Easy to Read (E2R) and Access for All (A4A): A Step to Determine the Understandability and Accessibility of Websites

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1 Introduction

World Wide Web (WWW) is one of the important applications of the Internet that removes the physical barrier to access services, products, and information that are not easily obtained by PwDs because of circumstances related to their disability for independent living and enhances their decision-making ability [60, 84]. It is no doubt that web is an important "able-bodied" neighbor or coworker, if you are a PwD [55]. Following the development of commercial applications, many researchers [9, 15, 28, 68, 71] have realized the potential of the Internet and WWW in tourism business and recommended for incorporating them into the travel and tourism industry. The incorporation of the Internet has revolutionized the travel and tourism business and is also significant for the growth and success of the industry [11, 13, 29, 62]. It is still continued.

Tourism is an information consumption industry, and WWW is able to serve that information over the Internet to the user for decision-making regarding tourism [9, 10, 59, 62]. With the development of Web 2.0, online users are empowered through technology [52, 53]. It is a tool of mass collaboration because it allows users to actively participate and collaborate with other users to produce, consume and diffuse the knowledge and information on tourism being distributed over the Internet [61, 65, 66]. The online travel agencies (OTAs) are one of the applications of the Internet in the tourism industry, and their websites hold the majority share of

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the travel agency business and continue to witness huge growth by 2025 [86]. They are making the travel simple and personalized for everyone. The major advantage of OTAs is booking an entire trip in one sitting, finding the best bargaining price, discovering travel inspiration, getting a glimpse of your travel, and sealing the deal anytime [58]. Online travel market places become more competitive due to the entry of new OTAs in the market and are increasingly adopting e-business model to accomplish their organizational goals [42]. Therefore, maintaining an effective and customized website has thus become imperative for OTAs to strengthen its customer relationships, win a larger market segment and serve small niche market segment like accessible tourism.

Website of OTAs is one of the dominant sources of information for the accessible tourism consumers with different access needs which empowers the disabled people to search for, find, plan, compare, bargain, book travel, and tourism experiences online and give feedback after using the products. Accessible tourism consumers are a growing niche market segment of tourism with full of opportunities and challenges. As per findings, the average yearly expenditure of consumers on tourism is EUR 80 billion in Europe, USD 13.6 billion in the USA, and AUD 1.3 billion in Australia [76]. It shows the potential of accessible tourism to contribute toward the economy. However, the market is underperforming due to different types of environmental barriers (planning and booking, infrastructure and transportation, building, communication and activities involving destination) and social barriers (lack of awareness about accessibility, lack of training, and tourism-related business and attitudinal barriers) [76]. From the aforementioned barriers, lack of access to information through the website is a major barrier for accessible tourism because information is the lifeblood of tourism [62]. Most of the tourism websites have failed to address the issue of information accessibility through their website toward PwDs [22, 79].

Understanding the needs of the online users with or without disability translates to the success of tourism websites, and it is of utmost importance to the tourism and hospitality organization [41]. Accessibility and readability issues in tourism websites are imperative for both travel and tourism industry and accessible tourism consumers. Accessible OTA websites can make a difference in the highly competitive tourism market as such websites will entice more customers, especially PwDs, providing better opportunities to create direct relationships with the consumer and loyalty in the long run for the OTAs. However, the accessibility and readability of OTA websites are still questionable and yet to unearth due to the importance of OTAs in accessible tourism. Hence, it is imperative to examine the accessibility and readability of OTA websites toward the commitment of accessible tourism.

Thus, the aim of this study is to provide an in-depth understanding of web accessibility and web readability toward accessible tourism from the World Wide Web Consortium (W3C) guideline perspective. For this, web accessibility of 35 OTA websites belonging to three international corporations has been checked by applying online open access tools, namely, *AChecker, WAVE, and Tenon*, and their understandability performance through six different readability indices. In addition, ranking has been performed in terms of accessibility and readability violation scores

along with site visiting ranking by *Alexa ranking tool*. Therefore, this research finding would be of great interest to many organizations to embody an open, welcoming, and inclusive environment for PwDs to carry out optimal tourism experiences and boost their universality of the web for all.

2 Objectives

The following are the main objectives of this study:

1. To determine the web accessibility score of 35 OTA websites in terms of WCAG 2.0 guidelines.
2. To produce the readability score of OTA websites by applying six different indices.
3. To describe the relevance of web accessibility and readability of OTA websites on accessible tourism.
4. To rank the websites based on the accessibility and readability score and compare the rank with site visiting ranking.
5. To check performance among the three international corporations in terms of testing techniques used.

3 Literature Review

3.1 Online Travel Agency

The Internet has been widely accepted by the tourism researchers that it can serve a valuable tool for the promotion and distribution of travel- and tourism-related experience of customers [11, 16, 17, 70, 87].

It is a valuable online platform for both consumers and suppliers for the dissemination of information, communication, and online purchasing of product and service related to the destination without any geographical and time constraint [42, 48, 72]. Websites have developed into one of the leading points of supply of information for tourism and hospitality, since they produce details about transportations, holiday packages, and hotels of a destination. Due to the growing use of websites for purchasing travel-related products, the online travel industry is forecasted to reach $1,091 billion by 2022, and the major booking source for the user includes websites of direct travel suppliers and websites of OTAs [7].

Tourism academic researcher has added accessibility is an important criteria of OTAs for service quality (E-QUAL) to improve customer satisfaction and loyalty in the travel and tourism industry [39]. More importantly, accessibility is a critical criteria to measure the quality of websites for OTAs [38, 49]. High-quality websites can entice more consumers than low-quality websites [56, 85, 94].

Considering the importance of accessibility of OTA websites in travel planning and booking, it should be expected from the OTAs that equal chances and opportunity must be met especially by PwDs due to their access needs without any digital divide. Nevertheless, to be easy to access those features, it would be reasonable that PwDs should be able to access the e-distribution, an issue that has not been addressed by travel and tourism industry as a whole [46].

The Internet has made the users independent in planning their trips, since it provides updated and detailed information related to a destination for their decision-making by sitting at one place [10]. In the recent two decades, the quantity of studies on the importance of information for PwDs has increased [12, 18, 24]; however, no further understanding has been achieved into the significance of OTA websites from functionality perspective, that is, evaluating the accessibility and readability of the website. Therefore, it is necessary to research on the readability and accessibility of OTA websites, to remove the barriers by providing accessible information of the tourism products readily available.

3.2 Accessible Tourism

More than a billion of people are estimated to experience some form of disability, and the prevalence of disability is high in developing countries [92]. The number is going to increase because population are aging and there is a global increase in chronic health issues associated with disability, such as cardiovascular diseases, diabetes, and mental illness. The International Classification of Functioning, Disability and Health (ICF) and the Convention on the Rights of Persons with Disabilities (CRPD) highlighted the major barriers of disability that are widespread in the environment which include inadequate policy and standard, negative attitude, lack of provision of service, problems with the service delivery, inadequate funding, lack of accessibility, lack of evidence and data, and lack of consultation and involvement [73, 92].

Due to the growing level of social integration and economic condition, PwDs are participating in tourism activities frequently [75]. Consequently, tourism researchers have reported that the market of accessible tourism has a big opportunity for the travel and tourism organizations having extensive growth and future possibilities [4, 8, 14, 19]. A substantial amount of research has been done to capture the accessible tourism market and its barrier from both demand and supply sides of tourism [6, 57, 67]. Although different steps are taken to make tourism accessible for everyone especially PwDs, access to information through websites is a prominent issue in the travel and tourism industry for disabled people [22, 89]. Majority of the tourism websites are not accessible and are not following the WCAG guideline [25, 46, 79]. Therefore, creating accessible websites should be one of the basic elements in the development of accessible tourism.

3.3 Web Accessibility

Web accessibility is defined as the websites, tools, and technologies that are designed and developed so that PwDs can *perceive, operate, navigate,* and *interact* with the web [83]. Hence, the effect of disability completely changed on the web as it eliminates barriers to communication that many people encounter in the physical world. However, when applications and websites are poorly designed, they can create barriers for the inclusion of people from using the website. Accessibility is important for organizations that want to create an optimal website and include people for using services and products. But it is rarely found in the tourism and hospitality industry [22, 63, 91].

Web accessibility for PwDs is a growing field of research in human-computer interaction [2, 20, 26, 35, 64]. In education and government field, a plethora of research on web accessibility has been conducted by different researchers due to its importance for disabled people [3, 30, 32–34, 36, 37]. They used different online automatic tools like AChecker, WAVE, TAW, Cynthia Says, readFX, etc. for the evaluation process of websites. However, in tourism scholarship marginal research has been conducted on web accessibility mostly confined to websites of destination marketing organizations (DMOs), websites of national tourist organizations (NTOs), and hotel websites based on WCAG 1.0, undermining the relevance of OTA websites in accessible tourism [22, 44, 50, 63, 89, 91]. Not only web accessibility but also web readability determines the success of the tourism websites for promoting accessible tourism, which is always disregarded by the tourism researchers [63].

Web accessibility is not a new concept in tourism and hospitality industry, but the research is limited mostly on the online tool Bobby with guideline WCAG 1.0 [27, 63, 91, 93]. For the web accessibility of US airline online reservation websites, when assessed with Bobby online, it was found that out of 73 websites, only 3 passed the initial test for accessibility, more than 75% sites contains 3 or more errors, and the most prominent error was alternative text to all images [27]. Not only US airline reservation websites but also Visitor Information Centers (VIC) websites of Queensland, Australia, fails to provide a text equivalent for each image in the main web page when assessed with priority level 1 of WCAG 1.0 through Bobby online [63]. Despite various rules and regulations, most of the developed countries' hotel websites such as in the UK, the USA, and Australia were inaccessible for PwDs and failed to one or more checkpoints of WCAG [46, 88, 90, 91]. In addition, in websites of tourism promotion organization, national airlines, lodging and hotels, tour operators, and travel agencies of developing countries such as in Uganda, South Africa, Kenya and Zimbabwe when tested by using LIFT and Bobby online with WCAG 1.0 guidelines, it was reported that 92% of websites were missing alternatives to visual and audio content and 67% of websites failed to address the issue of dynamic content in the website [44].

In 2004, researchers [89] tested the accessibility of 100 German and UK tourism-related websites and found that the home page of 10 UK and 10 German websites was barrier-free regarding priority 1 checkpoints, only 3 German websites passed

the priority 2 checkpoints, and 2 UK and 1 German website passed the priority checkpoints of WCAG 1.0 [89]. Xiong et al. [93] expanded the accessibility test of websites by adding both WCAG 1.0 and Section 508 guidelines for measuring accessibility. The study found that websites had poor level of accessibility, and the majority of the websites failed in providing alternative text for the non-text element. Oertel et al. [50] assessed the accessibility of 16 official national tourist organization websites of the European Union. The research found that none of these websites met first priority of WCAG 1.0, and the websites even lack of basic and easy checkpoints, for instance, alternative text, clear navigation mechanism, etc. The official tourism website of Denmark was more accessible, and the website deliberately refrained from time-dependent elements.

Recently due to the development of online tools based on WCAG 2.0 and WCAG 2.1 guidelines, some research has measured the web accessibility of NTOs on the basis of WCAG 2.0 guidelines [21, 22, 79]. In the websites of official NTOs of countries registered in the United Nations World Tourism Organization (UNWTO), when tested by using TAW in terms of conformance level AA and AAA of WCAG 2.0, it was found that South Korea, Hong Kong, and Japan are following the good practice of accessibility as compared to other countries. They can serve as an example for other countries regarding accessibility [79]. Vila et al. [21] tested the accessibility of 190 websites of official NTOs around the world. The study found that the number of problems in success criteria was 2051, the number of warning in success criteria was 8096, and the number of not reviewed in success criteria was 188 for conformance level AA, and the number of problems in success criteria was 2038, the number of warning in success criteria was 6927, and the number of not reviewed in success criteria was 191 for conformance level AAA of WCAG 2.0 [21]. Besides this, another study is conducted to examine the web accessibility of Northern European countries' tourism websites by the same author, by applying the same TAW tool and conformance level AA of WCAG 2.0. The study reported 2319 total problems, 9644 total warnings, and 379 total not reviewed. The websites of Norway had the maximum number of incidents, and websites of Belgium had the least number of incidents [22].

3.4 Web Readability

Readability is how easily a reader can read and understand the words, sentences, written text, and style of writing [23]. It is based on the principles of legibility, familiarity, complexity, and typography of a sentence. Readability is measured through readability score by applying different readability indices available. Readability score tells the level of education required to understand a piece of text. The most commonly used readability formulas to measure readability include Flesch-Kincaid Reading Ease (FKRE), Flesch-Kincaid Grade Level (FKGL), Gunning Fog Score, Coleman-Liau Index (CLI), Automated Readability Index (ARI), and SMOG Index. These formulas test the readability based on the words, sentences, syllables,

average sentence length, percentage of hard words, and characters in a sentence. The readability analysis of 75 Australian and New Zealand tourism websites was tested by using the above tools, and it was found out that it is an issue for the older age people to understand the text of the websites, and the grade level is high (difficult to read) [43]. Researchers [32, 34, 51], etc. used these aforementioned readability indices to find the grade level and understandability of texts in websites. Similarly, we have also used these readability indices in our study to find the grading cum understandability scores of 35 OTA websites.

Based on the review of literature, there is a need to focus on accessibility and readability of tourism websites regarding different corporations and to find their bonding strengths between the parameters of accessibility, readability, and site visiting status of OTA websites belonging to international corporations.

4 Methodology

4.1 Data Collection Method

Based on operation around the globe findings [69], three major US travel international corporations, namely, *Booking Holdings Inc.*,[1] *Expedia Group Inc.*,[2] and *TripAdvisor Inc.*,[3] are used in this study. A total of 35 OTA websites collected from each corporation having individual brands on their global website consists of 14, 16, and 4 websites of *Expedia Group, TripAdvisor,* and *Booking Holdings Incs.*, respectively.

4.2 Web Content Accessibility Guideline (WCAG)

WCAG is a technical document on standards of web accessibility developed by the *Accessibility Guidelines Working Group (AGWG)*.[4] AGWG is a part of the World Wide Web Consortium (W3C) Web Accessibility Initiative (WAI). W3C WAI develops support materials and standards to help organization and individual for understanding and implementing accessibility. W3C WAI resources are used to make applications, websites, and other digital creations more accessible and usable to everyone. W3C WAI combines people from disability organization, government, industry, and research laboratory from around the globe to develop resources and guidelines to make the web accessible to *people with neurological, cognitive,*

[1] https://www.bookingholdings.com/

[2] https://www.expediagroup.com/

[3] https://www.tripadvisor.com

[4] https://www.w3.org/WAI/GL/

auditory, speech, physical, and visual disabilities [83]. WCAG is developed in cooperation with organizations and individuals around the globe with an objective of creating and providing a standard of web content accessibility that satisfies the needs of governments, individuals, and organizations internationally. WCAG explains how to make web content more accessible to PwDs. Web content usually refers to the information in a web application or web page containing markup or code that defines presentation, structure, etc. and natural information such as images, text, and sounds. WCAG is primarily designed for web accessibility evaluation tools for developers, web authoring tool developers, web content developers, and others who need or want a standard for web accessibility including mobile accessibility. There are different versions of WCAG available, namely, *WCAG 1.0, WCAG 2.0, and WCAG 2.1*.

1. WCAG 1.0 was published in May 1999. It included 14 guidelines and 65 checkpoints. Each checkpoint has a priority (P) levels, namely, P1, P2, and P3, authorized by the working group on the basis of checkpoint's impact on accessibility [40]. In addition, there are three levels of conformance in WCAG 1.0 document including *Conformance Level "A"*, all P1 checkpoints are satisfied; *Conformance Level "AA"*, all P1 and P2 checkpoints are satisfied; and *Conformance Level "AAA"*, all P1, P2, and P3 checkpoints are satisfied [80].
2. WCAG 2.0 was published by W3C in December 2008. It succeeds WCAG 1.0. It was launched due to some shortfalls in WCAG 1.0 including some checkpoints that has been obsoleted because of development in technology for PwDs, moving from specific technology to technology independently, and reorganizing and improving accessibility guidelines to enhance accessibility [40]. It encompasses a wide range of suggestions and recommendations to make the web content and application more accessible. It will also address the issue of accessibility to a wide range of disabled people including learning disabilities, cognitive limitation, deafness and hear loss, limited movement, blindness and low vision, photosensitivity and combination of these. WCAG 2.0 not only improves the accessibility of the web content, but it also makes the web content more usable to users.

   WCAG 2.0 consists of *four* principles, namely, *perceivable, operable, understandable, and robust, denoted as POUR*. Under these principles, there are 12 guidelines that provide basic objectives to web content developers to make the web content more accessible to people with different disabilities. Under each guideline, success criteria are provided regarding three conformance levels: A (lowest), AA (medium), and AAA (highest) [81].
3. WCAG 2.1 is an extension of WCAG 2.0, published in December 2008 as a recommendation of W3C. Web content that conforms the guidelines of WCAG 2.1 also conforms the guidelines of WCAG 2.0 [82]. The publication of WCAG 2.1 is not to supersede WCAG 2.0, while W3C recommends WCAG 2.0. The W3C advises using standards of WCAG 2.1 to maximize the accessibility efforts and also encourages to use the current version of WCAG. WCAG 2.1 was initiated with an objective to enhance accessibility guidance for three major

groups, namely, *users with disabilities on mobile devices, users with cognitive or learning disabilities,* and *users with low vision*. It expands WCAG 2.0 by including new success criteria, definitions to support the success criteria, guidelines to organize the additional success criteria, and a couple of additions to the conformance section. This additional success criterion helps to make it clear that websites which conform to the success criteria of WCAG 2.1 also conform to the success criteria of WCAG 2.0 [82].

4.3 Tools and Techniques Used

There are different tools and techniques used for checking the accessibility status of websites based on the World Wide Web Consortium website.[5] These tools and techniques are based on different versions such as WCAG 1.0, 2.0, and 2.1, Section 508, etc. of accessibility guidelines and standards. Among them, some tools are open access and some are paid. But, we used open access tools based on WCAG 1.0 and 2.0, namely, *AChecker, WAVE, and Tenon*, for the evaluation process of 35 websites belonging to aforementioned three international corporations. The working snapshots of AChecker, WAVE, and Tenon tools are shown in Figs. 1, 2, and 3, respectively. In addition, the study used the online *WebFX tool*[6] to test the readability cum grade level means easy to read (E2R)

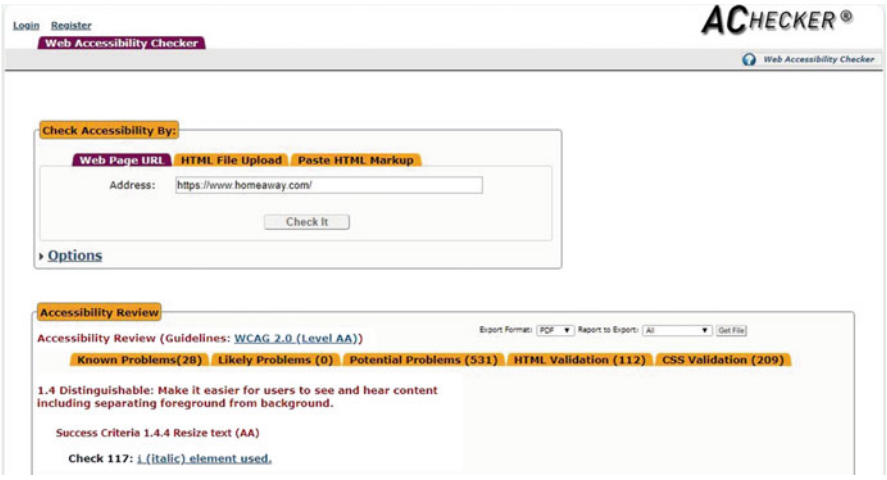

Fig. 1 A working snapshot of AChecker tool

[5] https://www.w3.org/WAI/ER/tools/

[6] https://www.webfx.com/tools/read-able/, a full-service digital market agency.

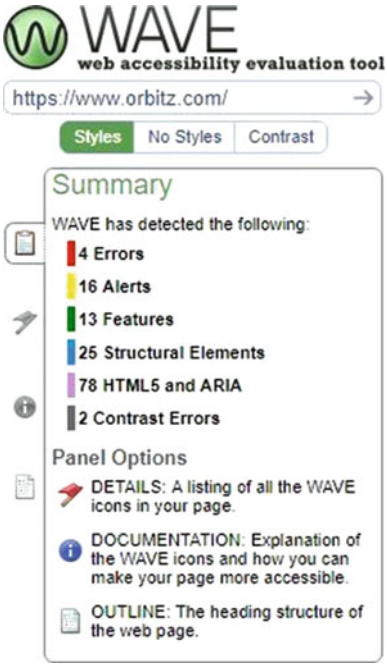

Fig. 2 A working snapshot of WAVE tool

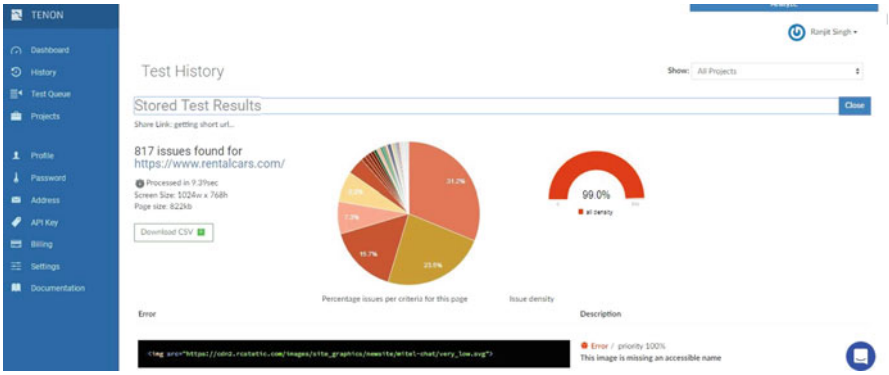

Fig. 3 A working snapshot of Tenon tool

scores of 35 OTA websites using *test by URL* technique. It includes six readability index results, namely, *Flesch-Kincaid Reading Ease (FKRE), Flesch-Kincaid Grade Level (FKGL), Gunning Fog (GFOG), Simple Measure of Gobbledygook (SMOG), Coleman-Liau Index (CLI), and Automated Readability Index (ARI)*. All the six readability indices involve different equations in terms of counting words, sentences, syllables, complex words and sentences, etc. to measure the websites based on US grading system of understandability. The working snapshot of WebFX tool is shown in Fig. 4.

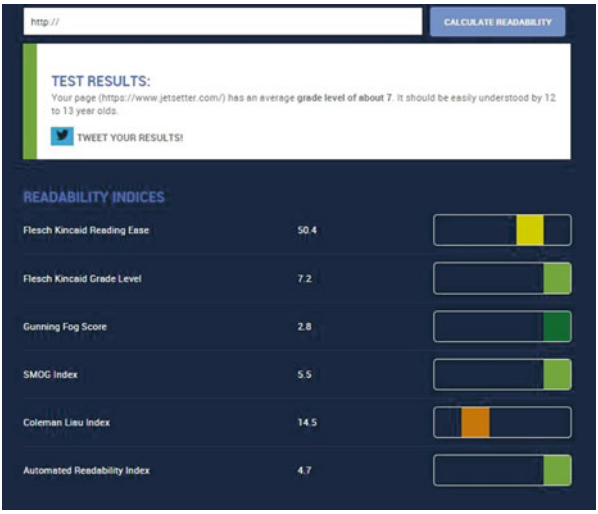

Fig. 4 A working snapshot of readability tool

Furthermore, to find the ranking of these 35 websites globally and nationally, we used online tool called *Alexa*.[7] In this study, we extract the global ranking of these aforementioned 35 websites which are later used to find the relevance with respect to accessibility and readability variables too. Also, SPSS procedure is used to find the correlations among the selected variables, namely, AChecker, WAVE, GFOG, and Alexa, called statistical analysis.

5 Result Analysis and Discussion

Based on the analysis of 35 websites, the following results shown in Table 1 with respect to access for all called accessibility (AChecker, WAVE, and Tenon), easy to read called readability (GFOG), and most visiting websites called ranking of Alexa (Alexa Global) are found.

5.1 Access for All Result

AChecker tool is used to test the selected 35 websites regarding conformance levels (A, AA, AAA), enabling HTML and CSS validators [1]. It identifies three types of problems.

[7] https://smallseotools.com/Alexa-rank-checker/

Table 1 Accessibility, readability, and ranking performance of 35 OTA websites

Performance scores based on different methods						
S.No.	OTA website	AChecker	WAVE	GFOG	Alexa Global	Tenon
1	https://www.expedia.com/	1448	399	5.8	585	NA
2	https://www.hotels.com/	1600	196	4.2	715	480
3	https://www.vrbo.com/	2260	467	6.6	2310	921
4	https://www.trivago.com/	558	120	6.1	7414	22
5	https://www.homeaway.com/	2622	467	8.8	6796	1007
6	https://www.orbitz.com/	834	137	5.4	3862	NA
7	https://www.travelocity.com/	789	149	3.7	4170	NA
8	https://www.hotwire.com/	437	263	0.8	5291	2155
9	https://www.wotif.com/	812	150	4.5	31,447	NA
10	https://www.ebookers.com/	812	145	3.5	79,307	NA
11	https://www.cheaptickets.com/	279	137	5.3	17,618	NA
12	https://www.carrentals.com/	1486	228	6.5	41,146	588
13	https://www.cruiseshipcenters.com/	2340	582	2.6	256,414	1826
14	https://www.classicvacations.com/	5519	489	12.1	315,662	1437
15	https://www.tripadvisor.com/	2412	672	5.9	264	3585
16	https://www.airfarewatchdog.com/	2681	166	3.4	19,909	1869
17	https://www.bookingbuddy.com	248	106	9.8	20,727	255
18	https://www.familyvacationcritic.com/	2349	399	5.7	91,410	818
19	https://www.cruisecritic.com/	2543	186	7.4	11,932	623
20	https://www.flipkey.com/	2104	123	5.9	62,610	526
21	https://www.holidaylettings.co.uk/	2687	106	4.2	76,220	799
22	https://www.holidaywatchdog.com/	317	92	6.8	1,023,328	218
23	https://www.housetrip.com/	1750	223	5.6	416,668	594
24	https://www.jetsetter.com/	1735	368	2.8	45,876	916
25	https://www.oyster.com/	1343	113	4.2	21,598	295
26	https://www.seatguru.com/	2392	645	3.6	8102	5212
27	https://hotels.tingo.travel/	80	56	7.1	180,645	100
28	https://www.vacationrentals.com/	1685	121	4.8	152,508	424
29	https://www.viator.com/	2728	127	6.3	4544	1269
30	https://www.onetime.com/	167	113	9.7	400,337	390
31	https://www.booking.com/	3213	467	6.2	89	1451
32	https://www.kayak.com/	4559	1140	4.1	895	NA
33	https://www.priceline.com/	583	179	5.3	2200	NA
34	https://www.agoda.com/	1352	274	6.8	696	956
35	https://www.rentalcars.com/	6517	318	5.2	3320	817
Mean		1864.03	283.51	5.62	94,760.43	1094.56
STDev		1463.75	226.40	2.21	196,981.49	1120.58

1. *Known problems:* These are the accessibility barriers. OTA must modify these errors to make their web page accessible.

2. *Likely problems:* These are the probable errors and require human decision. OTA can modify these errors to increase the accessibility of their website.
3. *Potential problems:* AChecker cannot identify these problems and require human to take decision. OTA may modify the web page to address these problems or simply conform that the problem identified is not present.

Therefore, Table 2 presents the overall AChecker evaluation result of 35 websites based on 3 international corporations. It was found that their aggregate mean and standard deviation is more better than the individual level of conformance. Under level AA, potential problems are very high which need to be minimized. Based on the findings, the overall score should be minimized so that accessibility for all may be achieved.

After the analysis of AChecker, another accessibility tool is used called *WAVE*[8] to identify six types of problems, namely, errors, alerts, features, structural elements, HTML5 and ARIA, and contrast errors. It indicates that errors are accessibility errors that need to be addressed, while features are probable accessibility features that need to be addressed to improve the accessibility. The objective should not be to get rid of all the problems, except for the errors. Alerts require close examination, and other problems are displayed to facilitate human analysis of accessibility. The overall violation scores of accessibility among the selected 35 websites based on WAVE tool are shown in Fig. 5.

Using Tenon tool[9] to identify the worst performing web pages among the selected 35 websites, it is found that out of 35 websites, 17 are worst performing websites regarding total issues, errors, and warning densities which is shown in Table 3.

The most common identified issues regarding features among the websites are shown in Table 4. It is found that language, typography, and content, CSS, images and other non-text content, and navigation features are highly violated, having violation scores of 10,953, 6155, 3186, and 2874, respectively. It is highly suggested to web developers and designers to focus on these issues by content category to minimize them so that accessibility among the sites is attained in a more better way.

Table 2 AChecker tool evaluation result of 35 websites based on 3 international corporations

AChecker tool report							
35 OTA websites	Known problems	Likely problems	Potential problems	HTML validation	CCS validation	Mean	STDev
Level A	1413	12	9424	1393	1396	136.38	149.96
Level AA	1032	12	10,092	1408	1376	139.2	143.28
Level AAA	1136	12	9547	1413	1367	134.75	130.39
Mean	59.68	0.6	484.38	70.23	68.98		
STDev	67.57	1.92	450.96	112.2	73.37		

[8] https://wave.webaim.org/

[9] https://tenon.io/

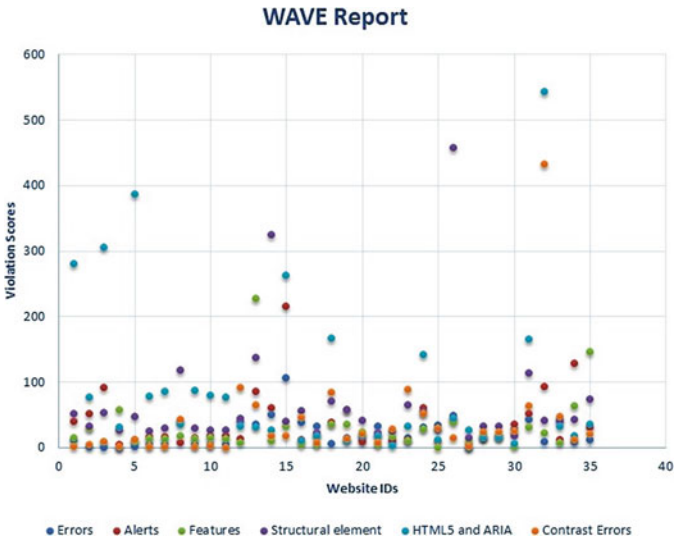

Fig. 5 A violation scores of selected corporation websites based on WAVE tool

Table 3 Detection of worst performing web pages among the 35 websites

Worst performing web pages (Tenon tool)				
S. No.	OTA website	Total issue	Error density	Warning density
5	https://www.homeaway.com/	1007	54	51
8	https://www.hotwire.com/	2155	66	168
13	https://www.cruiseshipcenters.com/	1826	183	24
14	https://www.classicvacations.com/	1437	133	50
15	https://www.tripadvisor.com/	3585	129	39
16	https://www.airfarewatchdog.com/	1869	116	88
18	https://www.familyvacationcritic.com/	818	56	43
21	https://www.holidaylettings.co.uk/	799	96	9
24	https://www.jetsetter.com/	916	89	27
26	https://www.seatguru.com/	5212	365	163
27	https://hotels.tingo.travel/	100	10	5
28	https://www.vacationrentals.com/	424	49	10
29	https://www.viator.com/	1269	94	47
30	https://www.onetime.com/	390	27	24
31	https://www.booking.com/	1451	133	31
34	https://www.agoda.com/	956	83	31
35	https://www.rentalcars.com/	817	67	32

Table 4 Tenon tool result of 35 websites: issue by content category

Tenon tool result: issue by content category		
Features	Total issues	Issue percentage
Images and other non-text content	3186	10.07%
Tables	222	0.70%
Cascading Style Sheets (CSS)	6155	19.47%
Forms	1094	3.46%
Navigation	2874	9.09%
Frames and i-frames	70	0.22%
Document structure	4733	14.97%
Language, typography, and content	10,953	34.64%
Dynamic content	0	0.00%
Multimedia	4	1.20%
Keyboard accessibility & focus control	1207	3.81%
Custom controls	1114	3.52%

Table 5 Readability analysis of 35 OTA websites based on three international corporations

Readability analysis						
Corporation websites	FKRE	FKGL	GFOG	SMOG	CLI	ARI
Readability index scores	69.9	5.25	6	5.6	10	2.9
Average grade level	6					

5.2 Easy to Read Result

The main motive of these selected websites is to communicate with the customers to share information and resources. At the same time, their easy to read status is an important factor for easy to access resources. Table 5 presents the readability scores of different indices[10] and the overall grade level of understandability of websites based on three international corporations. It is found that their average grade level of readability comes under 6 of US grade. It should be minimized further so that more easy to read status of websites can be achieved.

5.3 Ranking Relevance and Correlations

A relevance of ranking based on violation scores obtained from different techniques along with site visiting ranking of 35 OTA websites is shown in Fig. 6, using rank cases in SPSS procedure to convert violation scores into ranking to determine the importance of association between the accessibility, readability, and site rankings.

[10] https://www.webfx.com/tools/read-able/

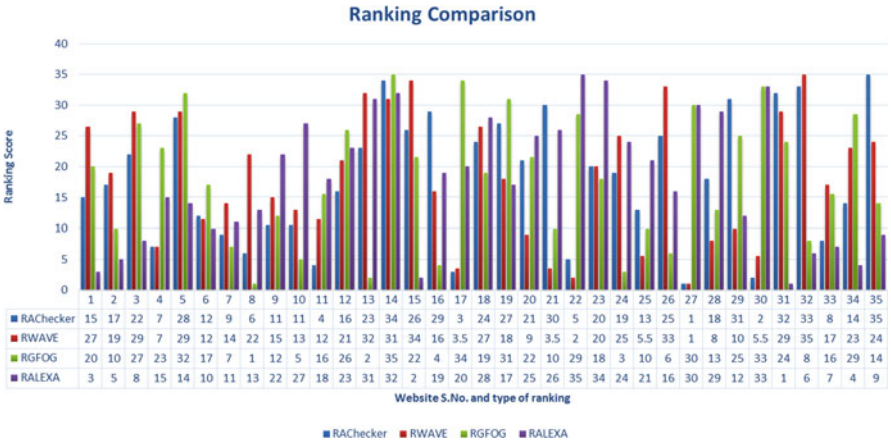

Fig. 6 A relevance of ranking based on violation scores obtained from different techniques along with site visiting ranking of 35 OTA websites

Table 6 Correlation between the variables AChecker, GFOG, WAVE, and Alexa

Correlations		AChecker	GFOG	WAVE	Alexa
AChecker	Pearson correlation	1.00	0.12	0.57	−0.15
	Sig. (2-tailed)		0.494	0.000	0.398
	N	35	35	35	35
GFOG	Pearson correlation	0.12	1.00	−0.08	0.26
	Sig. (2-tailed)	0.494		0.642	0.129
	N	35	35	35	35
WAVE	Pearson correlation	0.57	−0.08	1.00	−0.17
	Sig. (2-tailed)	0.000	0.642		0.340
	N	35	35	35	35
Alexa	Pearson correlation	−0.15	0.26	−0.17	1.00
	Sig. (2-tailed)	0.398	0.129	0.340	
	N	35	35	35	35

Table 6 presents the Pearson correlation between AChecker, GFOG, WAVE, and Alexa variables of accessibility, readability, and site ranking. It is found that the correlation between accessibility and readability is positively weak, and intra-accessibility correlation is positively strong. But, the correlation of accessibility with site ranking is negative, and readability with site ranking is positive. Thus, it is suggested that if the violations of accessibility guidelines are minimized, and the readability of web content is enhanced, it may result in more positive correlation among the websites.

Table 7 Statistical performance score cum relevance of attributes among the selected three international corporation websites

Statistical inference of 35 OTA websites							
		AChecker		WAVE		GFOG	
Corporation name	Website S. No.	Mean	STDev	Mean	STDev	Mean	STDev
Expedia Group Inc.	1–14	1556.86	1360.60	280.64	163.57	5.42	2.74
TripAdvisor Inc.	15–30	1701.31	979.83	226	193.63	5.83	2.04
Booking Holdings Inc.	31–35	3244.8	2403.29	475.6	385.67	5.52	1.03

5.4 Statistical Analysis of Corporations

Table 7 presents the statistical performance score cum relevance of attributes among the selected three international corporations websites. It is found that there is a maximum accessibility violation in Booking Holdings Inc. than the other two. But the readability score is almost the same. In a nutshell, there is a need to focus the parameters of accessibility and readability to get rid of these issues so that the universality of these websites is achieved and accessible tourism may be enhanced.

6 Suggestions and Implications

Web accessibility and readability are an important aspect for the success and acceptance of OTA websites globally by the users especially PwDs. However, from the result it has been found that most of the websites failed to comply with one or more guidelines of WCAG 2.0, and the readability level is also quite high. This is the dominant issue in the field of tourism and hospitality that creates the barrier for PwDs to access the information over the Internet [25, 79, 91]. Rules and regulations are made to address these issues related to PwDs, but it is not strictly enforced. In some countries like the USA, the UK, and Australia, violating the standards of web accessibility is against the law of disability and would be subject to a lawsuit [45, 54]. These laws and regulations related to accessibility should be more extensive and include travel and tourism industry to strictly enforced accessibility as primary criteria.

The government of each country should ensure that all the rules and regulations for accessibility are followed by the online travel organizations, an accreditation policy is necessary to recognize the accessibility of website by the corresponding government, and a periodic check of the website is necessary for the continuous improvement of the web accessibility [63].

It is not only the responsibility of the government to enforce the accessibility regulation, but it is also the responsibility of the OTAs to follow the accessibility guidelines, to make their websites accessible for accommodating the niche market segment. Bridging the gap between tourism and PwDs is not only important for

human right and freedom to promote accessible tourism and sustainable development [74] but also a business opportunity for OTAs to include the new customers in their business, since they likely to participate in tourism at low season, they mostly travel in groups, and in some region, these groups spend more than average on their trips [77]. Accessibility issues of a website could be addressed at the beginning because the cost is minimal at the beginning, and if it is not resolved at that time, then the accumulated cost is higher, and it is termed as accessibility debt [78]. Therefore, OTAs should take care of accessibility issues from the beginning and update it regularly according to guidelines. Accessibility is a continuous process because of changes in the external environment and consumer behavior; hence, OTAs are updating their websites often to accommodate their customers' needs and expectations.

In addition to accessibility, readability is also a critical factor of a website for the users including PwDs. Texts that are difficult to read and understand would create barrier for the user while using the website. Hence, OTAs should design their content of the website according to the understanding and readability expectations of their users and avoid complex words to improve readability. It does not matter what the website is portraying if their users cannot understand it. Indeed, PwDs are often more loyal toward the website that respects their access needs [47]. The indices used for determining web readability are based on the English language. Therefore, there is a need of readability tools that should be independent of language. Moreover, the readability was measured on US grade level for understanding the text [34]. Thus, the researchers should focus to build readability tools that measure country-specific grade level or tools that are universal in nature irrespective of the country grade level.

In order to make a web page accessible as per the international or national guidelines, it is important that web developer or web designer should be aware of WCAG or any other standard guidelines. However, previous research reported that they do not have knowledge on WCAG and are not familiar with the standards and technologies used by PwDs [31]. The limited awareness and knowledge and absence of training for personnel who are responsible for the accessibility of the website like content creators and developers can bring about barriers in making the web page accessible [5]. Therefore, it is necessary for the organizations and government to provide adequate training on web accessibility to minimize complexity universally, and training should be based on the latest guidelines of web accessibility.

7 Conclusion

In the twenty-first century, web accessibility and readability issues are the most discussed and researched subjects of the WWW due to their significant impact on people with access needs and to provide equal participation of PwDs in Information and Communication Technologies (ICT). However, the issues of web accessibility and readability in the travel and tourism field are yet to unearth from WCAG 2.0

and readability index perspectives. To address these issues, this study has analyzed that accessibility and readability along with performance and site visiting ranking of 35 OTA websites belong to three international corporations.

Based on the result obtained, it has been found that websites (35 OTAs) are not successfully implementing the WCAG guidelines and failed in one or more guidelines of WCAG 2.0. The most violated issues such as *language, content and typography, CSS, document structure, and image and other non-text content* should be minimized to improve accessibility. In addition to this, warnings cum alerts should be minimized, and accessibility component features should be added to OTA websites for further enhancement. Also, it has been found that their average grade of readability is 6, which needs to be minimized further so that readability of web content is attained. Therefore, OTAs should simplify their text to improve their performance on readability so that users having lower-grade level could have a better (more easy) understanding of the text.

Therefore, it is suggested to web administrators and developers to remove the identified issues and make corresponding improvements in OTA websites regarding accessibility and readability standards that can improve their global ranking too. Doing this, correlations between the said variables may be positively strengthened.

In the future, OTA websites need to take more inclusive steps to embrace PwDs as online users by reexamining, reevaluating, and reviewing their websites to ensure swift navigation inside the web page and overall accessibility cum readability.

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