Large-scale accessibility evaluation of Romanian municipal websites

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Abstract. The Digital Agenda for Europe has clear objectives as regards the enhancement of digital literacy, skills, and inclusion. Poor web accessibility has a negative impact on the inclusion of citizens and customers in the provision of online services. In this respect, web accessibility is a critical precondition for a barrier-free Europe. Recently, a new European directive has been issued that requires the web accessibility of public sector bodies by September 2020, the latest. This paper reports on a large-scale evaluation of the accessibility of municipal websites in Romania. The evaluation has been carried on in June-July 2019 and targeted 186 websites. The sample includes all towns having a population of over 10,000 inhabitants. Overall, these towns account for 92% of the total urban population. The results show that web accessibility is low, only one website passing the requirements of WCAG 2.0. The comparison with previous evaluation results shows little progress and could be explained by low accessibility awareness, weak accessibility policy at country and local level, and bad practices in web development.

Keywords: web accessibility, municipal websites, local e-government, WCAG 2.0

1. Introduction

Equal access to digital services for all citizens means accessible digital services. In turn, this requires the identification and removal of barriers affecting their use by people with disabilities. According to the European Disability Strategy (EU, 2010a), one in six people in the European Union (EU) has mild to severe disability. Since the population is aging, the number of people that are restricted to fully benefit from digital services is likely to increase in the future.

The commitment to promoting web accessibility in Europe started a long time ago with the Riga Ministerial Declaration (2006) focusing on the ICT for an inclusive society. Several initiatives at European level exist that are aiming to establish a barrier-free Europe: the European Disability Strategy 2010-2020 (EU, 2010a), the Digital Agenda for Europe (EU, 2010b), and the

new Action Plan for eGovernment 2016-2020 (EU, 2016a) to mention just a few. An underlying principle of the new Action Plan for eGovernment is inclusiveness and accessibility of digital public services. The basis of web accessibility requirements is the Web Content Accessibility Guidelines (WCAG2, 2008) document that was issued in 2008 by the W3C (World Wide Web Consortium). WCAG2 specifies three levels of conformance (A - lowest, AA, and AAA - highest). For EU public websites the AA level of conformance is required.

Recently, a Directive of the European Parliament and of the Council (EU, 2016b) on the accessibility of the websites and mobile applications of public sector bodies has been issued that will come into force starting with September 2019 for new websites and from September 2020 for all websites. Public sector bodies include state, regional, and public authorities. Given the current situation of the web accessibility in Europe, the fulfillment of these requirements seems to be problematic.

This paper reports on the accessibility of municipal websites in Romania for visually impaired people. This work extends a recent conference paper by enlarging the sample (Pribeanu, 2019). The evaluation has been carried on in June-August 2019 and targeted 186 municipal websites. The sample includes all towns having a population of over 10,000 inhabitants.

In the next section, we present the main concerns and initiatives at international and European level as well as some recent results regarding the accessibility of Romanian public websites. Then the methodology and the evaluation results are presented and discussed. The paper ends with the conclusion and intention of future work.

2. Web accessibility

2.1 Basic web accessibility requirements

Long-time ago, the World Wide Web Consortium (W3C) launched the Web Accessibility Initiative (WAI, 1997) with the purpose to make the web accessible to all people, including people with disabilities. An important step of this initiative was to develop a set of guidelines for web content developers and evaluators. The first version of the web content accessibility guidelines, WCAG 1.0 (WCAG1, 1999) has been published two decades ago, in 1999.

The second version WCAG 2.0 (WCAG2, 2008) has been published in

2008 and it is now the underlying reference of the accessibility policies in Europe. The WCAG 2.0 specification, WCAG2 for short, defines three levels of conformance with the accessibility guidelines: A - lowest, AA (required for European public websites), and AAA - highest.

WCAG2 is based on four accessibility principles: perceivable, operable, understandable and robust. In this respect, web accessibility means that people with disabilities are able to perceive, understand, navigate, and interact with the web. For each principle, several accessibility guidelines exist. Compliance with accessibility guidelines is checked against several testable success criteria. For each success criterion (SC), several techniques exist that could be used to test the conformity.

Apart from the compliance to WCAG, an accessible web also requires a valid HTML code. If the code does not respect the HTML specification, assistive technologies might fail when trying to handle the web content. Last but not least, it is important to check the code for broken links.

2.2 Accessibility of the municipal web

Existing situation and accessibility concerns in Europe

According to the second MEAC report (2011), the level of e-accessibility in Europe was low. The study analyzed the status of e-accessibility policy and implementation, at global and domain level, in 12 member states. The report advocated for a more coherent and effective approach aiming to strengthen the policies, regulations, and monitoring actions. In this respect, regulations at the national level, as well as the commitment of decision factors, play an important role.

More recently, the European Commission asked for a study on the existing national initiatives as regards the monitoring methodologies for web accessibility (Funka, 2016). The landscape of monitoring concerns is varying from no initiative found in almost half of the member states to five and more in three countries. Assessing the current level of the European municipal web is difficult since there are relatively few accessibility studies in the last decade and very few of them are targeting the accessibility of local e-government websites.

Factors related to the accessibility of the municipal web

Abdelgawad et al (2009) took a qualitative approach to analyze the main

factors that may contribute to the accessibility of Norwegian municipalities. They found that most important would be the budget for the workforce, the workforce selection process, a reasonable balance between the desired development rate and the available capacity, training the workforce in HTML and WCAG, and updating the technology.

Ruano (2014) studied the local e-Government strategies in Spain and found a relationship between the population size and e-government capacity to deliver digital services. As regards web accessibility, this relationship is reflected in higher compliance with accessibility guidelines for the websites of bigger municipalities. For example, only half of the small towns with a population of 500-1000 inhabitants respect the accessibility requirements according to the law.

Welleman et al. (2017) analyzed the main factors influencing the adoption and implementation of web accessibility standards in municipalities. They found that assigning responsibilities, management decisions, perceived benefit, and legislation are important for the adoption process. They also suggested that different strategies might be needed in small and large municipalities.

The study of Inal & Ismailova (2019) analyzed the relationship between the human development level of the country (HDI – Human Development Index) and accessibility. The sample included the websites of the capital cities from 146 countries. Accessibility has been assessed against WCAG2 using AChecker tool. They found that in countries with a higher HDI the number of accessibility errors is smaller. The most violated accessibility guideline is the first one, related to providing a text alternative for non-text content.

Related work in accessibility evaluation

Paris (2006) analyzed the accessibility of 26 homepages of the local council websites in Northern Ireland against WCAG1 and found that most of these (85%) failed to pass the lowest level of conformance. She explained this situation by the low accessibility awareness, the lack of mechanisms to ensure compliance and lack of political will to prioritize the web accessibility issue.

Kuzma (2010) evaluated 130 websites of the UK members of the Parliament in a tool-based approach. Websites have been tested against WCAG1 and WCAG2. Overall, she found that only 30 websites (23%) met WCAG1 requirements and only 7 websites (5%) met WCAG2 requirements. Her study also reported that 82 out of 130 websites (63%) had an alt tag

missing, 54 websites (42%) had clickable images without alternative text, and 23 websites (18%) had frames with no titles.

The study of Kopackova et al. (2010) investigated the accessibility of 39 homepages of municipal websites in the Czech Republic during two periods of time, in 2006 and 2008. They tested the accessibility against WCAG1 with the Cynthia Says tool and found that that results in 2008 are worse than the results in 2006. The discussion with municipality representatives suggested that the only explanation is the focus on design rather than on accessibility issues.

Gambino et al. (2016) checked the web accessibility of major Italian chief towns in 2012. They used W3C validator, CSS validator, and AChecker. The evaluation has been done on a sample of 976 webpages (for most websites they analyzed two webpages) and the results showed that the websites were not accessible. Overall, they found over 18300 HTML errors, over 1500 CSS errors, and over 9300 accessibility errors. On average, this means about 10 accessibility errors per webpage.

Akgul (2015) analyzed the accessibility of Turkish municipal websites in 2014-2015. The sample consisted of 30 homepages of the first 30 towns ranked upon the population. The evaluation has been done against WCAG2 level A, by using the TAW tool. He found over 3400 accessibility errors (on average, over 100 errors), out of which 52% were related to the first accessibility principle (perceivable). None of the webpages was fully accessible.

Angelico et al. (2017) analyzed the web accessibility and transparency for accountability of 86 Portuguese municipal websites in 2016. For each website, the homepage has been evaluated by using the AChecker Tool. The results showed that 76% of the websites didn't pass the lowest level of conformance to WCAG2. The most violated accessibility principle was perceivability. MTI (Municipality Transparency Index) is an index used to assess the transparency of municipalities in Portugal. The results showed a low association between MTI and accessibility. The authors concluded that MTI should be revised to include accessibility indicators.

The study of Sanchez-Labella et al. (2017) analyzed the accessibility of Spanish city councils' websites in 2016, based on a set of 16 accessibility indicators. The sample included 62 websites of towns having more than 100,000 inhabitants. The results showed that none is fully accessible and the most affected by the accessibility issues are people with visual disabilities.

However, a comparison with the results of previous studies showed that there are several websites that improved accessibility.

Recently, a large-scale study of the Italian municipal websites has been published by Barrriceli et al. (2018). They analyzed the accessibility of 8057 websites using AChecker tool and found that only 98 of these are fully accessible. Most frequent accessibility issues were: lack of alternative text for images (19.23%), scripts lacking a no script section (27.65%), onclick event handler without on keypress event handler (27.65%).

2.3 Web accessibility in Romania

Statistical data provided by the National Authority for Disabled People (ANPD, 2019), for March 2019 is mentioning 826197 people with various disabilities, out of which 95014 have visual disabilities. Most of them have severe (51091, i.e. 53.77%) or marked visual disability (36028, i.e. 37.91%).

In 2015 a national strategy has been launched that aims at removing the barriers for people with disabilities. The strategy has been approved by the Government Decision 655/2016 and includes an action plan. Then a monitoring instrument targeting the implementation of the strategy has been approved by the Order 1254/2018 of the Minister of Labor and Social Justice. The latter includes accessibility objectives and measures as well as the requirement to revise the existing regulations. These documents show that some concern for web accessibility exists. However, there are no precise deadlines (the objectives refer to a period, for example, 2016-2020 and not to a strict deadline, for example, September 2019). Up to now, the legislation didn't change yet and there are no specific regulations to integrate the requirements of the strategy.

The study of Lujan-Mora (2013) on the European government and parliament websites reveals a low accessibility score for Romania which has been ranked the 24th out of 27 countries.

Few studies are available that assess the conformance with WCAG2 of Romanian public websites. Two previous studies checked the conformance with WCAG2 on a sample of 60 municipal websites in 2014 (Pribeanu et al., 2015; Pribeanu, 2019). The comparison of evaluation results showed that accessibility is not preserved in time.

3. Method and sample

The evaluation was carried on in June-July 2019. The sample (N=186) includes the municipal websites of all Romanian towns having over 10,000 inhabitants, according to the 2011 census. The total population of these towns is 9,986.5 thousand inhabitants which represent 91.97% of the total urban population of Romania.

For each web site, only the home page was validated for several reasons. Almost all pages have a similar layout that is featuring a header, a horizontal menu and one or two vertical menus. Validating two pages may conflate the number of errors since many errors are in the header and menus. Second, municipal websites have different information architectures which make it difficult to select a second web page having similar content. In turn, this may bias the comparison of results. Third, the larger the sample, the more effort is needed.

The conformance with WCAG2 (level AA) has been assessed in a tool-based approach by using Total Validator v12.0.0, which is an accessibility checking tool for HTML code, broken links, WCAG1, and WCAG2 (any level). The number of links, number of the headings (if any), and number of landmarks (if any) have been collected by using other available tools.

Total Validator evaluation tool has been selected for several reasons. First, in previous studies targeting the accessibility of municipal websites Total Validator has been used. Using the same tool, it is possible to make relevant comparisons between results. Second, a recent study comparing five free accessibility evaluation tools showed that Total Validator is suitable for this kind of studies (Padure & Pribeanu, 2019).

For each webpage, the following measures have been collected: number of success criteria (SC) failures, number of occurrences (accessibility errors), number of parsing errors, number of HTML errors, number of broken links, number of links, headings, and landmarks. The accessibility errors have been then analyzed and discussed by the level of compliance, accessibility principle and guideline.

The methodology is similar with the one used in previous studies, except for the number of failures of SC which has been added in order to enable a more detailed analysis, a better classification of accessibility errors, and to facilitate the comparison with the results obtained with other evaluation tools. Although a comparison with the evaluation results of previous studies is not possible, this could be done in the future accessibility evaluations.

4. Evaluation results

4.1 Summary of results

In Table 1, a summary of results is presented that includes the number of errors, number of websites with errors (N), minimum, maximum and mean (M) number of errors, and standard deviation (SD).

Table 1. Summary of results

Categories	Errors	N	Min	Max	M	SD
Failures of SC	1286	185	0	15	6.91	2.96
WCAG2 total	11873	185	0	960	63.83	98.36
WCAG2 A	10129	185	0	568	54.46	72.99
WCAG2 AA	1744	89	0	392	9.38	35.78
HTML	19010	178	0	1180	106.80	165.31
Parsing	1680	108	0	238	15.56	33.70
Broken links	12255	156	0	920	78.56	138.98

The total number of failures of SC is 1286, with a mean of 6.91 (SD=2.96). Only one homepage had no SC failure. 61 homepages had between one and five SC failures, 101 had between six and ten SC failures and 23 had over 10 SC failures.

A total number of 11873 WCAG2 errors were detected, out of which 10129 are level A errors and 1744 level AA errors. The average number of errors per web page is 63.83 (SD=98.36) with a maximum of 960 errors. Only one homepage had no errors. A grouping of homepages according to the total number of WCAG2 errors is presented in Table 2. The last group of 29 homepages (15.59%) having over 100 errors account for 6639 errors which mean 55.91% from the total number of errors.

Table 2. Websites on the total number of WCAG2 errors

Accessibility errors	Number	Percent
1-10 errors	24	12.90
11-20 errors	39	20.97
21-50 errors	53	28.49
51-100 errors	41	22.04
Over 100 errors	29	15.59
Total	186	100.00

A total of 178 homepages have HTML errors. The mean number of errors is 106.8 (SD=165.31). There are 108 homepages with parsing errors (M=15.56, SD=33.7) and 156 with broken links (M=78.56, SD=138.98).

Other accessibility issues are related to a large number of links and the lack of structuring by using landmarks and headings. The number of links is varying from 6 to 1098 with a mean value of 200.59 (SD=170.03). Only 50 homepages have up to 100 links. A number of 66 homepages have between 100 and 200 links, 44 between 200 and 300 links, and 26 more than 300 links per page, which makes the navigation difficult for people using a screen reader.

There are only 76 websites having the homepage structured on 3 levels of heading or more. 39 homepages have no heading at all and the rest have one or two levels of heading, in many cases with very few headings. Only 100 homepages have landmarks and only 37 have more than 5 landmarks on the webpage.

4.2 Most frequent error types

Most of the WCAG2 errors are related to the first principle (perceivable) accounting for 85.63% (10167) of the total number of errors. The rest of WCAG2 errors are related to the other three principles: operable (6.84%), understandable (0.69%), and robust (6.84%). The main types of WCAG2 errors are presented in Table 3.

Table 3. Main types of WCAG2 errors

Principle / Guideline	Errors	%	N
1. Perceivable	**10167**	**85.63%**	**184**
Alternative text	2505	21.10%	137
Link text	2946	24.81%	167
Using relative units (AA)	1556	13.11%	72
Improper use of CSS	1556	13.11%	93
Labels for controls	629	5.30%	122
Tables	205	1.73%	38
Headings ordering	342	2.88%	130
Other	428	3.60%	
2. Operable	**812**	**6.84%**	**77**
Stuttering effect	471	3.97%	46
Unique labels (AA)	188	1.58%	21
Other	153	1.29%	
3. Understandable	**82**	**0.69%**	**54**
4. Robust	**812**	**6.84%**	**95**
Total	11873	100.00%	185

Three error types are more frequent: the lack of text alternative for non-text content (21.10%) found in 137 websites, lack of text description for the

link (24.81%) found in 167 websites, improper use of CSS (13.11%) found in 93 websites, and the use of absolute instead of relative units (13.11%) found in 72 websites.

Other frequent accessibility errors are the improper ordering of heading elements (2.88%) found in 130 websites, improper association of labels to controls (5.3%) found in 122 websites, stuttering effect (3.97%), and use of nested tables (1.73%).

4.3 Comparison with previous data

An overall comparison with the summary results from 2014 is presented in Table 4 that shows the mean number of errors for each category, the number, and percentage of websites having errors.

Table 4. Summary of results – comparison with 2014 (mean values)

	2019	N	2014	N
WCAG2 total	63.83		103.50	
WCAG2 A	54.46	185 (54.46%)	81.27	60 (100.00%)
WCAG2 AA	9.38	89 (47.85%)	37.06	36 (60.00%)
HTML	106.80	178 (95.70%)	200.42	57 (95.00%)
Parsing	15.56	108 (58.06%)	22.96	45 (75.00%)
Broken links	78.56	156 (83.87%)	29.49	52 (86.67%)

The comparison shows that the mean values and number of websites with errors in 2019 is lower than five years ago. This doesn't mean that the accessibility has much improved. In a recent paper (Pribeanu, 2019) the comparison of the same sample (N=60) showed quasi similar results. The lower mean number of errors in Table 4 suggests that the accessibility of the first 60 websites is lower than the accessibility of the next 126 websites.

The only exception in Table 4 is the average number of broken links. An explanation could be a larger number of links. The number of links collected three months ago on the sample of 60 websites was 191.13 (SD=132.01). However, the percentage of websites having broken links is a little bit lower in 2019.

A comparison of websites in a given error range is presented in Table 5. As it could be noticed, the percentage of the first two categories together (up to 20 accessibility errors) is higher in the sample of 186 websites while the percentages of the last three categories (over 50 errors) are lower.

Table 5. Websites by number of errors – comparison with 2014 (%)

Accessibility score	2019	2014
1-10 errors	12.90	13.33
11-20 errors	20.97	8.33
20-50 errors	28.49	31.67
50-100 errors	22.04	28.33
Over 100 errors	15.59	18.33
Total	100.00	100.00

A more detailed comparison on the mean number of WCAG2 A errors is presented in Table 6. For comparison reasons, the average has been computed for the whole sample (the number of websites having errors per category in 2014 was not available).

Table 6. Number of WCAG2A errors - comparison with 2014 (mean values)

Principle / guideline	2019	2014
1. Perceivable	**54.66**	**62.15**
Alternative text	13.47	16.38
Link description	15.84	14.05
Improper use of CSS	8.37	12.47
Labels for controls	3.38	2.72
Tables	1.10	2.25
Headings ordering	1.84	10.90
Other	2.30	2.25
2. Operable	**4.37**	**8.73**
3. Understandable	**0.69**	**1.50**
4. Robust	**8.51**	**12.57**

The results in 2019 are better with one exception: providing a proper label for controls. Again, this is mainly because the samples are different than because the accessibility improved.

4.4 Discussion

Overall, this study confirms the results of previous studies in that the accessibility of municipal websites is low. Most frequently encountered accessibility errors are lack of a proper description for the purpose of a link, lack of text alternative for non-text content, improper use of tags, use of absolute rather than relative units, lack of control labels, and improper ordering of headings.

The first 60 websites (over 33 thousand inhabitants) have on average 86.65 WCAG2 errors (SD=140.46), next 60 websites (15.5-33 thousand) 62.02

errors (SD=75.07) and the last 66 towns (less than 15.5 thousand) 44.74 errors (SD=60.50). It seems that in general, bigger municipalities have lower accessibility. However, the differences in each group are very large so it couldn't be stated that a relationship exists between the size of the towns and the accessibility of the homepages.

A similar situation exists for the number of SC failed which is larger for the websites of the first group of towns (M=7.68, SD=3.12) than for the second group (M=6.80, SD=3.03), and the third group (M=6.32, SD=2.61). o

The number of links on the homepage is very high. In general (at group level), bigger municipalities have a larger number of links (which may be explained by a richer functionality) and a larger number of broken links on the homepage.

Few websites are using landmarks and several levels of headings to structure the webpage. These shortcomings make the navigation difficult for people using a screen reader.

As mentioned in a previous section, there are several factors that contribute to a low level of accessibility of municipal websites: budget, quality of the workforce, available technology, assigning responsibilities, management decisions, adequate strategies, and legislation (Abdelgawad et al., 2009; Welleman et al., 2017).

Although the EU Directive has been issued two years ago, there are no clear regulations yet at the national and local level as regards the conformance of public websites with the WCAG2 guidelines. Consequently, accessibility checking before a new release or update is not a common practice.

As mentioned in a previous study, such regulations should mention, among other things, some mandatory requirements for a website release: name of the developer (company or own IT department), level of web accessibility conformance, and release date (Pribeanu et al., 2012).

This study has several limitations. First of all, automated accessibility checking has its own inherent limitations (Vigo & Brajnik, 2011). However, this is the only reasonable approach for a large-scale evaluation.

Second, only the homepage has been checked for conformance with WCAG2. Third, although the population of the 186 towns represents more than 90% of the total urban population, the sample does not include the websites of all Romanian towns.

5. Conclusion and future work

This study analyzed the accessibility of 186 Romanian municipal websites. Up to now, this is the largest accessibility study of Romanian websites. The results show that the accessibility of the municipal web is low since there is only one homepage that passed the first accessibility level. This should be worrying since there are less than 2 years left until the entry into force of the EU Directive regarding the accessibility of public websites.

This work contributes to a wider picture of the Romanian municipal websites accessibility. As regards the current status, the accessibility of the municipal web is still low, with many errors that are violating the first principle of WCAG2. As regards the evolution in time, there is little progress in the last five years.

Surprisingly, bigger municipalities that are supposed to have much funding available for IT seem to have lower accessibility. Therefore, in order to ensure the conformance level required for the public web by the EU Directive, a clear accessibility policy is needed at the national and local level. Without regulations on web services procurement, it is unlikely that things will change. At this moment, accomplishing the objective of an accessible public web, including the municipal websites, by September 2020 seems quite problematic.

The first priority is to establish regulations at the national level as regards the conformance with WCAG2 guidelines. In turn, this should lead to the adoption of a local accessibility policy. Accessibility regulations should cover both evaluation and monitoring actions. In this respect, the results of this study could be used as a starting point for future accessibility evaluations of the municipal websites.

The second priority is to elaborate an evaluation and monitoring strategy. This strategy should have pragmatic goals and rely on the current status of websites accessibility in Romania. Since several accessibility tools exist, the first thing to be done is to select one ore two evaluation tools that are suitable for large scale evaluation. A pragmatic approch would be to evaluate only the homepage in the first stage in order to avoid wasting evaluation resources. After, and only after a reasonable level of accessibility is reached, a more systematic evaluation methodology could be used.

In the next future, a second evaluation will be carried on targeting the municipal websites of all towns in Romania. A comparative analysis of results will be done in order to check the improvement of accessibility and

the degree to which municipal websites maintain the accessibility level.

A second research direction would be a comparison with the municipal websites accessibility in other European countries.

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