2.1 (AA) | Guidelines          | High          | Medium  | Low     | Pass Percentage |
|---------------|---------------------|---------------|---------|---------|-----------------|
| 1.1           | Text Alternative    | A             | C, D, E | B       | 13.33           |
| 1.2           | Time-Based Media    | N/A           | N/A     | N/A     | N/A             |
| 1.3           | Adaptable           | A, B, C, D, E | -       | -       | 0               |
| 1.4           | Distinguishable     | A, C, D, E    | -       | B       | 13.33           |
| 2.1           | Keyboard Accessible | D, E          | N/A     | B       | N/A             |
| 2.2           | Enough Time         | N/A           | N/A     | B       | N/A             |
| 2.3           | Seizures            | A, C, D       | E       | B       | 53.33           |
| 2.4           | Navigable           | A, B, C, D    | -       | E       | 6.66            |
| 3.1           | Readable            | A, B          | -       | C, D, E | 66.66           |
| 3.2           | Predictable         | D             | C       | A, B, E | 40              |
| 3.3           | Input Assistance    | A, C, D, E    | -       | B       | 20              |
| 4.1           | Compatible          | C             | A, E    | B, D    | 66.66           |

The paper reports the collective performance of all the websites, as shown in the above table 6. In the tables, the columns, ‘High’, ‘Medium’ and ‘Low’, represents the websites which have high to low level of comparative web inaccessibility. The websites in the table 6 are represented with the alphabets (A, B, C, D, and E) as described in section 3.1.

The column High, Medium, and Low for a website describes the comparative degree of website’s suffering or ineptness for a given specific conformance level with respect to other websites. For example, the web accessibility guidelines for A (alphabetical representation for the website ‘<http://www.portaldogoverno.gov.mz/>’) are recorded under the column ‘High’. This means the website performed worst for the web accessibility guidelines ‘Text Alternative’ as compared with other websites being used for the evaluation in our research. Similarly, for the same web accessibility guidelines of ‘Text Alternative’ the website B <https://www.olx.co.mz/> in the same row did well as it passed more web evaluation tool’s test and thus is placed under the column ‘High’. And the websites (C, D, and E) are placed under the ‘Medium’ column as these websites performed with the results better than ‘High’ and worse than ‘Low’. Classifying the websites in these three columns gives the comparative results among the websites. This shows which website is better or worst compared to the other website for a specific success criterion.

The website A faces the most accessibility issues whereas the website B faces the least. Given that website, A is a governmental website and its importance for the citizens is paramount, the Mozambican governmental website utterly fails to make it accessible to its citizens, and potentially many people with disabilities causing many problems in accessing and using the website.

The pass percentage of any conformance level is the average figure of results from all tools combined over all the websites being evaluated. We define pass percentage to know how well the website has performed overall for a specific conformance level. Mathematically, we calculate it as:

Pass percentage = (number of passes for specific conformance level / total number of fields) \* 100.

For Instance, pass percentage for text alternative =  $(2/15) * 100$  equals 13.33 percent. This means data for pass percentage depicts all the websites collectively for a given web accessibility guidelines. A total number of fields remains i.e., the denominator or divisor as the total number of fields are 15 as 3 tools times 5 websites. N/A in the table represents the results for that field cannot be obtained because the result was not specified in tools results. Calculating N/A with a known entity would return an infinite or known result.

As can be seen from the table 6, the combined effort of all the websites, apart from 3 web accessibility conformance levels, Seizures, compatible and readable, the other 9 conformance levels show low to very low pass percentage. Such results are inevitable to cause web accessibility barriers for people with disabilities using it. The results from this prove that the websites do not satisfy the user's needs to access the website if the users are having varied sorts of impairments or disabilities. The overall performance of these websites able to impact to be used by people with disabilities is certainly bleak. This shows that these websites fail to make any prevalence among these group users.

#### **4.2 Results from Interviewing and Interacting with Web Developers in Mozambique.**

Out of 15 web developers interviewed for the research only 4 of them is found to have less than 4 years of work experience. The average experience of 15 web developers interviewed for the research was calculated to be 5.5 years. The responses from the web developers are categorized in 3 groups, by grouping and differentiating ideas or expressions under specific categories as shown in table 7.

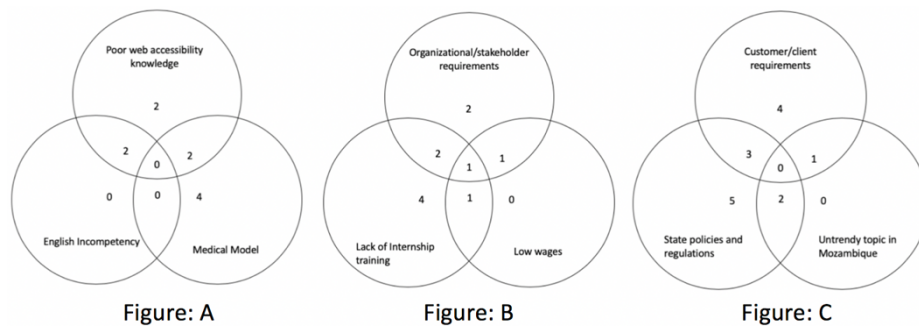
**Table 7.** Grouping of web developers' responses into Individual, Organizational and External factors.

| Group of factors       | Nature of web developers' responses   |
|------------------------|---|
| Individual factor      | Perceiving disability with medical model.<br>Poor knowledge on the topic of web accessibility.<br>English Incompetency. |
| Organizational factors | Low wages of web employees.<br>Lack of Internship training.<br>Organizational/stakeholder requirement.                  |
| External factors       | Customer/client requirement.<br>State policies and regulations.<br>Untrendy topic in Mozambique.                        |

The Venn-diagram A in the figure number 2 below shows the number of web developers' responses who thinks inaccessibility on the web is due to an individual ineptness or understanding of the topic. The report describes the three nature of responses under individual factor which are responsible for inaccessibility in the web. Several interviewee's responses mentioned under the Medical Model depict disability is an individual condition that limits their ability to use the web. The medical model defines disability located within the individual [38]. Thus, we categories their approach towards people with disabilities under the Medical Model. The response under "poor web accessibility knowledge" means the responses from the interviewee who admitted inaccessibility is due to their poor knowledge on the topic. However, some responses blamed the inadequacy of their level of English. Further, they reported, as most of the mainstream web development environment and applications are in English, sometimes their limited comprehension skills in English do not allow them to advance their work. And thus, they work with a fixed package of workload in their everyday job.

The Venn-diagram B in the figure number 2 below shows the number of web developers' responses who thinks inaccessibility on the web is due to their organizations or company in which they work in. Some of the responses criticized the pay scale for web developers in IT companies being low. According to a few of them, given the nature and level of work in the IT industry, and is called a software developer or web developer, the tag does not justify the payment. While some also feel that, being newly hired in the company, it is the company's responsibility to train them on new or unknown topics. This would make them cognizant of the company's work culture, practice, and trend. Some of the web developers were also noted citing it is not because of them the web products are inaccessible rather it is the project manager's or other stakeholders' requirements that rarely mandates building accessible products. Also, the web developers have hardly been asked to incorporate web accessibility in the projects. There can be many probable inferences to this, including stakeholders' or project master's lack of knowledge on web accessibility. The presumption that the accessible web products can cost more and require more time or being complacent assuming ad hoc solutions satisfies the major customer base.

The Venn-diagram C in the figure number 2 below shows the number of web developers' responses who thinks inaccessibility on the web is due to other factors that are external than those factors mentioned above. Many web developers feel it is due to the State's poor law-making strategy and policy responsible for web inaccessibility to a great extent. They feel the topic is unique and are thus not aware of web accessibility practices because they are not obliged to follow such practices as regulations. They blame the absence of any ICT policies not relating to web accessibility. Also, some responses cited the client, or the customer does not come up with accessibility requirement and as a result, the product must be built based on what they demanded. However, the research also finds some interviewees feel the topic of web accessibility is not ubiquitous in Mozambique and thus untrendy which in effect fails to motivate the web accessibility practice further.



**Fig. 2.** The three Venn-diagrams A, B and C showing the web developers' responses categorized as individual factors, organizational factors, External factor respectively.

## 5 Discussion

The paper has explored the web accessibility issues in Mozambique. Analyzing the results from 2 perspectives: evaluation of websites and interviewing and interacting with web developers in Mozambique presented us with a broader understanding of the cause.

The 5 websites evaluated showed basic to major accessibility flaws and none of the websites comply with WCAG 2.1 guidelines to the adequacy to meet web accessibility standards. The governmental website, <http://www.portaldogoverno.gov.mz/> is found to have the worst accessibility among the 5 websites. This result is in line with the study [4] where the authors find the Mozambican governmental websites to be very much inaccessible as well, due to failures of HTML elements in the HTML documents. The failures are, missing alt or title attributes on decorative text, some colors being perceived too bright, table captions also being almost inexistent, and no proper connection of some flash objects with textual descriptions [4].

On a disappointing note, this paper studied that no websites showed the satisfactory accessibility level for the conformance level of the web accessibility according to WCAG 2.1 (except [www.olx.co.mz](http://www.olx.co.mz/)). Only 3 web accessibility conformance levels,

Seizures and physical reactions, compatible and readable, ranged from 50 to 66.66 pass percentage and the other 9 conformance levels failed to make impressive remarks. Such results of the websites are inevitable to cause web accessibility barriers for people with disabilities, using it. This proves that websites in Mozambique are inaccessible and thus fails to outreach the nation's people with disabilities population.

The approach towards the accessibility in web and inclusive design does not seem a serious practice amongst the web developers. For many (but not all) interviewees, 'accessibility' in the web is a novel and unfamiliar topic. Their responses (around 80 percentage) did not mention web accessibility and thus its scarce experiences among them should not be considered surprising. For remaining interviewees (web developers) showed little knowledge of web accessibility. None of the developers incorporates accessibility measures in all their products and only very few of them practice web accessibility measures at some time. This is to say, there exist, little if any web developers practice web accessibility on their own. The web developers are found to be deeply unaware of the web accessibility guidelines and tools.

The level of understanding and awareness of the web developers in the subject is undoubtedly found to be dearth. However, the other factors buttressing this obvious fact are worth reflecting upfront. Absence of state policies and regulations specific to web accessibility, rudimentary web requirements and apathetic considerations from stakeholders/clients for their products and lack of web accessibility training for web developers are the factors, in the first place, restraining web developers practice web accessibility. These identified extrinsic factors are fairly consistent and can be related to the factors explained in the research [39], where the author urges the simultaneous holistic extension of cultural, political, societal and economic factors for universal ICT access.

Considering that the average job experience for the interviewed web developers exceeds 5 years, the lack of practical experience with web accessibility is hard to fathom. As the web accessibility awareness among web developers is found lacking, this invariably can result in the lack the competencies and demanding skills required in the field of web accessibility. Most of the web developers' responses suggest the need of legislative framework and policies on web accessibility standards for web developers. This study found the similar kind of results, with the study from [31] in the context of Uganda, where web inaccessibility in the country is due to the absence of web accessibility specific regulations and policies. It can fairly be argued that the situations for improved web accessibility in a low-income country like Mozambique largely remains in the hands of the governmental policies.

The field of ICT in Mozambique is at its infancy stage, and certainly needs improvement in ICT policies and regulations relating to web accessibility, which in specific have not taken place before. With the government gradually initiating and developing ICT projects [30] shows the realizations have derived into effect. This research has found evidence on how some nations in the past or recently are able to improve accessibility on the web by amending and enacting the laws. From UN CRPD conventions regulations, web developers' responses, improved history of other nations enacting web accessibility laws, etc. provides enough rationale for Mozambique to act very soon to enact and regulate policies inaccessibility on the web. The UNCRPD article 9:

Accessibility, Paragraph 28 of Chapter 3 “Obligations of States parties” presents a suitable case for countries like Mozambique to implement accessibility in ICT by adopting suitable legal framework in the absence of relevant legislation [23].

## **6 Limitations and Future Work.**

The coverage of the research participants in the research is narrow. The reliability of the research conducted only in Maputo, to a certain degree can be debatable. This is called error sampling [32]. Nevertheless, as the study was conducted majorly in the capital cities of the provinces (including capita of Mozambique) where it is believed modern technology for web accessibility is provided. Thus, it would not impact the results greatly. This is because the higher value of the range of data would remain the same even though the study had covered more places in the country.

It is worth noting that, few web developers might have falsely responded to some questions favoring accessibility knowledge and practice owing to their dignity, identity, and fear of losing the job. This is because, some hesitancy and reluctance for some web developer were noticed during interview.

For one of the websites among 5 used for automatic evaluation, the URL for [www.olx.co.mz](http://www.olx.co.mz) is no longer available. This realization came during the final 2020 self-evaluation before the submission of the thesis. According to local source, the website has been taken down due to security concerns. However, the version of the website evaluated for automatic testing can be traced backdate at <https://web.archive.org/web/20190128220421/https://www.olx.co.mz/> at archive.org.

Future work should include web developers from other various parts of Mozambique to produce more consistent and accurate generalization of the country. Adding people with disabilities as the research subject, user testing and interviewing them could be beneficial in the future study. The results from such study combined with the results of this study should present the overall web inaccessibility situations in Mozambique. This study discovering dearth of accessibility in ICT and web, provides a new opportunity for stakeholders, regulation and policy makers and specially web developers to encompass accessibility/universal design guidelines and principles from beginning. A good reference for such practice can be exercised from widely accepted source of Web Accessibility Initiative (WAI) of W3C which develops guidelines, widely regarded as the international standard for web accessibility [7].

## **7 Conclusion**

The most used 5 websites in Mozambique being evaluated are found to have major accessibility flaws. Added with, interview and interactions with web developers in Mozambique revealed their inept awareness and skills in web accessibility guidelines and knowledge to perform any web accessibility practices in their web solutions. The fieldwork in Mozambique, helped gather the web developers’ responses and subsequently to understand the underneath issues contributing to the web inaccessibility from their individual levels. Our study found that the issues in web accessibility in



Mozambique, are more of an extrinsic in nature which is the cause for a functional (technical) issue, inaccessibility flaws on the web. Thus, the extrinsic (non- functional) factors must be addressed to achieve accessible functional (technical) requirements relating to web accessibility. These extrinsic factors are majorly societal, financial, organizational, legislative, and environmental/external factors. These factors contribute to maintaining a gap in the adoption of web accessibility support and services for people with disabilities and practice and awareness among web practitioners. Being one of the members among the state parties to the UNCRPD Article 9 relating to ‘accessibility’ aiming to improve accessibility for people with disabilities, Mozambique is only slowly progressing, this study finds.

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