Accessibility Analysis of e-Government Websites in Tanzania using Web Content Accessibility Guidelines 2.2

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Abstract
Digital accessibility is a critical component of inclusive e-governance, ensuring equitable access to information and services for all citizens, including individuals with disabilities. This study evaluates the accessibility of 42 Tanzanian e-government websites using the Web Content Accessibility Guidelines (WCAG) 2.2 as a benchmark. Employing the SortSite tool to assess the first ten pages of each website, findings reveal an average of 3.64 pages per site contain accessibility errors, a standard deviation of 2.28 and an Interquartile Range of 1.25–5.0. The most common violations occurred at Level A, indicating fundamental accessibility issues such as missing link contexts and inadequate support for assistive technologies. Notably, some sites, like the National Identification Authority portal, achieved full compliance, while others, such as the NHIF service portal, exhibited widespread non-conformance. The study emphasizes that while Tanzania has made significant strides in e-government, including deploying over 500 websites and national digital services, accessibility remains a neglected dimension. Strengthening accessibility is not only a legal and ethical imperative but a strategic necessity for fostering digital inclusion. This paper contributes to the growing discourse on e-government usability in developing countries and provides practical recommendations for policymakers and developers to enhance accessibility standards.

Keywords*: e-government websites, WCAG 2.2, accessibility, developing countries*

INTRODUCTION
Government websites play a pivotal role in efficiently delivering a diverse range of public services, catering to the needs of individuals and businesses across local and national tiers. The fundamental goal of e-government initiatives revolves around seamless access to these services. Despite considerable progress in enhancing digital accessibility, impaired

individuals still struggle to navigate e-government platforms. Effectively addressing this issue is a technological concern and a moral imperative for fostering inclusivity and adhering to sustainability and societal resilience principles. By prioritising accessibility in e-government design, policymakers can ensure that citizens of all abilities have equitable access to vital information and services, promoting a more inclusive and resilient society.

Aligned with guidance from the United Nations and other international organisations, it becomes increasingly essential for e-government deployment to actively work towards eliminating accessibility barriers. This proactive approach is crucial in guaranteeing that no segment of society is left behind, thereby fostering a society where everyone, regardless of physical abilities, can equally participate and benefit from digital advancements. Embracing inclusivity in e-government initiatives not only aligns with international standards but also contributes to enhancing overall societal well-being. As governments strive to create digital environments that are accessible to all, they contribute not only to technological progress but also to the overarching goal of building a society that values and empowers every individual.

Accessibility, which gauges how people with different abilities use and engage with e-government websites, is one of the critical elements that determine the quality of e-government websites (Henriksson et al., 2007); certain factors, such as colour selection, website structure and readability, affect accessibility. Therefore, e-government website accessibility is essential for fostering confidence and guaranteeing the successful implementation of e-government and the provision of public services. Accessibility in e-government websites has been a prominent research topic in earlier studies (Adepoju et al., 2016; AkgÜL & Vatansever, 2016; Elisa, 2017; Ismail et al., 2018; Mtebe & Kondoro, 2017; Paul, 2023; Uutsi & Mufeti, 2021). However, a relatively small number of earlier studies evaluated the accessibility of e-government websites using both the Web Content Accessibility Guidelines 1.0 (WCAG 1.0) and WCAG 2.0. The year 2018 saw the release of WCAG 2.1 by the World Wide Web Consortium (W3C, 2018). WCAG 2.1 extends the WCAG 2.0 and includes several accessibility guidelines for people with disabilities, including blindness, low vision, deafness, hearing loss, limited movement, speech disabilities and photosensitivity. Most recently, the W3C recommended the WCAG 2.2 on 5 October 2023 (W3C, 2023).

According to the W3C, WCAG 2.2 extends WCAG 2.1, and websites that conform to WCAG 2.2 also conform to WCAG 2.0 and WCAG 2.1 (W3C, 2023).

In light of the escalating significance of digital accessibility in our technologically driven era, it is disconcerting to note a conspicuous deficiency in scholarly investigations within the current literature that assesses e-government websites following the latest accessibility standards, notably the WCAG 2.2 guidelines. This research gap underscores the urgent need to embark on a thorough and systematic analysis of the accessibility status of e-government portals. This research endeavour becomes all the more imperative when considered within the context of Tanzania, where the digital landscape is evolving rapidly. Therefore, the objective of this study is to conduct a comprehensive examination of the adherence of Tanzanian e-government websites to the WCAG 2.2 guidelines. By doing so, the aim is not only to contribute valuable insights to the global discourse on digital accessibility but also to provide specific recommendations for improvements in the Tanzanian e-government domain, ensuring inclusivity and equitable access for all citizens.

The structure of the paper delineates a clear path for understanding the research process and findings. Beginning with Section 2, an exploration of related work sets the stage by reviewing existing literature and studies pertinent to the accessibility of e-government websites. Section 3 then delves into the methodology employed for assessing these websites, elucidating the criteria, tools, and procedures for conducting the analysis. Then, in Section 4, the findings gleaned from the evaluation are presented and analysed. Finally, in Section 5, the paper culminates in a comprehensive conclusion that synthesises the key findings, discusses their implications, and offers suggestions for future research.

LITERATURE REVIEW
E-government in Tanzania
Tanzania, officially known as the United Republic of Tanzania, is a country located in East Africa, bordered by Kenya and Uganda to the north, Rwanda, Burundi, and the Democratic Republic of the Congo to the west, Zambia, Malawi, and Mozambique to the south, and the Indian Ocean to the east. With its diverse landscapes, rich cultural heritage, and

abundant wildlife, Tanzania is renowned for its natural beauty and attracts tourists from around the globe.

In tandem with numerous nations worldwide, Tanzania has undergone substantial advancements in adopting and integrating e-government services, marking a transformative evolution in its governance landscape. This progressive trajectory finds its genesis in establishing the e-Government Authority (e-GA) in 2019, a watershed moment catalysed by the enactment of the e-Government Act No. 10 of 2019. Positioned as a pivotal public institution, the e-GA assumes a multifaceted mandate, encompassing the orchestration, supervision, and advocacy of national e-government initiatives. Tasked as the principal enforcer of pertinent e-government policies, laws, regulations, standards, and guidelines across all public entities, the e-GA plays a paramount role in steering Tanzania's digital governance agenda. The far-reaching impact of these e-government endeavours cannot be overstated, constituting the linchpin for optimising service delivery to Tanzanian citizens, businesses, and diverse stakeholders. Through adept utilisation of digital platforms and cutting-edge technologies, e-government initiatives are catalysts for bolstering efficiency, transparency, and accessibility within governance frameworks, thereby nurturing socio-economic advancement and fostering inclusive growth throughout the nation's expanse.

To date, the Government has demonstrated significant progress in advancing e-government initiatives. Among its notable achievements are legislative measures such as enacting the eGovernment Act, which has laid the groundwork for digital governance. Concurrently, establishing the Authority has provided a structured framework for overseeing and implementing these initiatives. Operationally, the government has spearheaded the development and deployment of several pivotal sector-specific systems. These include the Government electronic Payment Gateway (GePG), streamlining financial transactions, the Online (Business) Registration System (ORS) simplifying business registration processes, the Integrated Lands Management Information System (ILMIS) enhancing land management efficiency, the National e-Procurement System of Tanzania (NeST) facilitating procurement procedures, and the Fourth Generation Birth Registration System (BRS-4G) modernising vital records management.

Moreover, the Government has conducted extensive awareness campaigns to ensure citizen engagement and understanding of e-government services. These efforts encompass training programs attended by thousands of government personnel, conferences held in major cities like Arusha and Dodoma, and televised broadcasts to inform the public about e-government initiatives. As the e-Government Strategy 2022 outlines, the Government has expanded its online presence by implementing over 500 websites and portals. Notably, the Government Portal serves as a centralised hub for accessing a wide array of government services and information, embodying the commitment to provide citizens with convenient and efficient digital governance solutions.

Enhancing the accessibility of e-services stands out as a crucial focus area within the Government's e-government Strategy 2022. Acknowledging its pivotal role, the Government has actively spearheaded initiatives to create and deploy accessible e-services while fostering an inclusive and non-discriminatory environment for e-Government offerings (eGovernment Authority, 2022). Despite commendable efforts, it remains apparent that further steps are imperative to fortify the accessibility of e-services for all citizens. The imperative for action is underscored by the recognition that accessibility must extend beyond mere technical considerations to encompass diverse needs and circumstances. The efforts include but are not limited to addressing challenges related to disabilities, literacy levels, disparities between rural and urban populations, varying age demographics, and linguistic diversity (eGovernment Authority, 2022). In essence, the pursuit of comprehensive accessibility mandates a multifaceted approach transcending conventional barriers, ensuring that e-services cater equitably to all citizens' diverse needs and circumstances.

People with disabilities in Tanzania, like in many other parts of the world, face a range of challenges and opportunities as they navigate through various aspects of life. In terms of demographics, people with disabilities in Tanzania represent a diverse group, encompassing individuals with physical, sensory, intellectual, and developmental disabilities. The 2022 Census statistics published by the National Bureau of Statistics indicate there are 5,347,397 persons with disabilities[1]. This figure represents approximately 11.2% of the total population, as per the census conducted in 2022. The most prevalent type of disability is visual, which accounts

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[1] en-1738321655-01. URT_Demographic and Socioeconomic Profile.pdf [Last accessed 16 February 2024]

for 1,447,853 persons with visual impairment. These statistics shed light on the prevalence and significance of disabilities within Tanzanian society, highlighting the need for comprehensive policies and initiatives to address the needs and rights of people with disabilities. In the context of e-government, these statistics hold significant implications for the design, development, and implementation of digital services and platforms. Recognising that 11.2 % of the population lives with disabilities underscores the importance of ensuring that e-government initiatives are inclusive and accessible to all citizens, regardless of their abilities. Moreover, the statistics serve as a reminder of the importance of collecting and analysing data on disability prevalence and access to e-government services.

Over the past decade, there has been a notable dearth of studies addressing the accessibility of e-government websites in Tanzania. One seminal investigation in 2014 scrutinised the accessibility of 21 e-government websites, gauging their adherence to the WCAG 2.0 Level A guidelines. The findings revealed that 95% of these websites exhibited various accessibility errors. Subsequently, in 2017, Mtebe and Kondoro embarked on a similar endeavour, assessing 22 e-government websites against the WCAG 1.0 standards (Mtebe & Kondoro, 2017). Their analysis revealed a concerning trend, with 82% of the websites harbouring over 100 accessibility issues per 100 scanned pages. Building upon this discourse, a subsequent study conducted in 2020 underscored persistent challenges, reporting that 62% of the 79 e-government websites examined continued to grapple with accessibility errors. Fast forward to 2022, where Ishengoma delved into the accessibility landscape by scrutinising three prominent e-government websites: necta.go.tz, nacte.go.tz, and ajira.go.tz (Ishengoma, 2022). Ishengoma's findings highlighted that necta.go.tz and nacte.go.tz failed to meet the minimum accessibility conformance level, lacking the prerequisite error-free environment mandated for level A accessibility (Ishengoma, 2022). These collective studies underscore a glaring imperative for improvement within e-government websites, emphasising the critical need for their permeability, operability, comprehensibility, and robustness enhancements.

Accessibility of E-government Websites
Accessibility, in the realm of website design, pertains to ensuring that individuals of all abilities, including those with visual, auditory, motor, or

cognitive impairments, can navigate and interact with digital content effectively. The objective is to provide equal access to information and functionalities for everyone. The World Wide Web Consortium (W3C) has been instrumental in establishing accessibility standards to facilitate this inclusivity. In 1999, the W3C introduced the Web Content Accessibility Guidelines (WCAG) 1.0, marking the foundational step towards web accessibility. Building upon this framework, the W3C launched WCAG 2.0 in 2008, which offered a more comprehensive set of guidelines addressing a broader spectrum of accessibility issues. Recognising the evolving landscape of technology and user needs, subsequent iterations were introduced: WCAG 2.1 in 2018 and WCAG 2.2 in 2023. These updated versions aim to address emerging challenges and incorporate advancements in web technologies, ensuring that digital content remains accessible to all individuals, regardless of their disabilities. By adhering to these standards, websites can foster inclusivity, enabling diverse populations to engage with online information and services without barriers. The guidelines outlined by four fundamental principles, established by the World Wide Web Consortium (W3C) in 2023, have been systematically structured to ensure inclusivity and accessibility for all users. These principles serve as the cornerstone for creating digital experiences that cater to diverse needs and abilities (W3C, 2023):

v) Perceivable: "Information and user interface components must be presentable to users in ways they can perceive". This principle emphasises the importance of presenting information and user interface components in ways that are easily understandable and accessible to users, regardless of any sensory limitations they may have.

vi) Operable: "User interface components and navigation must be operable". Operability highlights the necessity for user interface components and navigation to be functional and easily usable, enabling seamless interaction with digital platforms.

vii) Understandable: "Information and the operation of the user interface must be understandable". The principle of understandability underscores the importance of making both information and the operation of the user interface clear and comprehensible to users, promoting ease of use and navigation.

viii) Robust: "Content must be robust enough that a wide variety of user agents, including assistive technologies, can interpret it."

Robustness ensures that digital content remains accessible and interpretable by a wide range of user agents, including assistive technologies, thereby enhancing the overall accessibility and usability of the digital environment.

Scholarly inquiries, exemplified by extensive research in (Paul, 2023), have scrutinised the accessibility landscape of e-government websites on a global scale. Their findings have consistently highlighted many accessibility inadequacies, benchmarked against established guidelines like WCAG 1.0 and its successor, WCAG 2.0. Paul's (2023) seminal work serves as a poignant reminder of the prevalence of significant accessibility gaps within e-government portals. Across varied geographical contexts, recent investigations have consistently revealed a disconcerting reality: many government websites fall short of meeting the rigorous accessibility criteria outlined in WCAG 1.0 and WCAG 2.0 standards. This pervasive trend underscores the urgent need for concerted actions to bolster the accessibility features of e-government interfaces, ensuring that all users have equitable access and fostering inclusivity within digital governance realms.

Numerous studies, including those by (Al-Sakran & Alsudairi, 2021; Doush & Almeraj, 2019; Ilhan et al., 2020; Nakatumba-Nabende et al., 2019; Paul, 2023; Uutsi & Mufeti, 2021) have collectively shed light on a range of notable deficiencies prevalent in e-government websites. These deficiencies span from broken pages and lacking form labels to empty links and images devoid of alternative texts. Such revelations underscore the pressing need for substantive improvements across government web platforms. Policymakers and web developers must heed these findings and prioritise implementing robust accessibility measures, rectifying existing shortcomings and ensuring that e-government services are truly inclusive and accessible to all citizens, irrespective of their abilities or disabilities.

Since the publication of the WCAG 2.2 guidelines in October 2023, there has been a noticeable gap in the scholarly literature concerning the utilisation of these updated accessibility standards for assessing e-government website accessibility. This dearth of research underscores the need for comprehensive investigations into the adherence of e-government platforms to the latest WCAG guidelines. Consequently, this study endeavours to bridge this gap by conducting a thorough

accessibility evaluation of Tanzanian e-government websites, employing the WCAG 2.2 standard as the benchmark for assessment. By undertaking such an analysis, this research seeks to shed light on the current state of accessibility compliance among Tanzanian e-government portals and identify areas for improvement in alignment with the latest accessibility standards. Through this examination, valuable insights can be gleaned to inform policymakers and stakeholders about the efficacy of existing accessibility measures and facilitate targeted interventions to enhance the inclusivity and usability of e-government platforms for all users, including those with disabilities.

METHODOLOGY

The process of evaluating web accessibility primarily relied on employing automated tools to gauge the adherence of web pages to the WCAG standards. The plethora of automated tools available for this purpose includes Sortsite, AChecker, HTML Validator, CSS Validator, APrompt, and EvalAccess 2.0 (Abduganiev, 2017). These tools exhibit variations in their criteria, ranging from efficiency to conformance levels (A, AA, and AAA), as shown in Table 1. In the WCAG, adherence to Level A success criteria is characterised by relatively straightforward requirements, constituting the foundational tier of conformance. In contrast, Levels AA and AAA entail more rigorous standards, demanding more effort and attention to detail. Meeting these higher levels of conformance may present challenges that surpass the capabilities or resources of certain entities (W3C, 2023). The author acknowledges that automated tools have known limitations and cannot reliably detect issues such as keyboard traps, improper focus order, screen reader compatibility, or dynamic content interactions. This limitation provides an avenue for further studies to incorporate hybrid approaches combining automated checks with expert manual reviews or participatory usability testing involving people with disabilities.

Table 1
WCAG Conformance Levels

Conformance Level	Description
A	The website conforms to the Level A success criteria. This is the minimum level of conformance.
AA	The website conforms to the Level A and Level AA success criteria.
AAA	The website conforms to Level A, Level AA and Level AAA success criteria. This is the highest conformance level.

This study used the Sortsite website evaluation tool to assess the accessibility of 42 e-government websites in Tanzania based on the WCAG 2.2 guidelines. The online version of the Sortsite tool was used, given its capacity to provide evaluation by scanning the initial ten (10) pages of each website under scrutiny, including the homepage and 9 consistently selected inner pages (e.g., 'About', 'Services', 'Contact', etc.), to ensure comparability across all websites. Only the top-level domains were included to ensure consistency and comparability. Subdomains associated with departments, programs, or campaigns were excluded, as they often vary widely in structure, purpose, and management responsibility. This approach provided a nuanced understanding of each website's accessibility profile, capturing essential elements and potential barriers users might encounter during their navigation journey. Central to the selection criteria was the focus on e-government websites offering services at the national level, thereby excluding local government counterparts from the purview of this study. This deliberate decision ensured the evaluation remained targeted, homing in on platforms with significant user engagement and nationwide relevance. Additionally, the emphasis on user-centricity guided the selection process, with preference accorded to websites frequented by a substantial user base, thus ensuring the practicality and relevance of the findings to the broader digital populace. Furthermore, including websites catering to English and Swahili (Tanzanian language), speakers underscore the study's commitment to linguistic diversity, acknowledging the significance of linguistic inclusivity in ensuring equitable access to governmental services across different segments of the country's population. E-government websites included in the assessment are websites for all 26 ministries, all 12 national authorities, two (2) independent departments and two (2) online services. Information about e-government websites in Tanzania is available online at [Government of Tanzania | Home](). The temporal dimension of the evaluation, spanning from November to December 2023, ensures that the findings remain contemporary and relevant, providing stakeholders with timely insights into the current state of accessibility within Tanzanian e-government platforms.

FINDINGS AND DISCUSSION

The study aimed to evaluate the extent to which e-government websites in Tanzania conform to established accessibility standards while concurrently identifying pivotal areas necessitating refinement to foster a

more inclusive digital environment. To accomplish this, a comprehensive analysis was conducted on a representative sample of 42 e-government portals, using the globally recognised WCAG 2.2 guidelines as the assessment benchmark. The evaluation employed the SortSite (online version) accessibility testing tool, which systematically examined a fixed set of 10 pages per website—comprising the homepage and nine consistently selected inner pages. The results revealed that, on average, 3.64 pages per site exhibited accessibility errors, representing a significant portion of the evaluated content. However, the standard deviation of 2.28 indicates considerable variability across websites—some had many more error-laden pages, while others had relatively fewer. Additionally, the interquartile range (IQR) of 1.25 to 5.0 shows that for the middle 50% of websites, between about 1 and 5 pages had accessibility issues. This spread illustrates that while some sites are performing relatively well, others lag behind notably. Together, these statistics highlight both the systemic presence and the uneven distribution of accessibility barriers within Tanzanian e-government platforms. Such disparities imply potential exclusion of users with diverse abilities and needs, underscoring the urgent need for targeted improvements. Strengthening the accessibility infrastructure of these platforms is essential to ensuring equitable digital access and fostering a more inclusive and participatory society.

As per the findings, the website experiencing the highest degree of accessibility errors is https://verification.nhif.or.tz/ServicePortal/application, where a thorough evaluation revealed that all ten pages analysed failed to meet adequate accessibility standards. This platform is a crucial gateway for the public to access vital health insurance services. However, the pervasive presence of accessibility barriers effectively barricades individuals with disabilities from availing themselves of these essential benefits. This stark disparity not only highlights the urgent need for remedial action to rectify accessibility shortcomings but also underscores the significant impact of such deficiencies on equitable access to healthcare services for marginalised populations.

Conversely, the National Identification Authority (NIDA) website at https://nida.go.tz/swahili/ presents a contrasting scenario, boasting a commendable track record of zero accessibility errors across all assessed pages. This exemplary performance suggests that the NIDA website prioritises inclusivity and accessibility, ensuring that individuals with

disabilities can navigate its interface seamlessly. Such a proactive approach fosters an environment of equal access and reflects the organisation's commitment to serving all citizens regardless of their abilities. This noteworthy achievement sets a precedent for other governmental entities, emphasising the pivotal role of accessibility in fostering a more inclusive digital landscape where every individual can fully participate and benefit from online services and information.

Additionally, the analysis revealed insights into the distribution of accessibility errors across different conformance levels of the WCAG guidelines. Specifically, the average number of accessibility errors varied across the three conformance levels. Level A exhibited the highest average at 6.64 errors, followed by Level AAA with an average of 3.69 errors, and Level AA with the lowest average of 2.48 errors, as referenced in Table 2. Level A represents the minimum conformance level mandated by the WCAG guidelines, indicating that most accessibility errors occur at this foundational level. This troubling revelation suggests that individuals with accessibility challenges encounter significant barriers even at the most basic level of interaction with these websites.

To further elucidate the extent of accessibility issues, Figure 1 illustrates the percentage distribution of accessibility errors across all levels of the WCAG 2.2 guidelines. This visual representation underscores the pervasive nature of accessibility deficiencies across various facets of website design and functionality, highlighting the need for comprehensive remediation efforts to address these shortcomings effectively.

Moreover, these findings align with previous studies, corroborating the persistent inadequacies in the accessibility of e-government websites for individuals with disabilities (Abduganiev, 2017; Adepoju et al., 2016; AkgÜL & Vatansever, 2016; Al-Sakran & Alsudairi, 2021; Doush and Almeraj, 2019; Elisa, 2017, 2020; Ilhan et al., 2020; Mohd Isa, 2011; Nakatumba-Nabende et al., 2019). This consistency in results underscores the systemic nature of the issue. It emphasises the imperative for sustained efforts to enhance the accessibility of digital platforms, ensuring equal access and usability for all members of society. Such endeavours are essential for fostering an inclusive digital ecosystem where individuals with disabilities can fully participate in civic engagement, access essential services, and exercise their rights on par with their non-disabled counterparts.
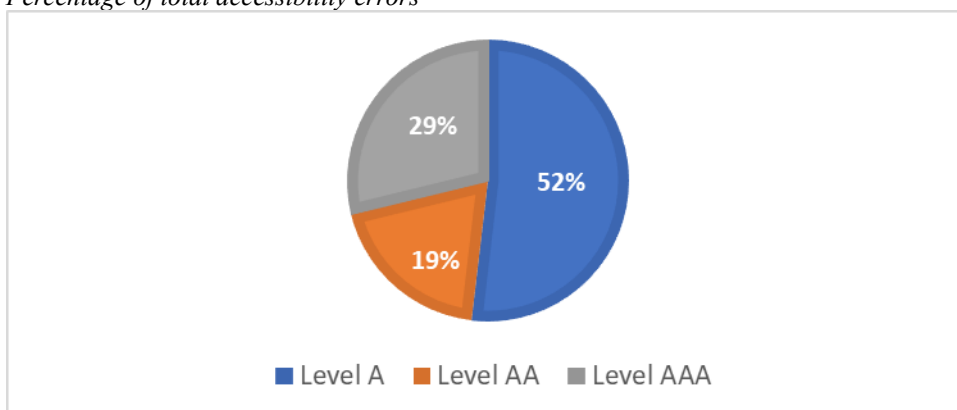
Table 2

List of websites and accessibility evaluation results based on the WCAG 2.2 guidelines

S/N	Website	Pages with accessibility errors	WCAG 2.2 issues		
			A	AA	AAA
1	https://verification.nhif.or.tz/ServicePortal/application	10	3	3	1
2	http://www.tra.go.tz/	7	5	3	3
3	https://www.nishati.go.tz/	7	9	2	5
4	https://www.lands.go.tz/	7	12	3	5
5	https://www.utumishi.go.tz/	6	6	4	3
6	https://www.vpo.go.tz/	6	5	3	4
7	http://www.maji.go.tz/	6	8	4	4
8	https://www.brela.go.tz/	6	8	3	4
9	https://www.tmda.go.tz/	6	5	4	5
10	https://olas.heslb.go.tz/olams/	6	3	3	0
11	https://www.tanzania.go.tz/	5	4	3	3
12	http://www.madini.go.tz/	5	6	2	3
13	https://www.jamii.go.tz/	5	11	3	5
14	https://www.tamisemi.go.tz/	5	9	1	4
15	https://www.mow.go.tz/	5	11	2	3
16	https://www.mawasiliano.go.tz/	5	9	2	5
17	http://www.mof.go.tz/	4	10	3	3
18	https://www.mwt.go.tz/	4	11	2	3
19	https://tcra.go.tz/	4	6	3	4
20	https://www.ega.go.tz/	4	3	3	4
21	http://www.moha.go.tz/	3	9	2	4
22	https://www.michezo.go.tz/	3	13	3	4
23	http://www.kazi.go.tz/	3	9	3	5
24	https://www.sheria.go.tz/	3	6	2	4
25	https://www.mifugouvuvi.go.tz/	3	5	1	4
26	https://www.modans.go.tz/	3	4	2	3
27	https://www.ppra.go.tz/	3	8	2	5
28	https://www.tira.go.tz/	3	8	3	6
29	http://www.moe.go.tz/	2	2	2	4
30	http://www.mit.go.tz/	2	10	4	4
31	https://www.ewura.go.tz/	2	6	1	3
32	http://www.foreign.go.tz/	1	2	2	3
33	https://www.kilimo.go.tz/	1	2	2	4
34	https://www.moh.go.tz/	1	7	2	4
35	http://www.pmo.go.tz/	1	5	2	3
36	https://www.maliasili.go.tz/	1	11	3	2
37	https://www.bot.go.tz/	1	8	3	4
38	https://www.ajira.go.tz/	1	6	2	4
39	https://www.osha.go.tz/	1	5	2	3
40	https://www.ncaa.go.tz/	1	4	2	5

S/N	Website	Pages with accessibility errors	WCAG 2.2 issues		
			A	AA	AAA
41	https://www.ports.go.tz/index.php/en/	1	5	3	6
42	https://nida.go.tz/swahili/	0	0	0	0
Total		**153**	**279**	**104**	**155**
Mean		**3.64**	**6.64**	**2.48**	**3.69**
Standard Deviation					**2.28**
IQR					**1.25-5.0**

Figure 1:
Percentage of total accessibility errors

Furthermore, the evaluation of e-government websites included an analysis of violated guidelines in Levels A, AA and AAA. Table 3 summarises the most violated WCAG 2.2 guidelines, which considers violations observed in over half of the websites evaluated (>21).

Table 3

Summary of violated WCAG 2.2 guidelines

Violated guideline	Descriptions (W3C, 2023)	No. of websites
Level A		
WCAG 2.2 A F63	"Failure of Success Criterion 2.4.4 due to providing link context only in content that is not related to the link."	42
WCAG 2.2 A F89	"Failure of Success Criteria 2.4.4, 2.4.9 and 4.1.2 due to not providing an accessible name for an image, which is the only content in a link."	40
WCAG 2.2 A 4.1.2	Failure to "ensure that Assistive Technologies (AT) can gather information about, activate (or set) and keep up to date on the status of user interface controls in the content."	33
WCAG 2.2 A 1.3.1	Failure to "ensure that information and relationships that are implied by visual or auditory formatting are preserved when the presentation format changes."	22
WCAG 2.2 A F65	"Failure of Success Criterion 1.1.1 due to omitting the alt attribute or text alternative on img elements, area elements, and input elements of type "image""	22
Level AA		
WCAG 2.2 AA 1.4.3	Failure to "provide enough contrast between text and its background so that it can be read by people with moderately low vision (who do not use contrast-enhancing assistive technology)."	39
WCAG 2.2 AA F78	"Failure of Success Criterion 2.4.7 due to styling element outlines and borders in a way that removes or renders non-visible the visual focus indicator."	33
Level AAA		
WCAG 2.2 AAA F22	"Failure of Success Criterion 3.2.5 due to opening windows that are not requested by the user"	38
WCAG 2.2 AAA 1.4.6	Failure to "provide enough contrast between text and its background so that it can be read by people with moderately low vision (who do not use contrast-enhancing assistive technology)."	36
WCAG 2.2 AAA 2.3.3	Failure to "allow users to prevent animation from being displayed on Web pages [as] some users experience distraction or nausea from animated content."	27

The results presented indicate that developers of e-government websites in Tanzania have the scope to improve accessibility for people with different disabilities. The improvement measures should go hand in hand with the WCAG 2.2 guidelines, which are well stipulated. For instance, the most violated guideline in Level A is the WCAG 2.2 A F63, as all 42

websites failed to provide contexts to links provided. Failure to comply with the WCAG 2.2 A F63 occurs when website developers do not provide context to link using ARIA properties such as aria-label or aria-labelled by. This leads to users being unable to understand where the links go quickly. To resolve this failure, website developers should use ARIA properties to ensure all links have contexts in the same line, paragraph, text, or heading.

The most violated guideline in Level AA is the WCAG 2.2 AA 1.4.3, as 39 websites failed to contrast text and its background sufficiently. People with moderately low vision are the most affected by not conforming to the WCAG 2.2 AA 1.4.3 guideline. This failure commonly occurs when website developers specify foreground colours without specifying background colours or use background images that do not contrast sufficiently with the foreground text. To resolve this failure, website developers should observe the contrast ratio while determining the positions and/or colours of text, foreground and background. According to the WCAG guidelines, a contrast ratio of at least 4.5:1 is recommended to achieve the minimum contrast for the visual presentation of text and images of text. Additionally, the guidelines recommend a ratio of 3:1 for large-scale text and images of large-scale text.

The most violated guideline in Level AAA is the WCAG 2.2 AAA F22, as 38 websites allow new windows/pop-ups to appear without the user's initiation or expectation. This feature fails if such windows/pop-ups lack prior indication to the user that they would appear. As such, the unexpected windows/pop-ups disturb the users' focus while browsing the website. To resolve this failure, website developers are urged to search thoroughly through the websites for actionable elements such as links, buttons or tabs and check whether they open new windows/pop-ups without any associated indication to the users. If such elements exist, then website developers should rectify the actions and use progressive enhancements to open new windows/pop-ups only when requested by the users.

CONCLUSION
Accessibility is one of the crucial aspects in determining the quality of any website, let alone e-government websites. Tanzania is a developing country implementing e-government to improve the quality and access to public services and reduce administrative burdens. Websites are among

the tools used by the Government. Therefore, the accessibility of e-government websites plays a critical role in delivering online public services to all.

This work shows a need to improve the accessibility of e-government websites in Tanzania. The results from the study show low compliance with the WCAG 2.2 guidelines among the investigated 42 e-government websites. This stark revelation underscores the urgent necessity for comprehensive accessibility audits and subsequent remediation efforts targeted at enhancing the inclusivity of such critical e-government platforms. Failure to address these accessibility shortcomings not only undermines the fundamental principles of digital inclusivity but also perpetuates systemic inequalities, depriving individuals with disabilities of essential services and opportunities.

Addressing the accessibility deficiencies within e-government websites demands a concerted effort from governmental bodies, web developers, and relevant stakeholders to prioritise inclusivity in digital design and implementation. Policymakers are recommended to ensure that e-government policies and strategies explicitly provide guidance and steps to be taken by practitioners on the accessibility of e-government websites. Practitioners, designers, and developers must properly consider addressing the accessibility concerns within e-government websites. Implementing robust accessibility standards and guidelines, coupled with ongoing monitoring and evaluation mechanisms, can pave the way for a more accessible and equitable digital landscape where all citizens, regardless of their abilities, can fully participate and benefit from online governmental services.

This paper is a significant addition to the continuous dialogue surrounding digital accessibility within the public sector, offering valuable insights and advocating for proactive measures to enhance inclusivity within governmental digital ecosystems. By highlighting the prevalent accessibility challenges faced by e-government websites in Tanzania, this study underscores the pressing need for concerted action to align these platforms with internationally recognised accessibility standards. In advocating for adherence to such standards, the paper emphasises the pivotal role of government agencies in fostering inclusivity and equity in e-government implementation. By prioritising accessibility in designing, developing, and maintaining their digital

platforms, governmental bodies can effectively dismantle barriers that impede access to essential services and information for individuals with disabilities. Furthermore, by championing digital accessibility within the public sector, governments can set a precedent for other stakeholders, including private organisations and non-governmental entities, to follow suit. This ripple effect can catalyse broader societal change, ushering in a culture where accessibility is not merely an afterthought but an integral component of digital design and development processes.

Integrating accessibility and inclusivity into e-government initiatives is a matter of legal and ethical responsibility and a strategic imperative for ensuring that digital services effectively serve all members of society, including those with disabilities. By leveraging technology to remove barriers and promote equal access, e-government can advance social inclusion, empowerment, and participation for people with disabilities in Tanzania.

While this study provides a comprehensive descriptive analysis of accessibility violations across 42 e-government websites, it does not examine the systemic or institutional causes behind these issues, which might include institutional barriers, technical barriers and policy barriers. Future research should adopt qualitative methods—such as interviews with web administrators or policy makers/administrators—to explore these structural dimensions in more depth. Additionally, although WCAG conformance is a widely used proxy for accessibility, it cannot fully substitute for the lived user experience. Future work should include participatory methods such as user testing or ethnographic studies to assess the real-world impact of digital inaccessibility on diverse users.

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