

Web accessibility of Bucharest sector websites

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ABSTRACT

Several European accessibility regulations that have been transposed into national regulations were issued in the last decade. It would have been expected that this would lead to a more accessible web. Unfortunately, in a few countries this is the case. This work reports on the accessibility evaluation of Bucharest sector websites carried out in a tool-based approach. Four accessibility checkers: Axe, AChecker, Total Validator, and Wave have been used. The results show large differences between the website sectors of Bucharest and a poor awareness of accessibility demands. Web accessibility is low, as all websites have errors. It seems that only transposing the regulations at the national level is not enough. More effort is needed from the local administration to improve quality assurance, set up clear responsibilities, and start periodic monitoring of web accessibility.

AUTHOR KEYWORDS

Web accessibility; accessibility score; municipal websites; sector websites; checking tools; and WCAG2.

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INTRODUCTION

Local government websites should ensure fair access to information and digital services to everyone, including people with visual impairment. As stated by the World Wide Web Consortium (W3C) in the Web Accessibility Initiative, "*web accessibility means that websites, tools, and technologies are designed and developed so that people with disabilities can use them*" [1].

Several European regulations to achieve web accessibility exist that concern web accessibility in the public sector. The Web Accessibility Directive of the European Parliament and Council, aiming to make the public web and mobile apps accessible, has been in force since December 2016 [2]. The directive has been transposed into the Romanian Government Emergency Ordinance no. 112/2018 [3].

Later on, the European Accessibility Act (EAA) was approved in 2019, which covers a wide range of services, from e-commerce and e-banking to ticketing [4]. Since the EAA is in force from June 2025, member states must transpose it into national regulation by June 28. In România, this has been done by Law 232/2022 [5]. Then, the Romanian Authority for Digitalization published a norm for monitoring accessibility in the public sector in 2022 [6].

In recent years, there have been relatively few accessibility studies targeting local government websites. There is only

one study dedicated to the accessibility of Romanian municipal websites in the last five years, which includes the homepage of the Bucharest municipality [7]. However, Bucharest is divided into six administrative sectors, each with the size of a large town, and most web services are available at the sector level.

This work aims to fill in this gap by evaluating the accessibility of sector websites. The evaluation was carried out using a tool-based approach against WCAG 2AA (Web Content Accessibility Guidelines), the conformance level required by European and national regulations [8]. Since there are many differences between the results provided by existing tools, it is recommended to avoid relying on one tool [9, 10]. To increase confidence in results, this research used four checking tools.

The next sections present some related work regarding the accessibility of public websites. Then the method and the evaluation results are presented and discussed. The paper ends with the conclusion and intention of future work.

RELATED WORK

Existing accessibility regulations that have been transposed at the national level state clear accessibility criteria. It would have been expected that this would lead to an accessible web. Unfortunately, this is rarely the case. Although several improvements have been reported in recent years, web accessibility is still low. Why this happens and which factors contribute to a more accessible web have been research questions for more than a decade.

Welleman et al. noticed that local administration is difficult to adapt to accessibility requirements for various reasons [11]. Their study identified five categories of factors that explain the adoption and implementation of accessibility regulation: adoption models, web design process, organizational structure, personal factors, and external influences. Among the factors with strong influence, they mentioned resources, quality assurance, budget and costs, responsibilities, quality of procurement, managerial decisions, laws, and regulations.

The study of Bai et al. [12] explored the relationship between accessibility and six factors that may influence it: agency resources, agency orientation, agency leadership, regional diffusion, population density, and website complexity. Based on a sample of 342 county government websites in the US, they found that the most important factors were the complexity of websites and the county population density.

Recently, Inal and Torkildsby [13] investigated the effect of new regulations by carrying out a longitudinal study over three years. All Norwegian municipalities were evaluated

using the Wave checking tool. The results highlighted continuous but insufficient improvements to achieve the required level of accessibility. The authors concluded that it is important to raise awareness and educate everyone who may contribute to a more inclusive digital society.

Another study questioning the effectiveness of regulations has been done in Finland by Laamanen et al. [14]. They analyzed the accessibility of 38 higher education institutions using two checking tools: Siteimprove and Wave. They found very large differences between homepages, with an average of 87 (Siteimprove) and 65 (Wave) errors per page. Their results also showed significant differences between tools. The most frequent accessibility issues were a lack of link purpose, a lack of text alternatives, and low contrast.

The study of Valtolina and Fratus analyzed the accessibility of Italian municipalities' websites using the AChecker and VaMola. They found that web accessibility is low, although many errors could be easily fixed [15]. The accessibility of Irish local government websites has been evaluated by Lynn et al. [16]. They used PowerMapper's OnDemand Suite and found that many websites were below PowerMapper's benchmark.

A recent accessibility evaluation of municipal websites in Romania analyzed the homepages of the first hundred towns (ranked on population) using three checking tools: Total Validator, AChecker, and Wave [7]. The results show poor web accessibility, with an average of 64.57 errors per webpage (Total Validator), 69.29 (Wave), and 55.72 (AChecker). The most frequent accessibility errors were the lack of link purpose description, the lack of text alternatives, the lack of labels for controls, and insufficient contrast.

EVALUATION RESULTS

Method and tool

WCAG2 defines three levels of accessibility conformance (A - lowest, AA, and AAA - highest) [8]. According to the Web Accessibility Directive, the AA conformance level is required in Europe [2]. The accessibility model defines four principles: perceivable, operable, understandable, and robust. Principles are implemented through accessibility guidelines, and for each guideline, several success criteria have been defined that, in turn, are tested by using various techniques.

The evaluation was carried out in March-April 2026. Table 1 presents the population by thousand inhabitants (in 2021) and the website address. The total population of Bucharest is 1716.9 thousand inhabitants, representing around 17% of the total urban population.

For each website, only the home page was checked, for several reasons. Using more than one page may conflate the number of errors, since many of these are located in the header and menus. Also, accessibility issues on the home page may likely be found on other webpages [17]. Also, homepages have different information architecture, thus making it difficult, if not impossible, to select a similar second page.

The accessibility evaluation was conducted using four

accessibility-checking tools: Axe [18], AChecker [19], Total Validator [20], and Wave [21]. Since the differences between tools are large, as shown in previous studies [9, 10], an accessibility score was proposed that is computed by averaging the number of errors provided by each tool

The accessibility errors have been analyzed and discussed by conformance level and guideline.

Table 1. Municipal Sectors' websites of Bucharest

Sector	Population	Density	Website
S1	217.4	3.11	primariasector1.ro
S2	291.5	9.17	www.ps2.ro
S3	374.7	10.99	www.primarie3.ro
S4	268.0	8.10	ps4.ro
S5	240.3	8.34	sector5.ro
S6	325.0	7.89	www.primarie6.ro

Parsing errors, HTML errors, link numbers, and broken links were also reported. For each website, the existence of an accessibility statement and accessibility facilities was checked.

Summary of results

First, the accessibility declaration has been searched. Only for two sectors, namely sectors 2 and 4, an accessibility declaration has been found. All websites implemented accessibility features that enable adaptation of content (text size, contrast, etc.).

Use of headings and landmarks was analyzed with Google Chrome extensions. The sector 3 website has only one level of headings. The rest of the websites defined several levels, but with ordering problems. Overall, the headings are made for style, not for structuring the content. As regards the landmarks, the websites of sectors 4, 5, and 6 have three landmarks (navigation, banner, and content info). The website of sector 1 also has a search banner, the website of sector 2 has only two (banner and content info), and the website of sector 3 has only one (navigation).

The number of parsing errors and HTML errors was checked with Total Validator. The number of links and broken links was checked with the Dofollo.ai tool (available at <https://dofollo.ai/tools/link-counter/>). The results are presented in Table 2.

Table 2. HTML, parsing, and link errors

Sector	HTML	Parsing	Links	Broken
S1	21		186	1
S2	79	1	173	
S3	31	9	150	1
S4	79		138	
S5	53		120	12
S6	63	1	158	1

The number of HTML errors varies from 21 to 79. The total number of links varies from 120 to 186. There are a few parsing errors and a few broken links.

Accessibility errors detected by each tool

A summary of WCAG 2A errors detected by each tool is presented in Table 3, varying from 1 to 59.

All sector homepages have level A errors, which shows low accessibility, since level A is the lowest compliance level. A comparison between sectors shows that the homepages of sectors 1 and 6 have a small number of errors. The largest number of level A errors was detected on the sector 2 website.

There are differences in the number of errors detected by each tool, related to the number of errors related to the use of headings, the different techniques used by each tool to check the success criteria, and the way of reporting errors and warnings.

Table 3. Sectors by number of WCAG 2A errors

Sector	AC	Axe	TV	Wave	Mean	SD
S1	59	17	56	36	42.00	19.54
S2	55	41	59	59	53.50	8.54
S3	18	3	13	1	8.75	8.10
S4	53	28	36	40	39.25	10.44
S5	45	44	51	35	43.75	6.60
S6	10	9	10	12	10.25	1.26
Total	240	142	225	183	197.50	44.17

The accessibility score of sectors varies from 8.75 (SD=8.10) to 53.50 (SD=8.54).

A summary of WCAG 2AA errors detected by each tool is presented in Table 4. The number of errors varies from 1 to 236, with an accessibility score per website varying from 6.75 to 90.50 (M=179.25, SD=171.84). The comparison between sectors shows a similar situation: sectors 3 and 6 have the best accessibility score, and sector 2 has the worst.

Table 4. Sectors by number of WCAG 2AA errors

Sector	AC	Axe	TV	Wave	Mean	SD
S1	9	13	12	51	21.25	19.91
S2	77	46	3	236	90.50	101.63
S3	27	2	5	1	8.75	12.28
S4	6	26	10	63	26.25	25.98
S5	35	8	2	58	25.75	25.85
S6	7	2	2	16	6.75	6.60
Total	161	97	34	425	179.25	171.84

The differences between websites are larger than in the case of level A errors. Summing up the accessibility scores for all websites yields 197.50 level A errors (M=32.92, SD=18.77), and 179.25 (M=32.04, SD=34.94) level AA errors. The average accessibility score for both error types is 62.79 (SD=46.47).

No significant correlation (Spearman rho) has been found between the number of errors and the website complexity or sector population.

A comparison with the average accessibility score of the first hundred municipal websites in 2025 (63.19) shows a similar low WCAG 2AA compliance, which is somewhat surprising, given the resources and budget available at the Bucharest sector level.

Most violated accessibility guidelines

Table 5 presents the mean number of errors (accessibility score) for each website per accessibility guideline.

Lack of link description was the most frequently violated guideline. Lack of text alternative for non-text content and lack of labels for controls are also frequent WCAG 2A errors.

Table 5. Errors by the accessibility guideline and the sector

Guideline	S1	S2	S3	S4	S5	S6
alt text	6.00	11.50	1.75	12.75	4.75	5.00
labels	14.50	2.50	1.25	3.00	3.00	2.00
headings	6.75	0.75	0.25	1.00	0.75	1.50
link description	12.75	30.75	3.25	17.75	31.25	1.25
duplicate IDs	0.75	1.25	0.75	0.25	0.00	0.00
Other A errors	1.25	6.75	1.50	4.50	4.00	0.50
Total A	42.00	53.50	8.75	39.25	43.75	10.25
contrast	15.75	85.00	1.25	22.75	17.25	5.00
format	0.25	5.50	6.25	3.00	7.50	1.00
headings	5.25	0.00	1.25	0.50	1.00	0.75
Total AA	21.25	90.50	8.75	26.25	25.75	6.75
TOTAL	63.25	144.00	17.50	65.50	69.50	17.00

Overall, for all six websites, lack of link descriptions accounts for 49.11%, lack of text alternatives for 21.14%, and lack of labels for controls for 13.29% from the total level A errors. Most level AA errors are related to contrast issues.

Discussion

The results of this study show that the accessibility of sector websites is low. The most frequent accessibility errors are the lack of link descriptions, the lack of text alternatives for non-text content, and the lack of labels for controls. These three violations of WCAG 2A account for more than 80% from the total.

Why is it so difficult to insert text? The main reasons are the bad habit of ignoring the needs of visually impaired users and the low awareness of WCAG 2.0 guidelines, which are now mandatory requirements. Needless to say, text descriptions for links and non-text content are usability features from which all users benefit, helping navigation and understanding the content.

Low accessibility of local government websites is due to many factors, among which the most important are the poor awareness of accessibility importance, ineffectiveness of accessibility regulations, lack of monitoring, and poor quality management at the local level. Similar factors leading to poor accessibility were reported by many authors [7, 13, 14, 22].

The results of the evaluation have several implications for evaluators, developers, and the local administrations.

For evaluators, using at least two checking tools and computing an accessibility score (average of errors detected by each tool) increases confidence in results and enables comparison over time.

For developers, a clear accessibility declaration should be easily found on the homepage. The declaration should apply to all webpages of the website, not only to the homepage. The quality management of the website should impose accessibility testing before publishing and after any content modification is made.

For the local public administration, periodic monitoring is required that includes accessibility testing of the website using at least two checking tools. Clear accessibility requirements must be specified when contracting web services.

This study has several limitations. First is the inherent limitation of the automated evaluation [23]. Second, a sample of only six websites is small. Future work should include sector websites in larger samples of municipality websites.

CONCLUSION

The accessibility of sector websites is low. Just transposing European regulations at the national level is not enough. National-level regulations should be enforced with clearer accessibility requirements. Without a clear accessibility policy for monitoring at the national and local levels, the situation will not change, making it impossible to meet the demands of the European Accessibility Act.

This study highlighted several aspects that should be considered in future accessibility evaluations. Most importantly, it is recommended to use several accessibility checkers and compute an accessibility score that enables both analysis of accessibility over time and comparison between websites.

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