

# Digital accessibility of smart cities - tourism for all and reducing inequalities: Tourism Agenda 2030

Elena Fernández-Díaz, Carmen Jambrino-Maldonado, Patricia P. Iglesias-Sánchez and Carlos de las Heras-Pedrosa

## Abstract

**Purpose** – There is widespread agreement that the tourism sector should address the issue of sustainability. The purpose of this study is to analyze the digital accessibility of the cities awarded as European Capitals of Smart Tourism for their innovative, accessible and sustainable practices by the European Commission.

**Design/methodology/approach** – An analysis of the digital level of accessibility of 50 uniform resource locator (URL) of European cities was undertaken. The analysis followed the international evaluation requirements of the World Wide Web (W3C).

**Findings** – The results show that none of the official Web pages analyzed obtained 100% in relation to the digital accessibility requirements. The main factors that pose barriers to communication and interaction were identified.

**Practical implications** – The paper encourages smart tourism destinations to overcome the challenge of matching both dimensions of accessibility to obtain barrier-free information to ensure cities are inclusive and sustainable in line with Agenda 2030 (sustainable development goal [SDG] 11).

**Originality/value** – The concept of tourism for all receives special attention in the sector, and this notion is reflected in the UN SDGs. However, accessibility has not been extensively analyzed in relation to the cohesion between the digital and the physical dimension. Tourism research tends to focus on accessible experiences within destinations. This paper introduces a new insight into the key issue of digital accessibility, which can promote destination choice and influence the tourism experience.

**Keywords** Smart cities, Smart tourism destinations, Web accessibility, WCAG 2.1, Sustainable development goals (SDGs)

**Paper type** Research paper

(Information about the authors can be found at the end of this article.)

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智慧城市的数字可及性-全民旅游和减少不平等现象：2030年旅游议程

目的：人们普遍认为，旅游业应该解决可持续性问题。本研究旨在分析被欧盟委员会授予欧洲智慧旅游之都的城市的数字可及性，以了解其创新、可及和可持续的做法。

设计/方法/途径：对50个欧洲城市的URL的数字可及性进行了分析。该分析遵循万维网（W3C）的国际评估标准。

研究结果：结果显示，所分析的官方网页中没有一个获得100%的数字无障碍要求。对交流和互动构成障碍的主要因素被确认。

原创性：全民旅游的概念在该领域受到特别关注，这一概念也反映在联合国可持续发展目标（SDGs）中。然而，无障碍性还没有被广泛地分析到数字和物理层面之间的凝聚力。旅游研究倾向于关注目的地内的无障碍体验。本文对数字可及性这一关键问题提出了新的见解，它可以促进目的地的选择并影响旅游体验。

实际意义：本文鼓励智能旅游目的地克服挑战，使无障碍环境的两个维度相匹配，以获得无障碍信息，确保城市的包容性和可持续性符合2030年议程（SDG 11）。

关键字 智能城市，智能旅游目的地，网络无障碍，WCAG 2.1，可持续发展目标（SDGs）。

关键词

文章类型 研究型论文

## **ACCESIBILIDAD DIGITAL DE LAS CIUDADES INTELIGENTES - TURISMO PARA TODOS Y REDUCCIÓN DE LAS DESIGUALDADES: AGENDA DE TURISMO 2030**

**Objetivo :** Existe un acuerdo generalizado en el sector turístico para abordar la cuestión de la sostenibilidad. Este estudio pretende analizar la accesibilidad digital de las ciudades premiadas como Capitales Europeas del Turismo Inteligente por sus prácticas innovadoras, accesibles y sostenibles por la Comisión Europea.

**Diseño/metodología/enfoque :** Se realizó un análisis del nivel de accesibilidad digital de cincuenta (50) URL de ciudades europeas. El análisis siguió las normas internacionales de evaluación de la World Wide Web (W3C).

**Resultados :** Los resultados muestran que ninguna de las páginas Web oficiales analizadas obtuvo el 100% en relación con los requisitos de accesibilidad digital. Se identificaron los principales factores que suponen barreras para la comunicación y la interacción.

**Originalidad :** El concepto de turismo para todos recibe especial atención en el sector y esta noción se refleja en los Objetivos de Desarrollo Sostenible (ODS) de la ONU. Sin embargo, la accesibilidad no se ha analizado ampliamente en relación con la cohesión entre la dimensión digital y la física. La investigación turística tiende a centrarse en las experiencias accesibles dentro de los destinos. Este artículo introduce una nueva perspectiva sobre la cuestión clave de la accesibilidad digital, que puede promover la elección del destino e influir en la experiencia turística.

**Implicaciones prácticas :** El documento anima a los destinos turísticos inteligentes a superar el reto de hacer coincidir ambas dimensiones de la accesibilidad para obtener información sin barreras que garantice que las ciudades sean inclusivas y sostenibles en línea con la Agenda 2030 (ODS 11).

**Palabras clave** Ciudades inteligentes, destinos turísticos inteligentes, accesibilidad web, WCAG 2.1, Objetivos de Desarrollo Sostenible (ODS)

**Tipo de papel** Trabajo de investigación

### **Introduction**

Sustainable development goals (SDGs) included in the United Nations 2030 Agenda challenge society in several ways. Particularly, the focus on social inclusion has attracted the attention of researchers, practitioners and policymakers. Goal 11 suggests a requirement to “make cities and human settlements inclusive, safe, resilient and sustainable.” SDG 10.2 also highlights a need to reduce inequalities for groups at risk of exclusion ([United Nations Development Programme, 2021](#)). It has been a challenge for cities to achieve these outcomes, which are a key element of global sustainability policies ([Koch and Ahmad, 2018](#)). However, in doing so, smart cities may play a leading role to overcome these challenges and achieve a new tourism sustainability paradigm that embraces inclusivity, accessibility and innovation ([Rucci et al., 2021](#)). [Albino et al. \(2015\)](#) and [Okafor et al. \(2022\)](#) state that smart cities, in addition to the adoption of technology, should encompass people and communities, information, infrastructure and social equity.

Tourism is considered to be a right to be enjoyed by everyone ([McCabe, 2020](#)). To achieve universally designed tourism environments requires the elimination of mobility, communication and other barriers to travel, allowing independence, equity and dignity ([Buhalis and Darcy, 2010](#); [Darcy and Dickson, 2009](#); [McKercher and Darcy, 2018](#)). However, participation in tourism activities continues to exclude certain social groups, especially the disabled ([Alves et al., 2020](#); [Figueiredo et al., 2012](#)) or who are of advanced age. Health problems can determine the viability of a tourist destination and may be complicated by a lack of information that recognizes their needs ([Buhalis and Michopoulou, 2011](#)). This lacking constitutes an inability to reach the minimum accessibility criteria.

The challenge of achieving equality of travel opportunities for people with disabilities requires knowledge, compromise, considerable effort and demands inclusive design for all citizens ([Eichhorn and Buhalis, 2011](#)). [Darcy and Dickson \(2009, p. 32\)](#) suggest that “a solution to meet people’s access requirements for the travel and tourism industry and destination management is through the application of universal design principles; that is, providing access for all.” An inclusive smart city considers all citizens, recognizing diversity and by eliminating physical and digital barriers ([Hollands, 2008](#)). Accessibility has taken

center stage as a tool for inclusion and achieving *tourism for all* (Buhalis and Darcy, 2010; Darcy and Dickson, 2009; Rucci *et al.*, 2021, 2022). The literature has also seen a shift in focus to digital accessibility in the past few years (Casais and Castro, 2021; Domínguez Vila *et al.*, 2019; Eusébio *et al.*, 2020; Fontanet Nadal and Jaume Mayol, 2011; Lestari *et al.*, 2019; Shi, 2006; Silveiro *et al.*, 2019; Singh *et al.*, 2021; Teixeira *et al.*, 2021; Williams and Rattray, 2005). In addition, accessibility is a complex concept that is still open to debate (Fernández-Díaz *et al.*, 2021; Lestari *et al.*, 2019; Madeira *et al.*, 2021; Nitti, 2018; Ribeiro *et al.*, 2018). Accessibility should integrate tourism, the environment, heritage, infrastructure, tourism agents and resources, information and digital ecosystems (Buhalis and Darcy, 2010; Buhalis and Michopoulou, 2011). More recently, as a consequence of penetration, the widespread use of technology and the proven importance of digital accessibility due to the COVID-19 pandemic, a smart city is expected to meet the accessible technology needs of all consumer groups allowing all to fully participate (Buhalis *et al.*, 2019; Zhang and Cole, 2016). However, there is little literature of the extent of accessibility, as a general concept and practice within a destination, coincides with digital accessibility. Thus, understanding how smart destinations integrate accessibility and rethink tourism strategies for the physical and digital dimensions is an emerging research issue and a matter of interest for destination development.

In response to this need for research, this study has as the main goal of delving into to what extent the cities recognized as European Capitals of Smart Tourism 2020, complied with the digital accessibility guidelines required by the International Consortium of the World Wide Web (W3C) (W3C, 2021a). This article is presented in five sections. The introduction is followed by definitions of accessibility, digital accessibility, inclusion, smart cities and the role of SDGs in a framework that proposes the research questions. Discussion of the methodology follows, including than assessment of the suitability of the Web Content Accessibility Guidelines (WCAG) to measure digital accessibility. The fourth section presents the results, with the fifth section presenting conclusions and discussion. Contributions to the literature are highlighted and practical implications and future research are explored.

## Theoretical background

### *Accessible tourism for inclusive tourism*

Darcy and Dickson (2009, p. 34) argue that “accessible tourism enables people with access requirements, including mobility, visual, hearing and cognitive dimensions of access, to function independently and with equity and dignity through the delivery of universally designed tourism products, services and environments.” There is extensive literature that explores the dimensions of accessibility (Buhalis *et al.*, 2019; Buhalis and Darcy, 2010; Buhalis and Michopoulou, 2011; Qiao *et al.*, 2022; Rucci *et al.*, 2021, 2022). While the literature continues to expand, the main dimensions for accessible tourism have been proposed (Buhalis *et al.*, 2005; Buhalis and Michopoulou, 2011). One dimension is physical accessibility referring to the environment, places, buildings, infrastructure, resources and the tourist information provided by destinations. The other dimension encompasses digital accessibility including websites, apps, social media and other platforms and documents using digital support. The relevance of digital accessibility has progressively been recognized in academic discussion and destination management. Several aspects of Web accessibility in the tourism sector have been developed, including the analysis of digital accessibility in official tourism offices (Casais and Castro, 2021; Domínguez Vila *et al.*, 2019; Lestari *et al.*, 2019; Shi, 2006; Singh *et al.*, 2021), of websites of travel agencies (Eusébio *et al.*, 2020; Silveiro *et al.*, 2019), its adoption by accommodation providers (Fontanet Nadal and Jaume Mayol, 2011; Teixeira *et al.*, 2021; Williams and Rattray, 2005), restaurants (Aizpurua *et al.*, 2015), museums (Poole, 2001) and mobile applications (Fernández-Díaz *et al.*, 2021; Lestari *et al.*, 2019; Madeira *et al.*, 2021;

Ribeiro *et al.*, 2018). However, there is little research that focuses on analyzing digital accessibility compliance associated with smart tourism destinations, and even less comparing the levels of accessibility in the physical and digital dimensions. Kulkarni (2019) suggested the biggest challenge facing digital accessibility is the technological capacity to adapt to the needs of different people, as technology continues to evolve very quickly. Nevertheless, considering the scope and strategic importance of the management of accessible, sustainable and inclusive destinations (Buhalis *et al.*, 2019; Darcy *et al.*, 2020; Rubio-Escuderos *et al.*, 2021) cannot be limited to the digital sphere, even more so with the potential by smart tourism destinations.

### ***The role of smart cities' Web accessibility in the development of smart and inclusive destinations***

A smart destination implies that citizens, visitors and businesses benefit from the delivery of more efficient traditional services and networks through digital solutions. These solutions offer greater interactivity and safety within public spaces (European Commission, 2021). Despite technology being central to this outcome, the broad scope of a smart city must encompass people and communities, information, infrastructure and social equity, in addition to technology (Albino *et al.*, 2015; Okafor *et al.*, 2022). These challenges are also faced by cities as tourism spaces (Ivars-Baidal *et al.*, 2021; Rucci *et al.*, 2021). Thus, a connection between physical, information technology, social and business infrastructure is required. However, addressing this challenge demands accessible technology, ensuring effective involvement and participation of the whole society (Buhalis *et al.*, 2019; Zhang and Cole, 2016). Moreover, it can enhance the development of cities (United Nations Conference on Trade and Development, 2020) and help to create inclusive smart tourism destinations (Buhalis and Darcy, 2010; Buhalis and Michopoulou, 2011; Rucci *et al.*, 2022). The United Nations Development Programme (2021) expressly advocates the development of inclusive cities that reduce inequality in vulnerable populations including the elderly and the disabled. European Accessibility Act (2019) states that information communication technology services (ICTs) and digital platforms make it possible to eliminate many of the obstacles still faced by persons with disabilities. In spite of this, inclusion should take into account the needs and differences within vulnerable social groups, including visual, hearing and intellectual vulnerabilities (Buhalis *et al.*, 2019; Lam *et al.*, 2020; Rubio-Escuderos *et al.*, 2021) and seniors or those with health issues. Each of these groups have differing needs which need adaptation. Standards for the recognition of accessible tourism destinations may be established by criteria that highlights levels of accessibility. However, there is a contrast between general agreement on the benefits of digitalization for accessible and inclusive tourism and the dark side of digitization within the literature (Turel *et al.*, 2019).

There is a broad consensus for the application of the WCAG developed by the W3C (W3C, 2021a) to assess digital accessibility. The guidelines aim to make all Web pages and Apps accessible, and these platforms should include accessibility-related information (United Nations Conference on Trade and Development, 2020). The W3C understands that Web accessibility is key for any organization seeking to create high-quality websites and tools. In addition, without excluding anyone from the use of its products and services (W3C, 2021b). These guidelines have been updated and evolved from WCAG 1.0 in 1999 to WCAG 2.1 in 2018. A draft recommendation of WCAG 2.2 was published in May 2021 (W3C, 2021a). The International Consortium has also determined control points to measure accessibility standards: perceivable, operable, understandable and robust (W3C, 2021a). Campoverde-Molina *et al.* (2020) insist that the accurate use of the international standard is needed to advance the field of digital accessibility. Additionally, international institutions have adopted WCAG 2.1 as the main guideline for websites and electronic documents according to the European Accessibility Act (2019).

Based on the theoretical framework, the following research questions were proposed:

- RQ1.* Are the cities recognized as European Capitals of Smart Tourism 2020 digitally accessible according to international standards?
- RQ2.* What are the main obstacles to achieving Web accessibility in the smart cities studied?
- RQ3.* Is there a relationship between the digital accessibility obtained after W3C standards evaluation with European recognition of smart cities with best practices in accessibility?

## Methodology

An exploratory analysis of the level of accessibility of 50 uniform resource locators (URLs) from the European Commission smart city awards shortlist was carried out ([Appendix 1](#)). The time period for analysis was from the months of September to December 2020.

At the Helsinki ceremony, two European cities received awards and four others were finalists. Gothenburg and Malaga were considered the “2020 European Capitals of Smart Tourism,” a recognition of the excellent performance in the field of smart tourism planning. In addition, four other cities were recognized for their achievements in four categories: Breda (The Netherlands) in Accessibility, Gothenburg (Sweden) in Sustainability, Ljubljana (Slovenia) in Digitalization and Karlsruhe (Germany) in Cultural Heritage and Creativity ([Appendix 2](#)). An independent panel of experts selected a shortlist of 10 cities from 35 applicants during a preselection phase in 2019.

This research applied the international standards as a methodological reference as the WCAG-EM is recommended by the European Union and the W3C is an evaluation tool for Web pages ([W3C, 2014](#)). This research analyzed compliance with WCAG 2.1, which included 13 guidelines and 78 conformance criteria. The WCAG 2.1 has 17 additional criterion than WCAG 2.0 ([Revilla Muñoz and Carreras Montoto, 2018](#)). The Wave tool, developed by Web Accessibility in Mind, [WebAIM \(2020\)](#), was used for the analysis, allowing the identification of the main errors, alerts and the structure of the elements in the page ([Figure 1](#)).

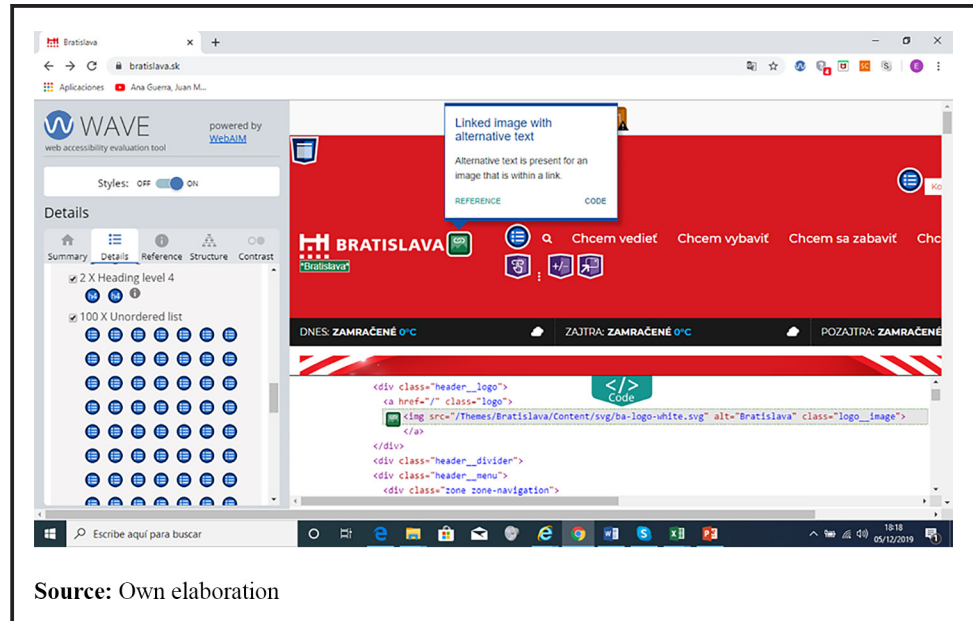
Manual analysis was then instigated using the following tools, allowing analysis of other complementary aspects:

- Google Chrome, Microsoft Internet Explorer, Mozilla Firefox on Android, Safari on iOS to identify zoom out (Control + +) ([W3C, 2021b](#)).
- Google Mobile Friendly to identify responsive design ([Search Console, 2021](#)).
- Accessibility insights for Color Contrast Analyzer ([Accessibility Insights, 2021](#)).
- CSS Tool which allows an evaluation of whether the content is clipped, overlapping or overflowing ([Carreras Montoto, 2021](#)).
- PEAT for Epilepsy detection, a success criterion: 2.3.1 with a “three flashes or below threshold” (A) ([Trace Research & Development Center, 2021](#)).
- W3C HTML Validator (X) for the validation of HTML code ([W3C, 2021c](#)).

## Case studies

Previous studies have tended to only use the home page within an accessibility evaluation, assuming that it is representative of the entire site, without evidence in the literature to support this. As the home page is not always the only page through which visitors enter and to obtain higher reliability of the analysis results, the following six URLs were assessed as being representative for the Web pages selected:

**Figure 1** Example of accessibility analysis using the Wave tool



Source: Own elaboration

1. Main page: the home page (Table 1).
2. A typical page: a second level page accepted to be representative of the Web structure and interiors.
3. A page containing contents arranged in tables.
4. A page including forms.
5. The search engine: to check the results offered by means of a keyword search for “web accessibility.”
6. One page including a video: to analyze compliance with the video guidelines.

Given the absence of some typology URLs pages in the websites analyzed, the analysis consisted of the following: four pages for Malaga, Breda and Bremerhaven; five pages for Gothenburg, Karlsruhe, Ljubljana and Nice, and six pages for Bratislava, Ravenna and Turin.

Using the Wave tool and manual checks for analysis, the total of pages analyzed (TP) was calculated, correct pages (TB) and incorrect pages (TM) were verified, and the percentage of

**Table 1** Sample

<i>Smart cities (city hall)</i>	<i>Main URL analyzed year 2020</i>
Gothenburg (Sweden)	<a href="https://goteborg.se/">https://goteborg.se/</a>
Malaga (Spain)	<a href="http://www.malaga.eu/">http://www.malaga.eu/</a>
Breda (The Netherlands)	<a href="https://www.breda.cat/">https://www.breda.cat/</a>
Karlsruhe (Germany)	<a href="https://www.karlsruhe.de/">https://www.karlsruhe.de/</a>
Ljubljana (Slovenia)	<a href="https://www.ljubljana.si/">https://www.ljubljana.si/</a>
Bratislava (Slovakia)	<a href="https://www.bratislava.sk/">https://www.bratislava.sk/</a>
Bremerhaven (Germany)	<a href="https://www.bremerhaven.de/">https://www.bremerhaven.de/</a>
Nice (France)	<a href="https://www.nice.fr/">https://www.nice.fr/</a>
Ravenna (Italy)	<a href="http://www.comune.ra.it/">http://www.comune.ra.it/</a>
Torino (Italy)	<a href="http://www.comune.torino.it/">http://www.comune.torino.it/</a>

the correct pages was obtained. The result of which is an average that represents the % compliance of Web accessibility for each page analyzed (%W) (Fernández-Díaz *et al.*, 2021).

The formula is as follows (%W) would be:  $(TB*100)/TP$ .

A total of 50 checkpoints with level A (minimum level of requirement) and double A (medium level of requirement) were analyzed, distributed in the four principles on which WCAG 2.1 is based (Tables 2 to 4).

## Results

After analyzing each variable of the WCAG 2.1, the results suggest that none of the official Web pages analyzed obtained 100% in the digital accessibility assessment (Figure 2).

**Table 2** WCAG 2.1 for the perceptible principle

<i>Principle</i>	<i>Guideline WCAG 2.1 (success criteria)</i>	<i>Checkpoints</i>	<i>Level</i>
1 – Perceivable	1.1: Text alternatives	1.1.1	A
		1.2.1	A
	1.2: Time-based media	1.2.2	A
		1.2.3	A
		1.2.4	AA
		1.2.5	AA
		1.3: Adaptable	1.3.1
		1.3.2	A
		1.3.3	A
		1.3.4	AA
		1.3.5	AA
	1.4: Distinguishable	1.4.1	A
		1.4.2	A
		1.4.3	AA
		1.4.4	AA
		1.4.5	AA
		1.4.10	AA
		1.4.11	AA
		1.4.12	AA
	1.4.13	AA	

Source: Own elaboration based on W3C (2021d)

**Table 3** WCAG for the operable principle

<i>Principle</i>	<i>Guideline WCAG 2.1 (success criteria)</i>	<i>Checkpoints</i>	<i>Level</i>
2 – Operable	2.1: Keyboard accessible	2.1.1	A
		2.1.2	A
		2.1.4	A
	2.2: Enough time	2.2.1	A
		2.2.2	A
	2.3: Seizures and physical reactions	2.3.1	A
	2.4: Navigable	2.4.1	A
		2.4.2	A
		2.4.3	A
		2.4.4	A
		2.4.5	AA
		2.4.6	AA
		2.4.7	AA
	2.5: Input modalities	2.5.1	A
		2.5.2	A
		2.5.3	A
		2.5.4	A

Source: Own elaboration based on W3C (2021d)

**Table 4** WCAG for the understandable and robust principles

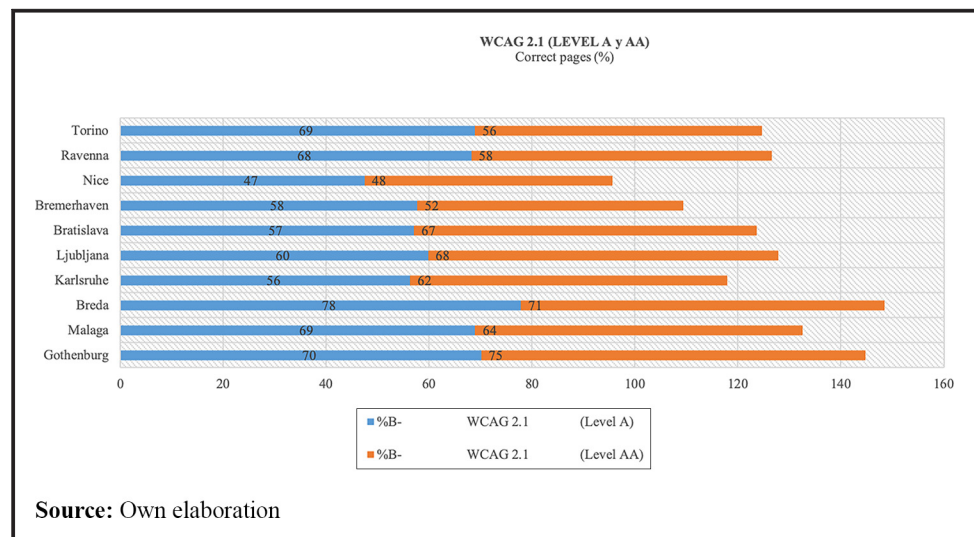
Principle	Guideline WCAG 2.1 (success criteria)	Checkpoints	Level
3 – Understandable	3.1: Readable	3.1.1	A
		3.1.2	AA
	3.2: Predictable	3.2.1	A
		3.2.2	A
		3.2.3	AA
		3.2.4	AA
	3.3: Input assistance	3.3.1	A
		3.3.2	A
		3.3.3	AA
		3.3.4	AA
4 – Robust	4.1: Compatible	4.1.1	A
		4.1.2	A
		4.1.3	AA

Source: Own elaboration based on [W3C \(2021d\)](#)

Based on the four principles that form the WCAG 2.1, it can be highlighted that all exceed 50% compliance, except for operable in the double A level, and robust at both levels (Table 5). Therefore, it can be determined that the pages analyzed were affected mainly in the operable area, referring to navigational elements that constitute the user interface and make interaction difficult. Similarly, the area of robustness affects the content being interpreted by user agents and other assistive technologies (W3C, 2021d) such as screen readers or bots.

The analysis of the results for each principle shows that Gothenburg and Breda had the best compliance data for the perceptible principle (Figure 3). Malaga, however, lagged behind Ravenna and Turin (Figure 3). In addition, Nice was most in need of improvement to allow users to use the presented information in all computation levels (W3C, 2021d).

For the operable principle, Ljubljana, Malaga and Ravenna were standouts in Figure 4 for total computation at both levels, with Breda relegated to fourth position. Nice was poorly positioned in relation to all others at both computation levels. Bratislava was lowest for Level A, however, and Bremerhaven and Nice required greater improvement at the double A level.

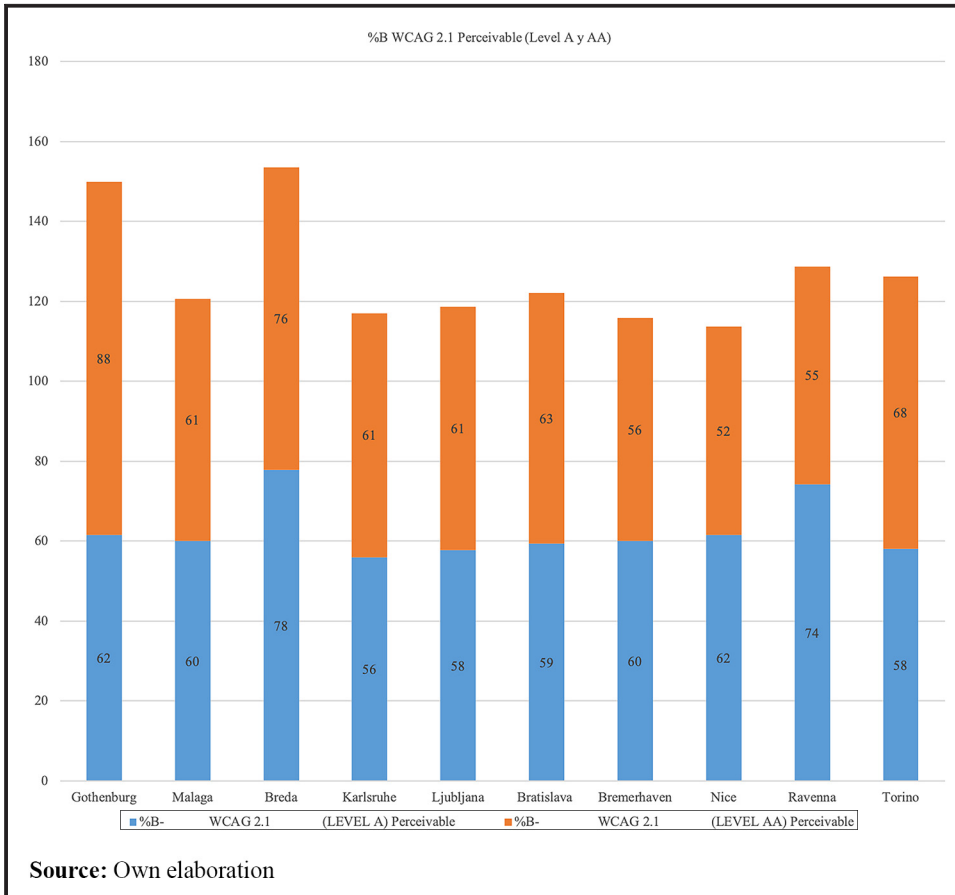
**Figure 2** Comparison of pages WCAG 2.1 Level A and AA of the websites of the smart city councils analyzed



**Table 5** Comparison of the % of correct pages based on the four WCAG 2.1 principles

	Principles	%B- WCAG 2.1 (Level A)	%B- WCAG 2.1 (Level AA)
1	Perceivable	62.6	64.0
2	Operable	61.6	49.8
3	Understandable	81.1	78.7
4	Robust	35.0	14.0
	Total (Average)	60.1	51.6

Source: Own elaboration

**Figure 3** Percentage of correct pages of WCAG 2.1 based on the perceivable principle

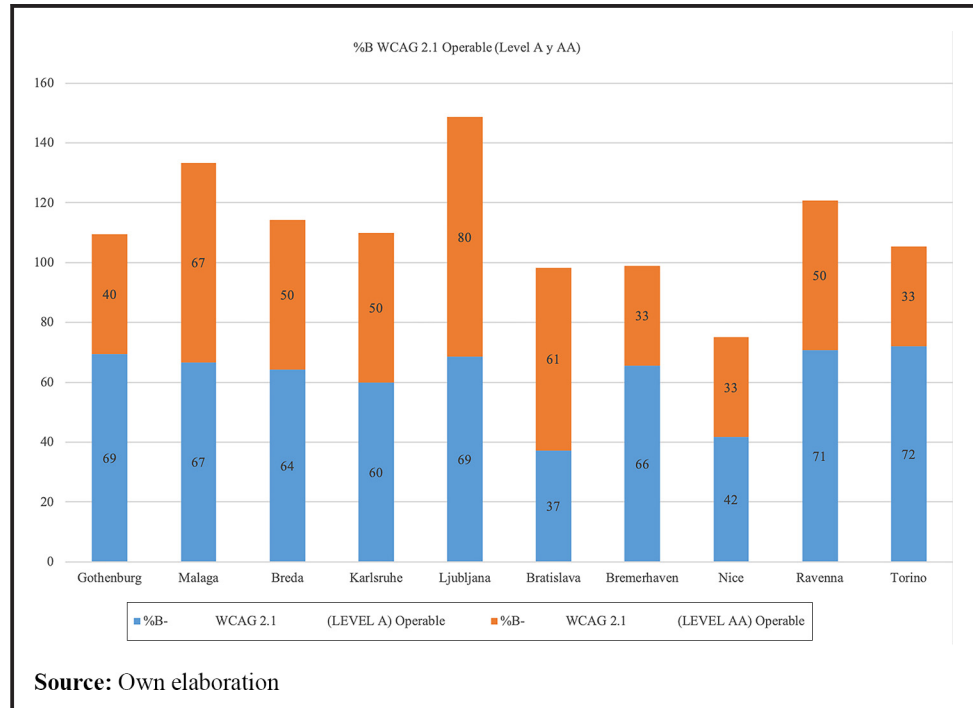
Source: Own elaboration

In [Figure 5](#), the understandable principle, which assesses if a person is able to understand the information and the functionality of the user interface, indicated that Bratislava achieved 100% with this principle at both levels, the best result in this area for both levels. Nice again demonstrated the lowest result.

[Figure 6](#) presents data corresponding to the robust principle. These figures were the worst in terms of percentage compliance. Only Breda demonstrated 100% compliance at both levels, and in double A, Malaga achieved 100% compliance. However, Bratislava and Turin achieved only 50% compliance. The remaining cities failed to comply with this principle in its entirety.

For the main success criteria with the highest percentage of noncompliance at levels A and double AA, as shown in [Figures 7](#) and [8](#), nine were demonstrated at both levels. In

**Figure 4** Percentage of correct pages of WCAG 2.1 based on the operable principle



**Figure 5** Percentage of correct pages in WCAG 2.1 based on the understandable principle

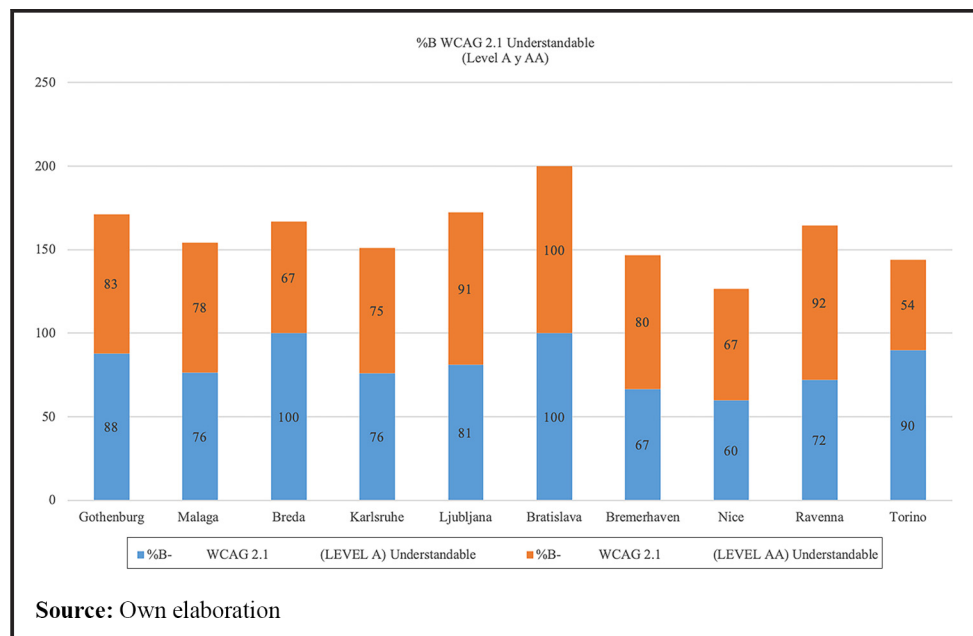
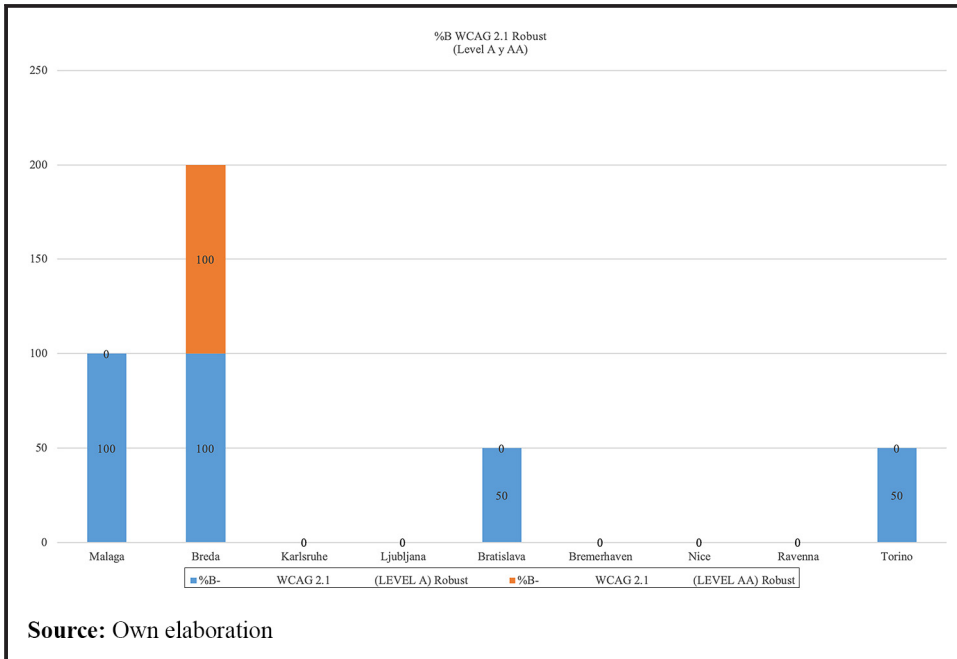
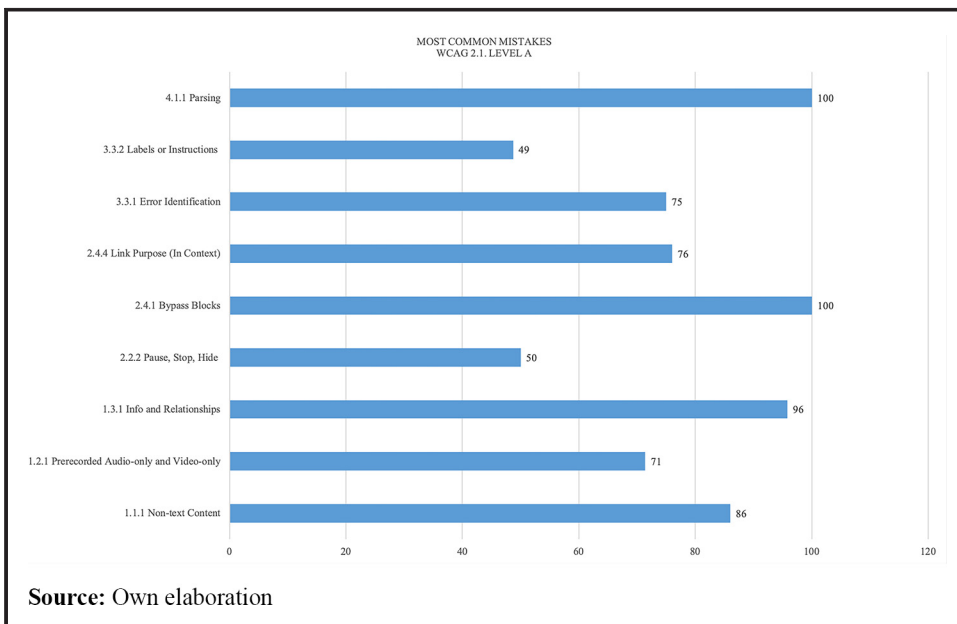


Figure 7, the success criteria with the least compliance for the total number of pages analyzed, and therefore, most of the smart cities did not comply with the criteria, were parsing when analyzing the URL and bypass blocks, followed by info and relationships, and nontext content.

**Figure 6** Percentage of correct pages of WCAG 2.1 based on the robust principle



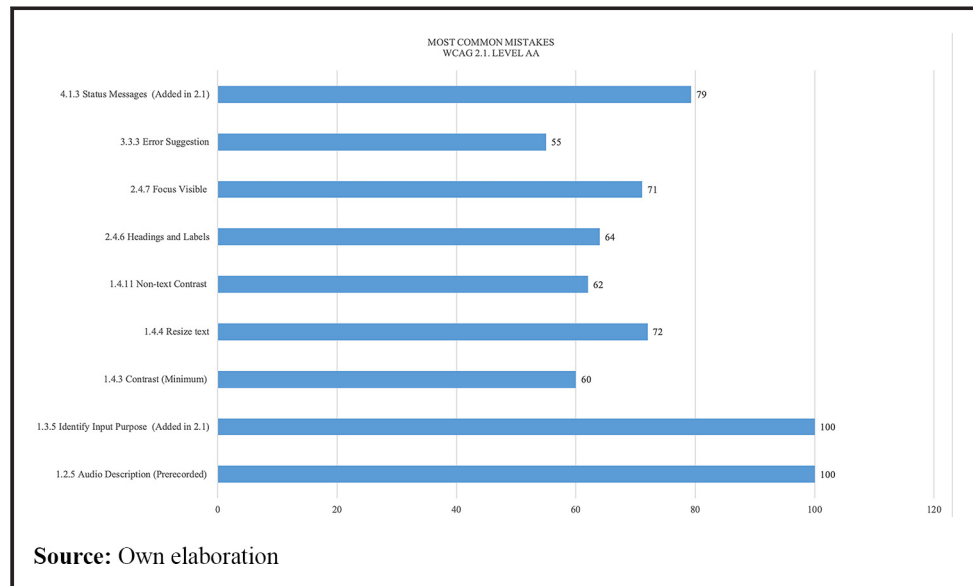
**Figure 7** Level A success criteria with the highest percentage of noncompliance of smart city websites



With respect to the success criteria at the double AA level with the highest percentage of noncompliance, two stand out, identify input purpose and audio description (prerecorded), with 100% noncompliance, as shown in [Figure 8](#).

Finally, the research analyzed the accessibility statement that each site claimed to have on the website ([Table 6](#)).

**Figure 8** Level AA success criteria with the highest percentage of noncompliance of smart city websites



**Table 6** Declaration of the web accessibility standards of each website

Main Web pages analyzed	WCAG 2.0 A	WCAG 2.0 double A	WCAG 2.0 triple A	Level accessibility WCAG 1.0 (Without specifying level)	WCAG 2.1 (Without specifying level)	Does not specify
<a href="https://goteborg.se/">https://goteborg.se/</a>					X	
<a href="http://www.malaga.eu/">www.malaga.eu/</a>		X				
<a href="https://www.breda.cat/">https://www.breda.cat/</a>						X
<a href="https://www.karlsruhe.de/">https://www.karlsruhe.de/</a>				X		
<a href="https://www.ljubljana.si/">https://www.ljubljana.si/</a>		X				
<a href="https://www.bratislava.sk/">https://www.bratislava.sk/</a>						X
<a href="https://www.bremerhaven.de/">https://www.bremerhaven.de/</a>						X
<a href="https://www.nice.fr/">https://www.nice.fr/</a>						X
<a href="http://www.comune.ra.it/">www.comune.ra.it/</a>						X
<a href="http://www.comune.torino.it/">www.comune.torino.it/</a>		X				

**Source:** Own elaboration

## Discussion and conclusion

The main findings of this research confirmed the existence of barriers to communication and interaction that impede the rights of those with disabilities to travel with independence, equity and dignity. These findings are consistent with Darcy and Dickson (2009), Nitti (2018) and Buhalis *et al.* (2019). Digital accessibility appears to present a challenge within smart cities based on an assessment of their website support. These findings coincide with other tourism studies (Aizpurua *et al.*, 2015; Eusébio *et al.*, 2020; García-Santiago and Olvera-Lobo, 2021; Michopoulou and Buhalis, 2013). Accessibility factors that demonstrated a lower percentage of compliance with international criteria within the literature included perceptible and robust (Eusébio *et al.*, 2020; Silveiro *et al.*, 2019; Teixeira *et al.*, 2021). These findings were consistent with our research for robust, although operable also achieved a lower percentage of compliance

in this study. When accessibility levels were taken into account, double A demonstrated the lowest percentage compliance, with an average of 50%, reflecting studies such as [García-Santiago and Olvera-Lobo \(2021\)](#) and [Domínguez Vila et al. \(2019\)](#). As with [Okafor's \(2022\)](#) findings, equal access to technology would be considered the only viable approach for the creation of an inclusive smart city.

In response to the first research question, the smart cities analyzed do not follow the accessibility criteria established by the W3C in its digital version. None of the smart city websites studied achieved full compliance with the WCAG 2.1 international framework. For the second research question, level A issues arose, including errors in the HTML code when analyzing the URL (from the robust principle) and the derivation blocks (from the operable principle). Both demonstrated 100% noncompliance and should be a starting point for improvement. At the double AA level, identify purpose input and audio description (prerecorded) presented with 100% noncompliance; both belong to the perceptible principle. In fact, these errors can limit access for all (disabled or elderly people). First, the information about the smart cities is not adequate for collectives with special needs and second, as the analyzed cities have a good level of physical accessibility, according to European Award criterias, and they are not communicating properly so as to have sufficient reach to connect with audiences.

For the third research question relating to the analysis of site declarations of digital accessibility linking with the recognition of the European Award as accessible smart cities, mainly focused on physical dimensions (transport, infrastructures, buildings, streets, etc.), it was concluded that there was apparently no relationship. Breda obtained the best percentage of compliance at both computation levels yet did not declare any digital accessibility standard on its website. Gothenburg claims to comply with WCAG 2.1 and obtained the second-best result for digital accessibility compliance. Malaga also claimed to comply with WCAG 2.0 and was the third best result. It was surprising that of the 10 cities analyzed, only five officially declared Web accessibility standard compliance. It can be concluded that cities which have been recognized as European Capitals of Smart Tourism in 2020 do not have similar levels of best accessibility practices. This represents a significant insight into this study's theoretical framework. It suggests that while Agenda 2030, SDG 11 and SDG 10 have generated hope for inclusion and sustainability within cities, there is still room for improvement in terms of digital accessibility. Similar reflections were found by [Rubio-Escuderos et al. \(2021\)](#), [Nitti \(2018\)](#), [Rucci et al. \(2022\)](#) and [Turel et al. \(2019\)](#). The results of the study cannot show what to extent smart accessible cities reached the SDGs, but the results allow the highlighting of the importance of convergence and working along these lines; as such, a study could provide some evidence through its practical implications for achieving them in the future.

This research contributes by identifying the factors that may result in digital exclusion given information access difficulties within tourism destination websites. To the best of our knowledge, previous literature on smart cities at an international level has not performed a detailed analysis of destination website compliance. This analysis was achieved using a combined methodology of manual review with complementary tools based on the WCAG 2.1. In line with [Casais and Castro \(2021\)](#), it is accepted that digital accessibility has much room for improvement. This issue remains a challenge for destination management, even for those perceived to be smart tourist destinations. This study contrasts with [Ivars-Baidal et al. \(2021\)](#), who demonstrate the high scores for smart cities for connectivity and issues linked with ICTs. However, the analysis within this current work highlights inconsistencies between destinations ranked by the European Union for best practices for accessible tourism and the application of WCAG accessibility standards.

The research provides a global vision of accessibility for smart tourism destinations by analyzing to what extent digital and physical accessibility converge. This introduces a new perspective to the literature and contributes by opening up the debate for a holistic view of tourism accessibility that is integrated within every dimension ([Buhalis et al., 2019](#); [Darcy et al., 2020](#)). Additionally, it reinforces the idea that the elimination of barriers supports

compliance with Web accessibility criteria. These findings may be helpful for the WCAG to promote advances in digital accessibility (Campoverde-Molina *et al.*, 2020)

The study also has practical implications for smart tourism destinations. Destination management organizations should recognize that facing the SDG challenges of equality and inclusion in both offline and online dimensions is an expectation of being a smart destination. Consequently, physical and digital accessibility should converge to achieve full involvement, adaptation and effective inclusion defined as tourism for all. The results identify key issues related to content and ways to introduce tourist information on the Web that is accessible to all.

A limitation of this research is that the sample represents award winning smart tourism destinations which is awarded to European cities. Despite the novelty of the study, digital and physical accessibility cannot be proved at the same level due to the former being analyzed with the fieldwork carried out, but the latter is the result of the European Awards with criteria established by a renowned international jury. Nevertheless, the main issue is the comparison between them both. Therefore, future research could explore these factors with an international comparison testing each kind of accessibility based on primary sources. The inclusion of a visitor's perspective might also be proposed to triangulate the results.

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**Table A1** Total 50 URLs analyzed smart cities award 2020

Smart cities	50 URLs analyzed year 2020
Malaga (Spain)	(H) <a href="http://www.malaga.eu/">www.malaga.eu/</a> (T) <a href="http://www.malaga.eu/el-ayuntamiento/bienvenida/">www.malaga.eu/el-ayuntamiento/bienvenida/</a> (TA) <a href="http://www.malaga.eu/la-ciudad/agenda/">www.malaga.eu/la-ciudad/agenda/</a> (S) <a href="http://saic.malaga.eu/portal/seccion_0006?idTramite=144">http://saic.malaga.eu/portal/seccion_0006?idTramite=144</a> (H) <a href="https://goteborg.se/">https://goteborg.se/</a> (T) <a href="https://goteborg.se/wps/portal/om-webbplatsen/e-tjanster-och-blanketter/om-ejanster/!ut/p/z1/04_Sj9CPyKssy0xPLMnMz0vMAfj08ziQw0NAI2cDB0N_H0NDQw8zUOdnA19z1NPM30wwkpiAJKG-AAjgb6BbmhigAccCx1/dz/d5/L2dBISEvZ0FBIS9nQSEh/">04_Sj9CPyKssy0xPLMnMz0vMAfj08ziQw0NAI2cDB0N_H0NDQw8zUOdnA19z1NPM30wwkpiAJKG-AAjgb6BbmhigAccCx1/dz/d5/L2dBISEvZ0FBIS9nQSEh/</a> (F) <a href="https://goteborg.se/wps/portal/kontakta-oss/felanmalan-gator-torg-och/!ut/p/z1/04_Sj9CPyKssy0xPLMnMz0vMAfj08ziQw0NAI2cDB0N3N2CTA08vzMAj2NLYwsjEz1wwkpiAJKG-AAjgb6BbmhigCjY3nF/dz/d5/L2dBISEvZ0FBIS9nQSEh/">https://goteborg.se/wps/portal/kontakta-oss/felanmalan-gator-torg-och/!ut/p/z1/04_Sj9CPyKssy0xPLMnMz0vMAfj08ziQw0NAI2cDB0N3N2CTA08vzMAj2NLYwsjEz1wwkpiAJKG-AAjgb6BbmhigCjY3nF/dz/d5/L2dBISEvZ0FBIS9nQSEh/</a> (S) <a href="https://goteborg.se/wps/portal/sokresultat/!ut/p/z1/04_Sj9CPyKssy0xPLMnMz0vMAfj08ziQw0NAI2cDB0N_P0DzAw8vQKMQv18HY0N3Y31w8EKDFCA04FTkJGTsYGBu7-RfhTp-pFNiK4_HgVR-IDvyA0NDXVUVAQAAtg0CIQI!dz/d5/L2dBISEvZ0FBIS9nQSEh/?q=web+accessibility">https://goteborg.se/wps/portal/sokresultat/!ut/p/z1/04_Sj9CPyKssy0xPLMnMz0vMAfj08ziQw0NAI2cDB0N_P0DzAw8vQKMQv18HY0N3Y31w8EKDFCA04FTkJGTsYGBu7-RfhTp-pFNiK4_HgVR-IDvyA0NDXVUVAQAAtg0CIQI!dz/d5/L2dBISEvZ0FBIS9nQSEh/?q=web+accessibility</a> (V) <a href="https://goteborg.se/wps/portal/press-och-media/!ut/p/z1/04_Sj9CPyKssy0xPLMnMz0vMAfj08ziQw0NAI2cDB0N_P0DzAw8vQKMQv18HY0N3Y31w8EKDFCA04FTkJGTsYGBu7-RfhTp-pFNiK4_HgVR-IDvyA0NDXVUVAQAAtg0CIQI!dz/d5/L2dBISEvZ0FBIS9nQSEh/?q=web+accessibility">https://goteborg.se/wps/portal/press-och-media/!ut/p/z1/04_Sj9CPyKssy0xPLMnMz0vMAfj08ziQw0NAI2cDB0N_P0DzAw8vQKMQv18HY0N3Y31w8EKDFCA04FTkJGTsYGBu7-RfhTp-pFNiK4_HgVR-IDvyA0NDXVUVAQAAtg0CIQI!dz/d5/L2dBISEvZ0FBIS9nQSEh/?q=web+accessibility</a> (H) <a href="https://www.breda.cat/">https://www.breda.cat/</a> (T) <a href="https://www.breda.nl/schuldhulpverlening/#r-page-title">https://www.breda.nl/schuldhulpverlening/#r-page-title</a> (F) <a href="https://www.breda.nl/contact-opnemen/formulier">https://www.breda.nl/contact-opnemen/formulier</a> (S) <a href="https://www.breda.nl/zoekresultaten?search=web+accessibility&amp;apply_filter=yes">https://www.breda.nl/zoekresultaten?search=web+accessibility&amp;apply_filter=yes</a> (H) <a href="https://www.karlsruhe.de/">https://www.karlsruhe.de/</a> (T) <a href="https://www.karlsruhe.de/b3/soziales/wohnungswesen.de">https://www.karlsruhe.de/b3/soziales/wohnungswesen.de</a> (TA) <a href="https://www.karlsruhe.de/b3/soziales/einrichtungen/abt-s/ausbildungfoerderung">https://www.karlsruhe.de/b3/soziales/einrichtungen/abt-s/ausbildungfoerderung</a> (F) <a href="https://www.karlsruhe.de/b2/bibliotheken/stadtbibliothek.de">https://www.karlsruhe.de/b2/bibliotheken/stadtbibliothek.de</a> (S) <a href="https://suche2.karlsruhe.de/browse?q=web+accessibility">https://suche2.karlsruhe.de/browse?q=web+accessibility</a> (H) <a href="https://www.jubiljana.si/">https://www.jubiljana.si/</a> (T) <a href="https://www.jubiljana.si/s/o-ijubljani/">https://www.jubiljana.si/s/o-ijubljani/</a> (F) <a href="https://www.jubiljana.si/s/o-nas/kontakt/">https://www.jubiljana.si/s/o-nas/kontakt/</a> (S) <a href="https://www.jubiljana.si/en/search/?q=web+accessibility">https://www.jubiljana.si/en/search/?q=web+accessibility</a> (V) <a href="https://www.jubiljana.si/s/mestni-svet/video-arhiv-sej-mestnega-sveta-mol-2018-2022/8-redna-in-3-izredna-seja-mestnega-sveta-mol-2/">https://www.jubiljana.si/s/mestni-svet/video-arhiv-sej-mestnega-sveta-mol-2018-2022/8-redna-in-3-izredna-seja-mestnega-sveta-mol-2/</a> (H) <a href="https://www.bratislava.sk/">https://www.bratislava.sk/</a> (T) <a href="https://www.bratislava.sk/sk/byvanie">https://www.bratislava.sk/sk/byvanie</a> (TA) <a href="https://www.bratislava.sk/sk/dane-a-poplatky">https://www.bratislava.sk/sk/dane-a-poplatky</a> (F) <a href="https://www.bratislava.sk/Users/Account/LogOn">https://www.bratislava.sk/Users/Account/LogOn</a> (S) <a href="https://www.bratislava.sk/Search?q=+pr%C3%ADstipnos%C5%A5&amp;culture=sk-SK">https://www.bratislava.sk/Search?q=+pr%C3%ADstipnos%C5%A5&amp;culture=sk-SK</a> (V) <a href="https://www.bratislava.sk/sk/modernizacia-dubravsko-karlovekej-elektrickovej-radialy">https://www.bratislava.sk/sk/modernizacia-dubravsko-karlovekej-elektrickovej-radialy</a> (H) <a href="https://www.bremerhaven.de/">https://www.bremerhaven.de/</a> (T) <a href="https://www.bremerhaven.de/de/verwaltung-politik/stadtverordnetenversammlung/15490.html">https://www.bremerhaven.de/de/verwaltung-politik/stadtverordnetenversammlung/15490.html</a> (F) <a href="https://www.bremerhaven.de/de/verwaltung-politik/buerger-service/formulare/elektronische-formulare-im-pdf-format.29971.html">https://www.bremerhaven.de/de/verwaltung-politik/buerger-service/formulare/elektronische-formulare-im-pdf-format.29971.html</a> (V) <a href="https://www.bremerhaven.de/de/suchergebnis.5565.html?search=web+accessibility">https://www.bremerhaven.de/de/suchergebnis.5565.html?search=web+accessibility</a>

(continued)

**Table A1**

Smart cities 50 URLs analyzed year 2020

Nice (France)	(H)	<a href="https://www.nice.fr/">https://www.nice.fr/</a>
	(T)	<a href="https://www.nice.fr/fr/particuliers">https://www.nice.fr/fr/particuliers</a>
	(F)	<a href="https://web.nice.fr/formulaires/objets-trouves/">https://web.nice.fr/formulaires/objets-trouves/</a>
	(S)	<a href="https://www.nice.fr/fr/recherche?term=web+accessibility">https://www.nice.fr/fr/recherche?term=web+accessibility</a>
	(V)	<a href="https://www.nice.fr/fr/videos/inauguration-des-nouveaux-locaux-de-l-epicerie-solidaire-a-la-croisee-des-besoins?type=videos">https://www.nice.fr/fr/videos/inauguration-des-nouveaux-locaux-de-l-epicerie-solidaire-a-la-croisee-des-besoins?type=videos</a>
Ravenna (Italy)	(H)	<a href="http://www.comune.ra.it/">www.comune.ra.it/</a>
	(TA)	<a href="http://www.comune.ra.it/La-Citta/Come-raggiungere-la-citta">www.comune.ra.it/La-Citta/Come-raggiungere-la-citta</a>
	(F)	<a href="http://www.comune.ra.it/Aree-Tematiche/Cultura-sport-e-tempo-libero/Biblioteca-e-centri-di-lettura">www.comune.ra.it/Aree-Tematiche/Cultura-sport-e-tempo-libero/Biblioteca-e-centri-di-lettura</a>
	(S)	<a href="http://www.comune.ra.it/content/search?SearchText=web+accessibility">www.comune.ra.it/content/search?SearchText=web+accessibility</a>
	(V)	<a href="http://www.comune.ra.it/Aree-Tematiche/Anagrafe-e-immigrazione/Cooperazione-internazionale-decentralata/Educazione-alla-pace/Ravenna-Saharawi-Andata-e-Ritorno-video">www.comune.ra.it/Aree-Tematiche/Anagrafe-e-immigrazione/Cooperazione-internazionale-decentralata/Educazione-alla-pace/Ravenna-Saharawi-Andata-e-Ritorno-video</a>
		<a href="http://www.comune.torino.it/">www.comune.torino.it/</a>
Torino (Italy)	(T)	<a href="http://www.comune.torino.it/gabinettodelsindaco/">www.comune.torino.it/gabinettodelsindaco/</a>
	(TA)	<a href="http://www.comune.torino.it/cosap/">www.comune.torino.it/cosap/</a>
	(F)	<a href="http://www.comune.torino.it/tonews/">www.comune.torino.it/tonews/</a>
	(S)	<a href="http://search.comune.torino.it/mrcell/searchpro?dd_adddb=ord_20 ban_20 fce_20&amp;xsl=light&amp;enc=utf-8&amp;bterm=10&amp;blevel=on&amp;expand=on&amp;end=10&amp;bmetakey=on&amp;type=search&amp;exclude=www.comune.torino.it/ucstampa/&amp;exclude=www.comune.torino.it/ordinanz/&amp;exclude=www.comune.torino.it/ro/&amp;exclude=www.comune.torino.it/torinoturistica/&amp;exclude=www.comune.torino.it/robots.txt&amp;exclude=www.comune.torino.it/torinoclick/rss/TorinoClickUltimi.xml&amp;exclude=www.comune.torino.it/torinoclick/newsletter.html&amp;exclude=www.comune.torino.it/torinoclick/cerca.shtml&amp;start=0&amp;term_query=web%20accessibility&amp;language=it&amp;gui_view_language=it&amp;gui_avanzata=0">http://search.comune.torino.it/mrcell/searchpro?dd_adddb=ord_20 ban_20 fce_20&amp;xsl=light&amp;enc=utf-8&amp;bterm=10&amp;blevel=on&amp;expand=on&amp;end=10&amp;bmetakey=on&amp;type=search&amp;exclude=www.comune.torino.it/ucstampa/&amp;exclude=www.comune.torino.it/ordinanz/&amp;exclude=www.comune.torino.it/ro/&amp;exclude=www.comune.torino.it/torinoturistica/&amp;exclude=www.comune.torino.it/robots.txt&amp;exclude=www.comune.torino.it/torinoclick/rss/TorinoClickUltimi.xml&amp;exclude=www.comune.torino.it/torinoclick/newsletter.html&amp;exclude=www.comune.torino.it/torinoclick/cerca.shtml&amp;start=0&amp;term_query=web%20accessibility&amp;language=it&amp;gui_view_language=it&amp;gui_avanzata=0</a>
		<a href="http://www.comune.torino.it/youtorino/">www.comune.torino.it/youtorino/</a>
	(V)	

Notes: (H): home page; (T): typical page; (TA): page with tables; (F): page with forms; (S): search engine page; (V): page containing video

## Appendix 2

**Table A2** Award categories from European capital smart of tourism

<i>European capital smart of tourism</i>	
<i>Accessibility</i>	Barrier-free destination, services digitally available to all travelers and visitors, regardless of physical disability, age or cultural background
<i>Sustainability</i>	Promote sustainability not only from the point of view of the administration and protection of natural resources as a city but also considering the local community
<i>Digitalization</i>	Use of digital technologies to improve the tourist experience by reinforcing the growth of local companies
<i>Cultural heritage</i>	Mainly based on the protection and capitalization of the local heritage, obtaining benefits in the destination, the industry and the tourists

Source: Own elaboration ([European Commission, 2021](#))

### About the authors

Elena Fernández-Díaz received a PhD in Advertising and Public Relations from the University of Malaga, Spain. Her main lines of research are digital accessibility, digital marketing, social networks and online reputation. From 2016 to 2018, she reconciled her professional career in an advertising agency as Account Director with her teaching in the Faculty of Tourism.

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