Website accessibility in the hospitality industry: a study in the central region of Portugal

Pedro Teixeira

Department of Economics, Management,
Industrial Engineering and Tourism,
University of Aveiro,
Campus Universitário de Santiago,
3810-193, Aveiro, Portugal
Email: pmiguel@ua.pt

Celeste Eusébio*

Department of Economics, Management,
Industrial Engineering and Tourism,
University of Aveiro,
Governance, Competitiveness and Public Policies (GOVCOPP)
Research Unit,
Campus Universitário de Santiago,
3810-193, Aveiro, Portugal
Email: celeste.eusebio@ua.pt
*Corresponding author

Leonor Teixeira

Department of Economics, Management,
Industrial Engineering and Tourism,
University of Aveiro,
Institute of Electronics and Informatics Engineering of
Aveiro (IEETA) Research Unit,
Campus Universitário de Santiago,
3810-193, Aveiro, Portugal
Email: lteixeira@ua.pt

Abstract: This study aims to understand the impact of web accessibility guidelines (WCAG 2.0) on accessible tourism market, by examining the level of website accessibility of hotels located in the central region of Portugal. First, a framework, named WCAG@AcceTourMark was developed, to identify the importance of the WCAG for the various segments of the accessible tourism market. Further, the level of web accessibility of a sample of Portuguese tourism accommodation units is examined, based on WCAG 2.0, using two automatic evaluation tools: AccessMonitor and "*Test de Accesibilidad Web*". Finally, the WCAG@AcceTourMark developed is used to identify the

segments of accessible tourism with greater difficulty in accessing the information disseminated by the tourism accommodation units examined in this study. Results reveal that people with disabilities face several constraints when accessing website information, as the low level of web accessibility constitutes a strong barrier to the development of accessible tourism.

Keywords: accessible tourism; hospitality industry; hotels; websites; web accessibility; people with disabilities; WCAG; web content accessibility guidelines; automatic assessment online tools; AccessMonitor; TAW; *Test de Accesibilidad Web*.

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Biographical notes: Pedro Teixeira has a Master's degree in Industrial Engineering in Industrial Engineering (2019). Currently is a PhD student in Industrial Engineering, at the University of Aveiro. The main research preferences are in the area of information systems, Industry 4.0, accessible tourism and investigation related to technological solutions to real-world problems.

Celeste Eusébio is an Associate Professor of Tourism and a researcher at GOVCOPP Research Unit at the University of Aveiro (Portugal). She holds a Degree in Tourism Management and Planning from the University of Aveiro (1995), a Master's in Economics from the University of Coimbra (1998) and a Doctoral Degree in Tourism, also from the University of Aveiro (2006). Her research interests include tourism economics, tourism impacts, social tourism, accessible tourism, tourism forecasts and consumer behaviour in tourism. She is at present the coordinator of the Degree in Tourism at University of Aveiro.

Leonor Teixeira graduated in Industrial Engineering and Management, received a MSc degree in Information Management, and a PhD in Industrial in 2008, from the University of Aveiro, Portugal. She is currently an Associate Professor of the Department of Economics, Management, Industrial Engineering and Tourism (DEGEIT) at the University of Aveiro. She is also a researcher at the Institute of Electronics and Telematics Engineering (IEETA) and collaborator at research unit on Competitiveness, Governance and Public Policies (GOVCOPP) of University of Aveiro. Her current research interests include Industrial Management in general, and in Information Systems applied to Industry in particular. She has published in several journals, books (chapters) and proceedings, and has several communications at international scientific conferences. She serves as a member of Program Board and Organising Committees for several scientific committees of international conferences and has collaborated as reviewer with several journals. She is associated with IIIS, IEEE Society, EMBS Society, and PTAIS.

1 Introduction

Nowadays, tourism is one of the most important economic activities in the world, contributing to 10.4% of the global gross domestic product (GDP) and about 10% of total employment generated (World Travel & Tourism Council, 2019). However, there are still some groups of our society that face various travel constraints, mainly people with disabilities (PwD) (Daniels et al., 2005; Buhalis and Michopoulou, 2011; Figueiredo et al., 2012; Loi and Kong, 2017). According to the World Health Organization (World Health Organization, 2011), about 15% of the world's population suffer from some type of disability and need leisure and tourism activities to improve their well-being. Moreover, in Portugal, many visitors have some type of special needs that require adapted tourism products (Ambrose et al., 2017; Dinis et al., 2020). Despite the already large size of the accessible tourism market, the ageing of the population in most tourist-generating countries, which often implies the development of some form of disability, and the fact that travellers with disabilities travel mostly in low season and accompanied by family or friends, will provide relevant economic contributions to tourism destinations. In addition, there is increasing worldwide concern over the inclusion of disadvantaged groups in all daily-life dimensions, including leisure and tourism. Consequently, for example, various efforts have been carried out in different countries to implement legislation to address the special needs of PwD, contributing to their active participation in society. Therefore, the contribution of tourism to a more inclusive community involves developing strategies that promote accessibility of tourism destinations, contributing to an increase in the participation of PwD in tourism activities (Yau et al., 2004; Darcy and Dickson, 2009; Figueiredo et al., 2012; Kong and Loi, 2017). Thus, all the actors involved in the tourism industry should be offering accessible tourism products, including accessible information and communication services (Michopoulou and Buhalis, 2013; Teixeira et al., 2019).

In the context of information and communications technologies (ICTs), the internet emerges as an outstanding communication tool. Consequently, in tourism, this tool is one of the most important information sources used by visitors to plan their trips (Luo et al., 2004; Almeida-Santana and Moreno-Gil, 2017; Mangani and Bassi, 2019). Although the number of studies examining the information sources used by PwD is limited, the internet and recommendations from friends and relatives are mentioned as the most important information sources used by this group (Zajadacz, 2014). For that reason, it is of utmost relevance to conduct studies on the accessibility level of online communication platforms used by tourism supply agents (e.g., websites) to design communication channels for all.

Although the literature shows that there is a large number of failures in terms of accessibility on tourism industry websites (e.g., Shi, 2006; Domínguez Vila et al., 2018; Teixeira et al., 2019), in recent years there has been growing concern about this issue. In this context, the European Standard-EN 301 549 (European Union, 2014) was developed in 2014 and updated in November 2019 to version 3.1.1 (EN 301 549 3.1.1) (European Union, 2019). This set of guidelines was designed by the European Telecommunications Standards Institute (ETSI) in response to a request from the European Commission to improve the accessibility level of ICTs. Additionally, other international organisations, politicians and academics highlight the relevance of providing accessible information (Daniels et al., 2005; Michopoulou and Buhalis, 2013; Zajadacz, 2014).

The selection of accommodation has a central role in the planning phase of a tourism trip (Worsfold et al., 2016). In the case of PwD, this issue becomes even more significant

because accessibility requirements are greater than those required by people without disabilities (Buhalis and Michopoulou, 2011). It is of utmost relevance that the hospitality industry provides information on the accessibility of the services it offers, as well as making sure that this information is delivered in an accessible way. Nonetheless, in the majority of the cases, a great number of tourism supply agents, including hotels and other tourism accommodation sites, do not provide accessible information (Buhalis and Michopoulou, 2011). In addition, there is a lack of studies regarding the level of web accessibility in the hospitality industry, specifically in the case of Portugal.

Portugal nowadays is an important tourism destination worldwide, with tourism being one of the main economic activities contributing 16.5% to the country's total Gross Domestic Product (GDP), in 2019 (World Travel & Tourism Council, 2020). Before the COVID-19 pandemic, Portugal represented one of the most prominent European tourism destinations, receiving around 16 million international visitors per year from different countries (e.g., UK, France and Brazil) (Turismo de Portugal, 2020b) and from diverse age groups (including people over 60 years old) (INE, 2020). Regarding accessible tourism, in 2019, Portugal won the 'Accessible Tourist Destination 2019' award from the World Tourism Organisation (WTO), the first country to receive this recognition (Turismo de Portugal, 2020a). In the Portuguese context, some studies have already performed web accessibility evaluations of some tourism supply agents (e.g., Macedo and Sousa, 2019; Teixeira et al., 2019, 2020; Borges et al., 2020; Eusébio et al., 2020; Gonçalves et al., 2020). However, in the context of Portuguese tourism accommodation, the state of web accessibility of websites is still quite unknown, with a limited number of studies in this field (Macedo and Sousa, 2019). Furthermore, no studies are known about the changes that should be implemented to increase the level of web accessibility of these tourism supply agents, which are important in the tourism experience of all visitors (people with or without disabilities).

The present study intends to address this gap, by presenting a study in the area of tourism accommodation. To increase knowledge on web accessibility in this tourism field, this study aims to evaluate the level of accessibility of the websites of hotels located in the central region of Portugal. To accomplish this goal, two automatic tools were used. In addition, a framework based on the academic literature was also created, with the intention of serving as a guide to identify accessible market segments, which will most probably suffer from low levels of web accessibility. This framework can be a great help for web developers and other tourism agents (e.g., hotel and marketing managers) to improve the development of communication channels based on the internet.

A great number of beneficiaries of this study may be identified:

i academics

ii tourism supply agents

iii policymakers

iv PwD.

Academics benefit from an advance in knowledge concerning the accessibility of information provided through one of the most important information sources used in tourism (both by PwD and people without disabilities). The tourism supply agents, specifically the hotel managers, obtain relevant information to improve the accessibility level of one of its main communication and marketing tools (hotels' websites). Based on

that, the failures in terms of hotels' website accessibility identified in this study, the hotel managers will be able to develop training modules for their programmers in accessibility or to collaborate with specialist organisations to improve the accessibility level of their websites. Besides, strategies to increase web accessibility in the hospitality industry would enable hotel managers to take a competitive advantage over their competitors and a differentiation factor for the market, since the inclusion strategies used by companies is increasingly valued by customers, contributing to attract new markets and projects. In addition, equal opportunities are a right of all citizens, regardless of their characteristics and functional capabilities. Hence, this study also provides relevant contributions for policymakers to develop plans, policies and legislation to increase the accessibility level of information delivery by hotels' websites. Finally, all people who use hotels' websites to plan their tourism trips will benefit from more accessible websites. Still, the main beneficiaries will be PwD, due to a reduction of their travel planning constraints.

This study intends to contribute to an advance in knowledge in the area of accessible tourism as well as in computer science. Concerning accessible tourism, this study examines how one of the most important travel constraints faced by PwD (absence of accessible information) can be overcome, examining the accessibility levels of hotels' websites, and proposes strategies to eliminate communicational barriers. In the computer science area, this study also provides significant contributions, namely to help web designers and programmers to implement universal and usable web applications for all users, including PwD. In literature, there are several studies addressing usability issues, but very few address accessibility issues in tourism area, which despite being a sub-area of usability has proven to be of great importance for a growing market – e.g., accessible tourism. Thus, based on the findings of this study, these professionals can understand which issues are more critical and require more attention in order to consider them in future developments and to create usable and accessible solutions for all.

In terms of structure, following this introduction, a theoretical background concerning the accessibility of the tourism accommodation services and website accessibility is presented. The methodology used to examine the level of accessibility of the websites of hotels located in the central region of Portugal is described. Further, the results obtained are presented following a brief discussion based on the framework developed. Finally, the paper ends with the most important conclusions, theoretical and practical contributions, limitations, and recommendations for future researches about this issue.

2 Literature review

2.1 Accessible tourism in the hospitality industry

The United Nations (UN) declared tourism as a human right in 1948 (United Nations, 2015). After more than 70 years, there are still several groups of people who are excluded from tourism activities due to the various travel constraints that they face. PwD (mobility, vision, hearing and intellectual), are one group that face a great number of travel constraints that often prevent them from participating in tourism activities (Poria et al., 2009; Eusébio et al., 2016; Evcil, 2018; Oostveen and Lehtonen, 2018). To overcome these travel constraints, it is of utmost relevance to understand how the tourism industry should be adjusted to give the same access conditions to all people, independently of their functional conditions.

The hospitality industry and particularly hotels play a crucial role in the tourism industry (Worsfold et al., 2016). Tourists' enjoyment of their accommodation has great relevance in the overall satisfaction of a tourism experience (Choi and Chu, 2001). Nevertheless, several authors (Avis et al., 2005; Daniels et al., 2005; Tantawy et al., 2005; Bi et al., 2007) have identified many constraints that prevent PwD from travelling, related to the built environment and accessible information. Therefore, the supply of accessible tourism services by the tourism accommodation units (Rahim and Samad, 2010), as well as the dissemination of information regarding the characteristics of these services, should be also carried out in an accessible way.

Although in recent years some studies have examined the accessibility level of the services offered by the hospitality industry (O'Neill and Knight, 2000; Darcy, 2010; Freeman and Selmi, 2010; Darcy and Pegg, 2011; Morris and Kazi, 2014; Tutuncu, 2017; Boxall et al., 2018), research on the level of accessibility of information disseminated by the hotel industry through the internet (e.g., websites) is still scarce (Farrar and Lambert, 2001; Morrison et al., 2004; Williams and Rattray, 2005; Williams et al., 2006, 2007; Mills et al., 2008; Xiong et al., 2009; Sun et al., 2017). Thus, it is important to analyse the accessibility of the information that hotels and other tourism accommodation types disseminate through the internet. The best way to perform that analysis is by evaluating the web accessibility of hotel websites since they are a great source of data and many tourists still rely on these platforms. If the websites are not accessible, it creates difficulties for users, specifically, for PwD, which may lead to the loss of all the potential the market of accessible tourism offers (Bekiaris et al., 2018).

2.2 Web accessibility in the hospitality industry

Web accessibility can be defined as an approach that helps web design to maximise inclusion, both in terms of people who use websites and the technologies that are used in that process (Alexander, 2004). To examine web accessibility, different paradigms have been published (W3C, 2020a). The guidelines that are most used by designers and programmers to ensure that their websites satisfy web inclusiveness are the web content accessibility guidelines (WCAG) (Domínguez Vila et al., 2020). These guidelines, developed by the World Wide Web Consortium (W3C) (W3C, 2018b), intend to ensure web accessibility by web users. Several versions of this set of guidelines have been released (WCAG 1.0; WCAG 2.0 and WCAG 2.1).

WCAG version 2.0 was introduced in 2008 and became a staple in web accessibility studies, integrating four general principles (perceivable, operable, understandable and robust), divided into 12 guidelines. The perceivable principle is accomplished when the website content is perceivable by people, regardless of their disabilities. Operable principle is achieved when the user interface components and navigation are operable. If the information and the operation of the user interface are understandable, then the understandable principle is satisfied. Finally, if the content can be interpreted reliably by a wide variety of user agents including assistive technologies, then the operable principle is met (W3C, 2018a). Every principle has different guidelines, and each guideline includes different success criteria. Each guideline can be evaluated with three different conformance levels: A (basic accessibility representing the minimum level); AA (intermediate accessibility), and AAA (high accessibility). WCAG 2.1 extends the recommendation of the WCAG 2.0 version. The modifications introduced by this version consisted on the addition of 17 new success criteria in seven7 guidelines, on perceivable,

operable and robust principles (W3C, 2020b). All WCAG 2.0 principles and guidelines remain unchanged, with small changes to improve web accessibility conditions for PwD, specifically people with physical, visual and cognitive disabilities. The relevance of this new WCAG version for creating accessible ICTs is especially important in a European context (Rubáček et al., 2020) with Standard-EN 301 549 latest version 3.1.1 already incorporating WCAG 2.1 (European Union, 2019). Notwithstanding, the new adjustments imply that automatic evaluation tools should start integrating this extended set of success criterion, as currently most existing tools only perform evaluations with WCAG 2.0 standards (W3C, 2020a).

As web accessibility studies are mostly based on automatic tools, WCAG 2.0 and its guidelines have been pivotal to assessment of the level of accessibility of tourism websites (Shi, 2006; Mills et al., 2008; Kuzma et al., 2009; Akgül and Vatansever, 2016; Domínguez Vila et al., 2018). In this regard, some particular studies have already analysed web accessibility conditions in the hospitality sector (Farrar and Lambert, 2001; Morrison et al., 2004; Williams and Rattray, 2005; Williams et al., 2006, 2007; Mills et al., 2008; Xiong et al., 2009; Sun et al., 2017; Halkiopoulos et al., 2020; Macedo and Sousa, 2019). For example, Williams and Rattray (2005) and Williams et al. (2006) examined the accessibility of UK hotel websites, through the software Booby. Williams et al. (2007) investigated the accessibility level of Australian, UK and US hotel websites. Mills et al. (2008) also examined the accessibility of hospitality websites in the US. The results of these studies reveal a low level of accessibility in hospitality websites. More recently, Halkiopoulos et al. (2020) studied web accessibility factors in Greek hotels, and despite websites showing updated content and information about accessibility, WCAG 2.0 standards were poorly followed. In a Portuguese tourism context, Macedo and Sousa (2019) performed a web accessibility study on the websites of the five largest hotel chains in Portugal, using AccessMonitor and WCAG 2.0 version. The authors concluded that digital inclusion of PwD is not assured and there is need for more awareness from tourism regulators concerning accessibility in hospitality websites.

The studies published concerning website accessibility also reveal that there is heterogeneity in accessibility requirements according to the type (e.g., mobility/physical, vision, hearing, cognitive/learning) and intensity (low, moderate and high) of user disability (Rumetshofer and Wöß, 2004). For that reason, it is important to examine the relevance of each WCAG guideline to each segment of people who belong to accessible tourism market and have specific access needs. In order to understand how the diverse segments of the accessible market are affected by each WCAG 2.0 success criterion, a framework was developed – WCAG@AcceTourMark (Table 1) – based on accessible tourism market segments described by Buhalis and Darcy (2011), on the characteristics of WCAG 2.0 guidelines and on the results of some studies that examined website accessibility (Shi, 2006; Mills et al., 2008; Domínguez Vila et al., 2017). This framework intends to help, web developers and designers understand how accessible market segments, are differently affected by various success criteria that compose the WCAG 2.0. The framework is also adaptable and can later incorporate the 17 new success criteria of WCAG 2.1, or even a newer version of the WCAG.

Table 1 **WCAG@AcceTourMark** framework: The impact of WCAG 2.0 guidelines and success criteria on the different accessible tourism market segments

WCAG 2.0			*Accessible tourism market segments*						
Principles	*Guidelines*	*Success criteria – Conformance level*	*Mobility impairments*	*Blind/Visual impairments*	*Deaf/Hearing impairments*	*Speech impairments*	*Cognitive impairments*	*Hidden impairments*	*Elderly/ seniors*
Perceivable	1.1 Text alternatives	1.1.1 Non-text Content –A		+++	+++				
	1.2 Time-based media	1.2.1 Audio and Video Only – A		+++	++		++		+
		1.2.2 Captions – A			+++				+
		1.2.3 Audio Description or Media – A		+++			+		+
		1.2.4 Captions (live) – AA			+++				++
		1.2.5 Audio Description – AA		+++			++		
		1.2.6 Sign Language – AAA			+++	++			
		1.2.7 Extended Audio Description – AA		+++					
		1.2.8 Media Alternative – AAA		++	++				
		1.2.9 Audio Only – AAA			+++				++
	1.3 Adaptable	1.3.1 Info and Relationships – A		+++	+++		++		++
		1.3.2 Meaningful Sequence – A		++		++	++	++	
		1.3.3 Sensory Characteristics – A		+++			+		+
	1.4 Distinguishable	1.4.1 Use of Colour – A		+++			++		+
		1.4.2 Audio Control – A	+		+++	++			
		1.4.3 Contrast – AA		+++					+
		1.4.4 Resize Text – AA		++					++
		1.4.5 Images of Text – AA		++			++		+
		1.4.6 Contrast – AAA		++					+
		1.4.7 Low or No Background Audio- AAA		+	+++	+			+
		1.4.8 Visual Presentation – AAA		++			+++		
		1.4.9 Images of Text (no exception) – AAA		+++			++		+

Table 1 **WCAG@AcceTourMark** framework: The impact of WCAG 2.0 guidelines and success criteria on the different accessible tourism market segments (continued)

WCAG 2.0			*Accessible tourism market segments*							
Principles	*Guidelines*	*Success criteria – Conformance level*	*Mobility impairments*	*Blind/Visual impairments*	*Deaf/Hearing impairments*	*Speech impairments*	*Cognitive impairments*	*Hidden impairments*	*Elderly/ seniors*
Operable	2.1 Keyboard accessible	2.1.1 Keyboard – A	+++	+			++		
		2.1.2. No Keyboard Trap – A	++	++					+
	Navigable	2.1.3 Keyboard (no exception) - AAA	+++	+			+		+
	2.2	2.2.1 Timing Adjustable – A	+++	++	++	+	++	+	+
	Enough time	2.2.2 Pause, Stop, Hide – A		+++			+++		++
		2.2.3 No Timing - AAA	++	+			++		
		2.2.4 Interruptions – AAA		+			+++		+
		2.2.5 Re-authenticating – AAA	++	+	+		++		+
Operable	2.3	2.3.1 Three Flashes or Below Threshold – A					+	+++	+
	Seizures	2.3.2 Three Flashes – AAA					+	+++	+
	2.4	2.4.1 Bypass Blocks – A		+	+		++	+	+
	Navigable	2.4.2 Page Titled – A	++	++			+		++
		2.4.3 Focus Order – A	++	++			+++		+
		2.4.4 Link Purpose – A	+	++			++		
		2.4.5 Multiple Ways – AA	+	++			+++		+++
		2.4.6 Heading and Labels – AA	+	+	+		+++		+
		2.4.7 Focus Visible – AA	++				++		
		2.4.8 Location – AAA	++				+++		
		2.4.9 Link Purpose – AAA	++	+			++		
		2.4.10 Section Headings – AAA	+	++			+++		+

Table 1 **WCAG@AcceTourMark** framework: The impact of WCAG 2.0 guidelines and success criteria on the different accessible tourism market segments (continued)

WCAG 2.0			*Accessible tourism market segments*							
Principles	*Guidelines*	*Success criteria – Conformance level*	*Mobility impairments*	*Blind/Visual impairments*	*Deaf/Hearing impairments*	*Speech impairments*	*Cognitive impairments*	*Hidden impairments*	*Elderly/ seniors*
Understandable	3.1	3.1.1 Language of Page – A	++	+++	+++		++	++	+
	Readable	3.1.2 Language of Parts – AA	++	+++	+++		++	++	+
		3.1.3 Unusual Words – AAA				++	+++		++
		3.1.4 Abbreviations – AAA		+	+		+++		+
		3.1.5 Reading Level – AAA					+++		+
		3.1.6 Pronunciation – AAA		++		++	+++		
	3.2	3.2.1 On Focus – A	++	++			++		+
	Predictable	3.2.2 On Input – A		++			++		+
		3.2.3 Consistent Navigation – AA		++			+++		++
		3.2.4 Consistent Identification – AA		+			++		
		3.2.5 Change on Request – AAA		++			+++		+
	3.3	3.3.1 Error Identification – A		++	++		+++	++	+
	Input Assistance	3.3.2 Labels or Instructions – A	+	+	+	+	+++	++	+++
		3.3.3 Error Suggestion – AA	+	+	+		++		+
		3.3.4 Error Prevention (Legal) – AA	+	+	+	+	+++		++
		3.3.5 Help – AAA					+++		++
		3.3.6 Error Prevention (All) – AAA	+	+	+		+++		++
Robust	4.1 Compatible	4.1.1 Parsing – A	++	++	++	+	++	+	+
		4.1.2 Name, Role, Value – A	++	++	++	+	++	+	+

+ Low effect / ++ Medium effect / +++ High effect.

According to Shi (2006), people with visual, hearing, cognitive, mobility and neurological disabilities are greatly affected by low levels of website accessibility and being highly impacted by issues in almost every WCAG 2.0 guidelines. Following the same line of thought, Mills et al. (2008) also identified inaccessible aspects, which have mostly impacted tourists with a visual disability. These aspects are mainly related to the perceivable principle. Finally, Domínguez Vila et al. (2017) identified ambiguities as a major concern in tourism-related websites of northern countries. Hence, the guideline '4.1 Compatible' tends to affect every segment of the accessible market.

Based on the literature on accessible tourism and web accessibility, a framework was developed to identify the impact of WCAG guidelines and success criteria on the various accessible tourism market segments. This was later used in the practical approach to identify types of disabilities that may be constrained by low levels of accessibility in hotel websites. With the *WCAG@AcceTourMar*k framework proposed in this research (Table 1), it is possible to observe that the WCAG 2.0 guidelines have different impacts on the various segments of the accessible tourism market. The success criteria can focus on diverse kinds of disabilities, but with different intensities. Therefore, three different types of effects are proposed. Each effect has a different symbol: + corresponds to a low effect; ++ corresponds to a medium effect and +++ reveals a high effect of the conformance level on the type of disability. The allocation of the three levels of effects was made with the help of the descriptions of each success criterion provided by W3C (W3C, 2016b). For example, success criteria 2.1.1 – Keyboard with conformance level A – has a high effect on users with mobility disabilities, a medium effect on users with cognitive disabilities, and a low effect on users with visual disabilities. Globally, according to the framework proposed, errors that affect web accessibility tend to make the access to online information difficult, especially for people with visual, hearing, cognitive and neurological disabilities, and for people with some types of physical disability. Moreover, the elderly people are also affected by almost every success criterion. *WCAG@AcceTourMark* can help other researchers and web developers in the scope of accessible tourism and web accessibility areas to understand the types of disabilities that are most affected when a WCAG criterion is not present. The framework presented in Table 1 allows a better perspective of the impact that problems of web accessibility can have on the accessible tourism market.

3 Methodology

3.1 Data collection method

To analyse the website accessibility of hotels, a research procedure was adopted following a multistage approach. For data collection, the National Register of Touristic Enterprises (RNET) database was used to identify hotel websites (https://rnt.turismodeportugal.pt) in March 2019. Considering the data present in this database, 1678 hotels and Pousadas de Portugal were identified. Of these, 23.5% of the total (representing 394) are located in the central region of Portugal and are the subject of analysis. Thus, the URL addresses of the website were saved on an excel sheet, and when the hotel did not present data about its website URL, the research was complemented with a Google search through the name and brand of a hotel or Pousada de Portugal. 50

accommodation units were excluded from the analysis because they did not have a website. Thus, a total of 344 websites were considered for analysis in the present study.

3.2 Data analysis methods

Two online automatic tools – AccessMonitor and "*Test de Accesibilidad Web*" (TAW) – selected from a list of 162 possible tools available at W3C (W3C, 2020a), were used to examine the 344 websites of hotels and *Pousadas de Portugal* and compliance criteria of each guideline for each principle, using A/AA/AAA conformance levels. AccessMonitor (available at http://accessmonitor.acessibilidade.gov.pt/amp/) and the Website Accessibility Test (TAW), (available at https://www.tawdis.net/) were selected to perform the analysis of the mentioned websites, not only because they are widely used, but also because they are available online and have WCAG as a reference. Given that at the time this study was carried out, the two online automatic tools used only assessed the accessibility of websites based on WCAG 2.0, this was the WCAG version used in this study. There are also some other researches that have applied automatic tools to evaluate web accessibility conditions (Shi, 2006; Kuzma et al., 2009; Akgül and Vatansever, 2016; Domínguez Vila et al., 2017, 2018). AccessMonitor is a tool developed by the Portuguese Science and Technology Foundation and which works entirely on the Web in accordance with WCAG 2.0. After a website URL address is entered, the tool generates a summary with the analysis that indicates a quantitative scale (AccessMonitor index), errors found by the degree of compliance (A, AA and AAA), and a test report. The presented global index of each website ranges from 1 (very poor web accessibility practices) to 10 (excellent web accessibility practices). AccessMonitor allows the identification of problems in website content, providing important information related to the accessibility level of the websites analysed. TAW is also an automated tool that evaluates web accessibility using WCAG 2.0, with the three levels of conformance (A, AA, and AAAAfter a URL is entered, the results are presented in three categories:

i 'problems' (corrections required);

ii 'warnings' (review by a technician is required)

iii 'not reviewed' (a fully manual review is necessary).

In both tools, the only input needed was the link to the respective website. After inserting the link on the tool, an accessibility report was generated, providing important details on the number of failures concerning WCAG 2.0. To analyse the data obtained, descriptive statistics (mean, minimum, maximum and standard deviation) were applied using the SPSS software. After identifying the failures, the WCAG@AcceTourMark framework was used to explore the segments of the accessible tourism market that are most affected by a lack of web accessibility.

3.3 Analysed sample

As mentioned, the sample is represented by 344 hotels and *Pousadas de Portugal* located in the central region of Portugal. Table 2 presents some data in order to characterise the sample.

Table 2 Analysed hotels by category and localisation

Category			*Location*		
Hotels	*N*	*%*	*NUTs III*	*N*	*%*
5 Stars	10	2.9	Aveiro	35	10.2
4 stars	103	29.9	Coimbra	64	18.6
3 stars	141	41.0	Leiria	39	11.3
2 stars	70	20.3	Oeste	53	15.4
1 star	11	3.2	Viseu e Dão Lafões	34	9.4
Pousadas de Portugal	9	2.6	Beiras e Serra da Estrela	40	11.6
			Beira Baixa	7	2.0
			Médio Tejo	72	20.9

As it can be seen, the vast majority are hotels (97.3%) and only 2.6% are *Pousadas de Portugal*, which are stately houses providing accommodation features. Regarding the hotels, most are categorised with a medium ranting, with only 2.9% with 5 stars, and 3.2 % with only 1 star. Regarding the location, the majority of the websites analysed belong to accommodation units located along the coastline (Aveiro, Leiria, Oeste, Médio Tejo) with 58% of the sample and only a small part (13.6%) are located in interior zones (Beira Baixa and Serra da Estrela).

4 Results

4.1 Results obtained with AccessMonitor

The results presented in Tables 3 and 4 were obtained with AccessMonitor. The global index varies between 3 and 8.3, with a mean of 5.08. Errors of type A are the most critical but also the most common, with a mean of 6.38 per website. Results demonstrated that every site has at least one type A error, with some sites reaching a total of 15 errors. This means that none of the analysed websites fulfils the minimum aspects regarding the level of accessibility. Regarding the AA and AAA levels, some errors were also found. This, of course, all influences the totality of errors, with a mean of 8.84 per website.

Table 3 Global Index and errors in web accessibility of hotels websites

AccessMonitor	*Min*	*Max*	*Mean*	*Std. Dev*
Global Index	3	8.3	5.08	1.02
Errors type A	1	15	6.38	2.70
Errors type AA	0	3	1.07	0.87
Errors type AAA	0	4	1.38	0.82
Total errors (A + AA + AAA)	2	18	8.84	3.34

Table 4 AccessMonitor global index of accessibility on the analysed websites

Web accessibility practices	*Global index value*	*N*	*%*
Very bad practices	[0–2]	0	0
Bad practices	[2–4]	43	12.50
Regular practices	[4–6]	233	67.70
Good practices	[6–8]	64	18.60
Very Good practices	[8–9]	4	1.20
Excellent Practices	[9–10]	0	0

Table 4 provides further details regarding the global index obtained with AccessMonitor. The results show that the most significant number of websites were classified as having regular practices, and 12.4% with bad practices. Only 1.2% of the total websites analysed were classified as having very good practices. There are no websites classified as having excellent practices.

The low level of global index and the high percentage of type A errors indicate that there are certainly some problems regarding web accessibility conditions on the analysed websites. Most websites were classified as having regular accessibility practices. However, the biggest share of detected errors is of type A, representing the most critical errors, which means that the basic level of web accessibility is not ensured.

These results also indicate that there are accessibility problems in the analysed websites, meaning that PwD will most likely have difficulty in accessing and understanding the information presented in the analysed websites. The results are in line with the findings of the other studies on web accessibility in the tourism industry (Teixeira et al., 2019; Borges et al., 2020). Borges et al. (2020) analysed a sample of several tourist websites from different countries using AccessMonitor and observed a low level of accessibility in these websites. Also, Teixeira et al. (2019) examined the website accessibility of Portuguese travel agents and also noted that the website accessibility of the travel agents analysed is very low.

4.2 Results obtained with "Test de Accesibilidad Web"

Table 5 shows the results obtained with the Website Accessibility Test (TAW), summarising the number of problems detected with this automatic evaluation tool. These problems are categorised in four principles (perceivable, operable, understandable, and robust) and 12 guidelines of the WCAG 2.0.

As it can be observed, the perceivable principle, which assures that information and other components included in the user interface are presented in a perceptible way to the users, is the most critical issue with a total of 10516 problems and a mean of 30.56 problems per each website analysed (standard deviation (SD) = 72.34). The most significant contribution to this result belongs to 'Text alternatives' and 'Adaptable' guidelines, which have an average of 15.89 (SD = 22.35) and 14.66 (SD = 56.65) problems, respectively, per website. Additionally, these two guidelines include only low-level (A) success criteria, which makes the scenario even more serious in terms of web inaccessibility. Considering this principle, and in order to make the websites more accessible, it is important to:

i include text alternatives for any non-text content

ii have contents that can be presented to the users in different ways, with a logical and meaningful sequence, and with compatible with assistive technologies.

Regarding the operable principle, which ensures easy and operable navigation between the different components of the interface, there are also critical issues, with an average of 20.60 problems per website analysed (SD = 61.38). In this case, the cause that most strongly contributed to this result was the 'Navigable' guideline (mean = 19.20 and a SD = 58.20), which is responsible for providing ways to help users find content, navigate and control their position on the website. This also confirms the poor results obtained with the 'Adaptable' guideline that was stated above. It is important to stress that the four success criteria included in this guideline – Bypass Blocks, Page Titled, Focus Order and Link Purpose in Context – make a part of the conformance level A, the basic level of accessibility. To increase accessibility at this level, it is important to provide ways to help users navigate, avoid mistakes and give instructions to get out of blocked situations.

Table 5 Problems identified with TAW

Principles	*guidelines*	*Problems detected*	*Min*	*Max*	*Mean*	*Std. Dev.*
Perceivable	1.1 Text alternatives	5467	0	229	15.89	22.35
	1.2 Time-based media	4	0	2	0.01	0.15
	1.3 Adaptable	5045	0	1021	14.66	56.65
	1.4 Distinguishable	0	0	0	0	0
	Total perceivable	10516	0	1250	30.56	72.34
Operable	2.1 Keyboard accessible	474	0	51	1.38	4.99
	2.2 Enough time	7	0	3	0.02	0.22
	2.3 Seizures	0	0	0	0	0
	2.4 Navigable	6619	0	1040	19.20	58.20
	Total operable	7100	0	1091	20.60	61.38
Understandable	3.1 Readable	160	0	3	0.47	0.53
	3.2 Predictable	109	0	7	0.32	0.75
	3.3 Input assistance	2167	0	104	6.30	10.29
	Total understandable	2436	0	104	7.08	10.53
Robust	4.1 Compatible	7199	0	235	20.89	32.69
	Total robust	7199	0	235	20.89	32.69

The robust principle, responsible for compatibility with possible user agents such as assistive technologies, is the one that has the most problems per website on average (mean = 20.89, SD = 32.69). This principle is also part of a guideline with two success criteria – Parsing and Name, Role, Value – which evaluate the most basic aspects of accessibility (level A). To overcome this problem, it is important to assure that website content will be accurately parsed into a structure of data or that it will be adequately rendered by assistive technologies (W3C, 2016a).

The present results, with most critical problems in perceivable, operable and robust principles are in line with the findings presented by Domínguez Vila et al. (2018), in a study conducted with official tourism organisations' websites, which showed that the most problems occurred in the perceivable and Robust principles. The studies presented by Gonçalves et al. (2020) and Silveiro et al. (2019) also show the same trend, revealing that the perceivable principle is one of the most critical.

Table 6 illustrates the results obtained in the warnings category with a total of 80099 errors detected. The results concerning the warnings confirm the results obtained in the problems category.

Table 6 Warnings identified with TAW

Principles guidelines		*Warnings detected*	*Min*	*Max*	*Mean*	*Std. Dev.*
Perceivable	1.1 Text alternatives	6682	0	163	19.32	20.15
	1.2 Time-based media	217	0	54	0.63	5.03
	1.3 Adaptable	13107	0	315	38.05	46.16
	1.4 Distinguishable	12737	0	1976	36.93	116.42
	Total perceivable	32743	0	2155	94.92	152.19
Operable	2.1 Keyboard accessible	474	0	51	1.38	4.99
	2.2 Enough time	0	0	0	0	0
	2.3 Seizures	0	0	0	0	0
	2.4 Navigable	12907	1	2324	37.48	127.12
	Total operable	13381	1	2375	38.86	130.15
Understandable	3.1 Readable	0	0	0	0	0
	3.2 Predictable	3150	0	124	9.10	15.09
	3.3 Input assistance	3096	0	40	9.00	9.10
	Total understandable	6246	0	133	18.10	19.69
Robust	4.1 Compatible	27729	0	1457	78.81	158.94
	Total robust	27729	0	1457	78.81	158.94

The most significant share of warnings belongs to the perceivable guidelines, where there are websites with 2155 warnings and with a mean of 94.9 per website with a SD of 152.2. The guidelines with most warnings detected were ‘1.1 Text alternatives’, ‘1.3 Adaptable’, ‘1.4 Distinguishable’, ‘2.4 Navigable’, and ‘4.1 Compatible’. Hence, several aspects need to be reviewed by programmers and web designers. Text alternatives to non-text content, presentation in different ways and ensuring compatibility with user agents represent some aspects that need to be both corrected and also the target of a careful review. Other characteristics like facilitating hearing, seeing, navigating and finding content should be re-evaluated.

5 Discussion of results according to the WCAG@AcceTourMark

To discuss the results obtained in this study, the *WCAG@AcceTourMark* framework was used. With the help of this framework, it was also possible to identify the groups of PwD that are most affected by the accessibility problems identified in the websites of hotels located in the central region of Portugal. Most errors in success criteria are related to conformance level A, which means the minimum web accessibility requirements for PwD are not being met by the majority of the analysed websites. With the help of the description provided by the W3C (W3C, 2018a), it is also possible to propose solutions to solve the websites' usability problems.

The failures identified in the perceivable principle were related to '1.1 Text Alternatives', '1.3 Adaptable', and '1.4 Distinguishable', as there is a large number of alerts. The incidents on these guidelines especially tend to affect people with visual disabilities or who have difficulty perceiving visual content and need assistive technology to convert text to braille or another non-text format (i.e. pictures, video) (W3C, 2018b). In fact, a lack of audio alternatives or changes in colour are the main obstacles in assuring web accessibility for people with this kind of disability. These results are in line with the findings obtained by Mills et al. (2008). Additionally, the elderly might also find difficulties given some visual problems related to advanced age. Text without size options was observed on many websites, which constitutes a great problem for people who, for example, have myopia or astigmatism. To solve these problems, WCAG suggests providing short text alternatives for non-text content, creating and ordering the content of the websites in a meaningful sequence, and using standard text formatting conventions for paragraphs, lists and headings. Moreover, it is also important to ensure that colour changes make sense within the context and that sound content only plays upon user request.

In the operable principle, problems and warnings were mainly related to guideline '2.4 Navigable'. Problems in success criteria mainly affect people with physical and visual disabilities but also people with cognitive deficits, since these groups have more difficulty in navigating and finding content. According to W3C (W3C, 2018a), this guideline provides ways to help users navigate, find content, and control the position where they are. To address these problems, it is important to provide information about the location of the user within the website, using mechanisms such as bypassing blocks of content and creating headings and labels that describe topics or purposes. On an important note, guideline '2.3 Seizures' did not register any problems or warnings. The success criteria for this guideline are related to photo sensibility and affect people with hidden impairments, such as epilepsy. It was indeed found that the websites analysed did not display flashing lights or any other type of content that could trigger seizures for people with epilepsy or other related hidden disabilities.

The understandable principle was the one with the fewest warnings and problems identified. The lack of labels and explanations on websites ('3.3 Input assistance') represents a factor that should be corrected if web accessibility is to be improved. Difficulties in avoiding and correcting mistakes affect all PwD. To overcome this problem, labels or instructions should be provided when user input is necessary and input errors should be automatically detected. The lack of web accessibility regarding this guideline tends to prevent the use of websites by people with a cognitive disability. If mistakes cannot be avoided or corrected, a fully barrier-free use is impossible. Further, web designers and developers should pay particular attention to the guideline '3.2

Predictable', due to the high level of registered warnings. This is verified in the study of Perna et al. (2020), where the software design and content of websites have some requirements specifically for PwD. A possible solution that can be implemented in the websites to solve this problem is to ensure that changes in the context only happen upon user request, so webpages can appear and work in predictable ways.

The failures in the robust principle were related to the fact that most websites are not ready for assistive technologies. However, a great number of PwD use assistive technologies to access websites. If websites are not compatible with or do not allow the use of these technologies, then they become inaccessible for a great number of PwD. The results obtained in this research demonstrated problems mainly in '4.1 Compatible'. The ambiguity and lack of compatible platforms reveal that the sample of studied websites share the same vulnerabilities, as the ones examined by Domínguez Vila et al. (2017). Furthermore, as the elaborated framework illustrates, the errors related to this guideline affect all PwD, that need assistive technologies to access websites. Hence, it is of utmost relevance that web designers and developers of the hotel websites analysed correct these issues. To address these problems, web designers should make sure their websites are compatible with current user agents, including assistive technologies such as screen readers.

6 Conclusions, implications and future research

The research conducted allowed analysis of the current state of web accessibility in the Portuguese hospitality sector. A sample of 344 websites belonging to hotels and *Pousadas de Portugal* located in the central region of Portugal were analysed in terms of accessibility, using two online automatic tools (AccessMonitor and TAW) that considered WCAG 2.0 principles. The results revealed that the information available on the websites analysed constitutes a barrier to accessible tourism, in particular violation of the perceivable and robust principles of WCAG 2.0.

The low results of the global index and many type A errors showed the lack of web accessibility in the websites analysed. This unsatisfactory data is in line with the findings of other studies (Farrar and Lambert, 2001; Morrison et al., 2004; Williams and Rattray, 2005; Williams et al., 2006, 2007; Mills et al., 2008; Xiong et al., 2009; Domínguez Vila et al., 2017; Sun et al., 2017; Domínguez Vila et al., 2018; Borges et al., 2020) exposing websites for ignoring segments of the accessible market. Indistinguishably, the results from TAW confirmed the results obtained with AccessMonitor. With TAW, it was possible to identify the WCAG 2.0 guidelines with most problems and warnings. Guidelines such as '1.1 Text alternatives', '1.3 Adaptable' (content not being presented in different and simpler ways), '2.4 Navigable' (help users navigate and find content), and '4.1 Compatible' (lack of compatibility with user agents), were those that need most corrections and re-evaluation in the websites studied. These results corroborate other studies in this field (Domínguez Vila et al., 2018; Angélico Gonçalves et al., 2020; Perna et al., 2020) that reveal those guidelines as the ones that contribute most to the lack of accessibility of information on websites. In fact, the high number of problems and warnings confirm the need to redesign the websites to make them more accessible to all users, independently of their personal situation or conditions of access.

With the development of the *WCAG@AcceTourMark* framework, it was also possible to understand which segments of the accessible market are most affected by the lack of

web accessibility. Considering WCAG 2.0, in the case of the perceivable principle, it can be observed that people with visual disabilities are the most affected. In the operable and understandable principles, the warnings and problems especially prevented people with cognitive disabilities from having a barrier-free use of the websites. Failures in the robust principle tend to affect all groups of PwD, with the greatest impact on those who need to use user agents, such as assistive technologies (mobility and visual disabilities). Despite the exploratory nature of the framework proposed, results obtained in this research also show that people with physical and visual disabilities and people with cognitive deficits are the groups that face most constraints when accessing information disseminated by the websites of hotels located in the central region of Portugal. It is of utmost importance to introduce changes to the websites of the hotels analysed to facilitate the visitors with disabilities to plan their tourism trips.

Both theoretical and practical contributions of this study may be highlighted. The theoretical framework proposed, *WCAG@AcceTourMark*, although exploratory, introduces a new attempt to identify the impact of WCAG 2.0 guidelines and success criteria on the various accessible tourism market segments. The *WCAG@AcceTourMark* can help other researchers, in the accessible tourism and web accessibility areas to identify the types of disabilities that are most affected when a WCAG 2.0 criterion is not present in a website. Overall, the diagnosis of the website accessibility level of hotels located in the central region of Portugal and the described framework presents a significant contribution to introduce improvements based on the accessibility guidelines. Additionally, the results can support further academic research studies about web accessibility evaluations by comparing the level of performance of hotels' websites with other tourism supply agents' websites.

Essentially, important practical implications can be retrieved for those involved in the creation of accessible tourism offers, such as hotel managers, marketing managers and web designers. For hotel managers, this study may have a powerful impact on raising awareness of the importance of having accessible websites. The results of this study can be useful to hotel managers to justify allocating a budget to increasing the accessibility of the websites, improving communication with an important growth market (PwD). Marketing managers can now be more aware that more accessibility in websites provides better business opportunities. Delivering accessible information in an accessible way is an important strategy to attract the accessible tourism market. Finally, the results may help hotel website designers realise what errors may compromise accessibility and how to correct them. The study also provides relevant implications for PwD. As explained, visitors with disabilities require a lot of information when planning their tourism trips (Devile and Kastenholz, 2018). Hence, the delivery of information in an accessible way can be the key to making tourism available to everyone, including visitors with disabilities.

Despite the significant contributions of this study, some limitations may be identified. First, only the accessibility level of the websites of hotels and *Pousadas de Portugal* located in the central region of Portugal were examined. The study of web accessibility of other players in the tourism value chain, such as transports, restaurants and tourism attractions (e.g., museums, cinemas and theme parks) is also of utmost relevance in reducing the high barriers that PwD still face when participating in tourism activity. Furthermore, besides websites, social networks are now also a widely used channel of communication in tourism (Dinis et al., 2020). Consequently, further studies should examine and compare the accessibility level of other online communication channels

used by all types of tourism supply agents (e.g., transports, restaurants, museums, cinemas and theme parks). Another limitation of this study is related to the use of only automatic tools to evaluate web accessibility. In this study, only WCAG 2.0 was considered because, at the time that this study was carried out, the automatic tools used only analysed websites' content based on WCAG 2.0, and not the last one, which is WCAG 2.1. On the other hand, despite the potential of these tools and the quality of the analyses provided, these automated evaluation tools do not consider the perception of PwD in a real-life situation. Future researches should focus on ascertaining the requirements of PwD for a tourism website to be accessible. This can be achieved through the application of usability tests to identify and estimate problems which might appear during the interaction of PwD with the websites. This research could be complemented through a survey of hotel managers to understand the relevance and impact of web accessibility and their degree of openness to change. Additionally, other stakeholders in the accessible tourism market and web designers should also be involved in this discussion to identify the best practices in the hotel sector in terms of access to digital information and interactivity with the consumer.

The role of web accessibility in the hospitality sector is crucial for the promotion of accessible tourism. Websites are essential for information sharing between tourists with disabilities and tourism organisations. The hospitality sector also has a very important role in ensuring customer satisfaction. This is more evident when tourists with disabilities are taken into consideration, due to all the restrictions, which tend to make tourism activities difficult for them. Being informed is the key, hospitality-related websites should respect in web accessibility design. Despite this, this research shows that there is currently still a long way to go in the central region of Portugal regarding this matter of web accessibility in the hospitality sector. The findings of the paper clearly show the accessibility problems and warnings on hotel websites. Therefore, with the growth of the accessible tourism market, it is important to invest in increasing the accessibility of information, regardless of the communication channel used to disseminate that information. Moreover, considering the current pandemic situation (COVID-19), hotels should adopt strategies to increase their competitiveness. This competitiveness should be achieved by enhancing the accessibility of their communication channels, in particular the digital channels, on which this study is based.

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Conflict of interest

The authors declare no conflict of interest.

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