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WEB ACCESSIBILITY AS A BARRIER TO SUCCESSFUL DIGITAL GOVERNANCE: A CASE STUDY OF THE ARABIAN GULF REGION

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Abstract

Conformance to web accessibility standards is crucial to successful digital governance. Examining the state of Web accessibility compliance in the state of Qatar, a fast growing digital economy with the world's highest per capita GDP has many lessons for emerging economies. Our audit of a selected sample of websites across government and other sectors suggests the need to raise awareness among executives and other key stakeholders regarding Web accessibility and to develop best practices and an improved policy framework. To better understand the barriers to adoption of Web accessibility standards in the country, we interviewed 30 CIOs and senior information technology managers. The results suggest a need for stronger regulations, since organizations will not otherwise comply due to concerns that enforcement of accessibility standards results in increased website development time and costs and undermines usable website design and management, particularly with multilingual websites.

Keywords

Web accessibility; standards; digital governance; regulations; audit; interviews.

1. Introduction

With the ever increasing use of the World Wide Web, accessibility has become an important topic. Web accessibility is defined as universal access to websites regardless of any form of disability (White et al., 2015). In other words, being accessible in the context of a website means making all the data and functions available to everyone regardless of their physical, cognitive or other limitations. The term "disabled" in this context means persons with visual, hearing, and physical impairments as well as the elderly (Brajnick et al., 2011). Web accessibility is important to these user segments because it deals with overcoming barriers to their access and usage of the Web (Cunningham, 2012). Disabled users who have motor impairments often use assistive technologies, i.e., specialized tools such as screen reader software and speech input systems. They use these technologies to perform functions and tasks on the Web that they, otherwise, would not be able to perform without the specialized tools (Thompson et al., 2007). For a website to be considered accessible, it must be flexible enough to work with the technology that a disabled user uses on the Web (Olalere & Lazar, 2011). At the same time, being accessible does not mean stripping all the advanced features from a website, and it does not mean returning to the days of unstyled Web pages (Cunningham, 2012). However, building and achieving an accessible website requires thoughtful planning and testing (Olalere & Lazar, 2011, Yamada, 2011).

According to the United Nations, the segment of the population made up of people over 65 years of age is going to increase significantly, and by 2030, out of a world population of 8.321 billion, 1.165 billion people will be 65 or older (Sanchez-Gordon and Lujan-Mora, 2013). Therefore, if websites are not accessible, it will be difficult for these users to navigate the Web. Moreover, having accessible websites means that e-government and e-business transactions are open to a wider range of users, especially disabled users, who will then have a

more positive experience, in turn increasing the perceived value of the websites (Kuzma, 2010). As Rogers (2016)'s research into the state of government accessibility standards around the world reveals, adoption of the Web Content Accessibility Guidelines (WCAG 2.0) is only progressing in many countries and legislations in very few countries have fully adopted WCAG 2 guidelines (W3C, 2008).

In the US, one reason that Web accessibility has gained a lot of attention is because of the federal regulations that required e-government websites to be accessible by 2003 (Lazar et al., 2003). Olalere & Lazar (2011) conducted a study to examine the accessibility of federal websites. They said that in the US, the disabled are frequent users of the Internet, yet many federal websites remained inaccessible. Furthermore, the existing federal regulations were designed to address perceptual and motor impairments, but not cognitive impairments. The reason is that research on cognitively impaired users is much newer and more limited. Section 508 guidelines of the Rehabilitation Act, however, are still being updated and have been subject to continual delays through 2013 and 2014 (Rogers, 2016).

In the UK, the Disability Discrimination Act (DDA) of 1995 mandated equal access to websites for people with disabilities. By 2005, over 5.7 million people of working age in the UK had some form of physical impairment. However, as of 2010, many of the UK's websites still did not meet Web accessibility compliance standards mandating the Equality Act of 2010 (Kuzma, 2010). An examination of the websites of members of the UK's Parliament confirms that only 30 of the 130 MP websites met WCAG Level 1.0 and DDA minimum requirements for accessibility standards. None of the websites passed WCAG 2.0 guidelines. The first step to overcoming this problem is that in creating new websites, designers must understand the current DDA law and use and follow accessibility tools and guidelines (Kuzma, 2010).

Recent studies initiated in the Arab region, specifically in the Gulf Cooperation Council (GCC) countries, aimed to analyze and evaluate the top websites in different sectors, such as the government and healthcare (Abanumy et al., 2005). Weber, 2010, Baporikar, 2014). The results from these studies show that most of the websites in the GCC region are not accessible to disabled users. Al-Khalifa (2012) evaluated Saudi Arabian e-government websites based on WCAG 2.0 and found that they violated a large number of accessibility guidelines and not a single e-government website had successfully met the WCAG 2.0 guidelines. The most serious problem was failing to provide text equivalents for non-textual content elements. And from a design aspect, the Saudi e-government websites violated SC 1.3.2 (Meaningful Sequence), because the design layout was table-based. Al-Khalifa believes that this violation of accessibility guidelines was primarily because of a lack of awareness among key stakeholders about the importance of web accessibility (Al-Khalifa, 2012). AKGÜL & Vatansever (2016) used automated tools to assess compliance by the top 25 Turkish e-government websites and confirmed that all the websites were non-compliant. As discussed, some limited research has been done in the Middle East to determine the state of Web accessibility compliance; however, none of these research efforts have considered Web accessibility specifically in the State of Qatar. Qatar is considered one of the fastest-growing economies in the world with a growth rate of 15%. Qatar's disability prevalence is also growing significantly. Approximately 12% of the population are registered disabled people. Besides, the 2010 census indicates that the number of people 65 years old or older has roughly doubled from 8,659 in 2000 to 15,708 in 2010. Qatar has many initiatives aimed at improving the accessibility of websites in various sectors of the economy. However, this transformation is taking a lot of time. Policies and legislation aimed at ensuring Web

accessibility compliance are still in the works, and clarity is needed on which sectors of the economy should be given priority (ictQATAR, 2011).

The rest of the paper is organized as follows. The next section evaluates the state of accessibility of a stratified sample of Qatari websites through manual and automated tests that follow WCAG guidelines and the existing set of best practices suggested by MADA, Qatar's e-accessibility center (ictQatar, 2011). Then, because the results from auditing cannot determine the level of awareness in Qatar among key stakeholders, the next stage of this study reports the results of interviews with 30 CIOs and senior information technology managers. The final section presents conclusions, assesses the research limitations of this study, and discusses future research ideas.

2. Website Auditing and Results

The website auditing study involved compilation of a list of 42 most prominent websites that fell under six major sectors: government, retail industries, travel agencies, healthcare, newspapers, and universities. The selection of websites was based on the following criteria: popularity, transactional services, impact on surrounding environment, and future resident population requirements. After examining the criteria for each website (see Table 1), the list was narrowed to 30 websites, 5 in each of the above named 6 sectors.

Criteria	Description
Website Traffic	How intense is the usage?
Transactional Services	Does the website provide transactional services?
Impact on Surrounding Environment	Both primary and secondary users are affected from the services provided from the website.
Future Resident Population Requirements	Is the site going to have impact in providing services for future resident population?
Language	The site has both Arabic and English?

Table 1: Criteria for Selection of Websites for Auditing

Two audit methods were considered to evaluate the homepages of the selected websites: manual and automated checking. The homepages were selected because if there were an accessibility problem on the homepage, a disabled user would not be able to navigate the website any further. Software tools are not perfect in detecting all kinds of accessibility problems (e.g., contrast and color) necessitating manual checking (Lazar et al., 2003). Manual checking involved checks for conformance to standards and polices that meet WCAG 2.0 A, WCAG 2.0 AA, and Qatar Web accessibility standards from MADA (ictQATAR, 2011). For automated checking, the automated software tool WAVE (http://wave.webaim.org/), which addresses WCAG 2.0 A, WCAG 2.0 AA, and Section 508 accessibility guidelines, was used. The protocols followed for manual and automated checking are described in detail below, along with the results.

Tool	Description
Screen Reader	The screen reader was used to determine whether a user is able to tab from the start to the end of the page without any breaks
Color Contrast Analyzer	The color contrast analyzer was used to determine whether the color choices for the website is legible and colorblind friendly for the visually impaired
Magnifying	The magnifying tool was used to determine whether the gaps between the

Tool	lines were sufficient so as to not confuse users operating under high magnification.

Table 2: Accessibility Tools Used for Manual Checks

2.1 Manual Checking

The manual checklist (see Appendix 1) contains criteria that follow both WCAG guidelines and e-policy Web accessibility compliance standards in Qatar. Accessibility tools (See Table 2 for details), such as a color contrast analyzer, were used as part of manual checks. Manual checking as detailed in Table 3, was divided into five categories that focused on testing the following aspects: contrast and color, layout, design and cascading style sheets, magnification tool, text, alt (alternative text) text, and links.

Category	Criteria
Contrast & Color	Use of appropriate number of colors (3 to 4) and background color, legibility of contrast, colorblind friendliness, pass WCAG 2.0 AA and AAA specifications with regular and larger text.
Layout, Design & CSS	Avoid use of Flash, Frames or Tables as structural layout? Use of CSS and DIV elements for website layout and design, ability to tab from the start to the end of the page without any breaks, text portions and objects on the site are re-scalable with relative sizing, headings are nested properly, headings are named appropriately, use of an appropriate grid system for layout
Magnification Tool	Are the gaps between the lines sufficient so as to not confuse users operating under high magnification?
Text	Minimum font size is CSS 100%, 12 points, open typeface fonts such as Verdana or Arial are being used
ALT Text	ALT text descriptions make sense when read out of context
Links	Menu links, text links and image links in the website are appropriately descriptive, check for redundancy or ambiguity in link phrases

Table 3: Detailed Criteria for Manual Checks

Category	Criteria
WAVE Test Checklist	Does the page pass the WAVE initial check?
	Is the page comprehensible when viewed in text only?
	Is the page comprehensible when viewed with the styles turned off?
	Does the page have a clear outline?

Table 4: Criteria for Automated Checks

2.2 Automated checking

The WAVE tool, developed by WebAIM (http://wave.webaim.org/) was used for automated checking (see Table 4). WAVE is a commonly used Web accessibility evaluation and assessment tool which delivers visual feedback about accessibility issues through injecting icons, tags, and indicators into the website. The WAVE tool has multiple features that help in detecting accessibility problems. For instance, it provides a summary that divides all the detected accessibility violations into different categories, such as errors and alerts. The

WAVE tool also has the ability to remove the page's style to indicate if it is comprehensible when the style is turned off, along with checking contrast errors. Many studies related to Web accessibility have used the WAVE tool for automated checking (Shawar, 2015). It is considered to be one of the most reliable tools to test for WCAG compliance.

2.3 Results of Audit

Of the 30 websites tested, none fully met WCAG guidelines and the existing e-policy Web accessibility compliance standards in Qatar (ictQATAR, 2011). All of the 30 websites showed critical failures. Retail industry websites showed the highest critical failure percentage in comparison to the other sectors (21.7%), whereas university websites showed the lowest percentage (11.5%). The pie chart in Figure 1 summarizes the results of auditing the selected Qatar websites. The chart shows that overall, university websites scored the largest passing percentage (9%) in terms of meeting several accessibility criteria, and healthcare scored the lowest passing percentage (5%). On the other hand, healthcare scored the highest percentage in the partial failure results (8%), and retail industries, travel agencies, and newspapers scored the lowest percentage (4%). The highest score in critical failure percentage was the retail industry (7%), whereas the university and government sectors scored the lowest percentage (4%).
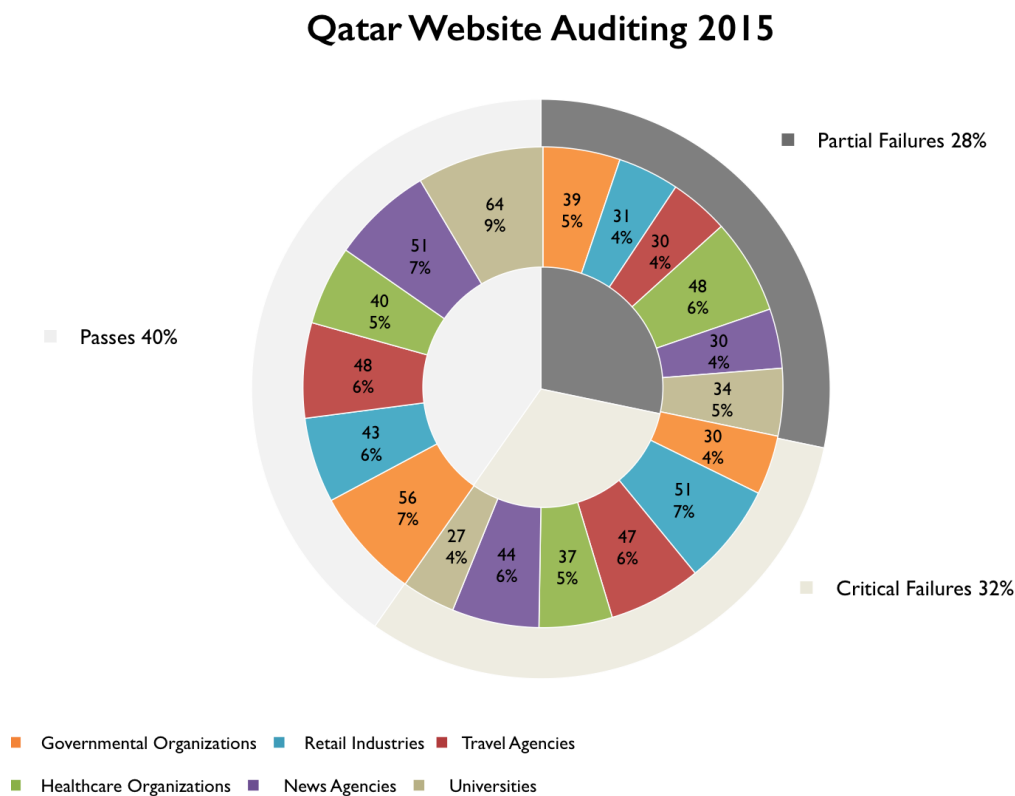

Fig 1: Results of Website Auditing

Common accessibility errors were observed across the websites. For instance, out of the 30 websites, 16 showed an accessibility violation related to the use of tables as a structural layout. Although some of the 16 websites used <div> for structural layout, they did not completely avoid the use of tables, causing a partial failure result in terms of the criterion *"Does the site avoid the use of Flash, Frames, or Tables as its structural layout?"* However, none of the websites in the universities sector violated this accessibility measure. Another

common problem was ALT text, for which 23 websites showed accessibility errors in not appropriately providing meaningful description of the images. None of the websites passed the assessment checkpoint, "*Can you tab from the start to the end of the page without any breaks*?" Although some of the websites showed good results in the beginning when the screen reader was used, at the middle of the homepage the screen reader skipped major contextual content items. Lastly, when using the WAVE automated toolbar for initial checking, none of the websites fully passed this accessibility measure, and 28 of the websites showed critical failure results, and 2 additional websites had partial failure results.

The results from the auditing evaluation showed that none of the 30 examined websites passed the test successfully, This suggests that organizations in Qatar, in general, have not yet given Web accessibility their full attention. As a result, people with disabilities are prevented from being directly involved with the Internet and essential online resources. One suggested reason is a lack of awareness among stakeholders. Lack of awareness regarding Web accessibility raises a serious concern about the qualifications of people who are entrusted with providing online services to all type of users, disabled as well as able-bodied. Moreover, these people who are in high and responsible positions must expose themselves to information and resources that facilitate all types of experiences for users of their websites.

3. Interviews and Results

A thorough literature review provided an understanding of the gaps in accessibility compliance in Qatari websites. One of these gaps is a lack of data about the state of Web accessibility, whether it is the lack of awareness about the importance and significance of Web accessibility, or whether it is the need to hire IT expertise in terms of Web accessibility (Abanumy et al., 2005), or whether legislation is needed to enforce compliance in local websites within a given time period similar to what was tried in the United States and UK. Because auditing alone is insufficient to understand the gaps, interviews with CIOs and IT managers are needed. The results from the interviews are expected to provide insight into these gaps in terms of the sources of the major problems in having inaccessible websites along with what remedial actions that are needed and who should be responsible.

Given the paucity of studies in the web accessibility domain, we constructed a questionnaire for our interviews drawing upon the definition of the construct "awareness," from the existing literature on closely related areas such as privacy or security (Kruger and Kearney, 2006; Siponen, 2000, 2001; Drevin et al., 2007). The four sub-constructs considered further were: knowledge, behavior, recognition, and motivation. We contacted 50 CIOs and senior IT managers by email and through mutual contacts requesting for an interview. Multiple emails and phone calls were needed before we secured appointments for the interviews. The interview questions were sent ahead of the actual meetings. Given time constraints, we limited our interview to 30 participants. The interviews, all face-to-face, lasting approximately 30 minutes, were carried out during a period of two months.

The interview data was first analyzed using Semantria (See https://www.lexalytics.com/), a sentiment analysis tool. Although the results were not significant, a few interesting themes emerged from the analysis - "tight budget," "always difficult," and "sensitive subject." These findings raised interesting questions such as: Why is Web accessibility considered a sensitive subject in some organizations? Why is accessibility always difficult to implement? And why is budget an obstacle to having accessible websites?

Further examination of the interview transcripts revealed reasons for the lack of accessible websites in Qatar. One reason is confusion. For instance, some interviewees did not interpret

"Web accessibility compliance" as serving the needs of disabled users. One interviewee interpreted it as providing the organization's employees with access to a certain application. However, when the term was further explained, the interviewees discussed how her organization's building is designed with certain features to serve the needs of disabled users, but not the website. And another interviewee said that in her organization the term accessibility is mainly related to security and not to disabled users. She said that, "*when we say Web accessibility compliance, we speak about security mostly. It's not for the ... aah ... real ... ah ... access ... access to the application. So no ... no for special needs*".

One important issue that emerged was the clash between website design expectations and accessibility standards. Thus, to meet those standards would often result in sacrificing some of the websites' design elements. To quote one interviewee "... *It's a lot of pressure to have your website look polished in a certain way, there is an expectation for it to look in a certain way, and if you tried to meet the standards, a lot of the time we have to sacrifice some of that.*" And another interviewee added that "*it will be a constant struggle between good design and being Web accessible.*" Cost was brought out as a main reason for the lack of accessible websites. Companies usually intend to reduce their budgets, and because there are no regulatory requirements to require websites to be accessible, they just neglect it. Compliance with multiple browsers and platforms also contributed to the increase in cost. The need for multilingual websites was another important barrier that emerged. To quote one interviewee: "*One roadblock that makes it harder to implement Web accessibility guidelines for Arabic content is that it's simply a challenge to work with Arabic content in our particular Web content management system (CMS).*" She stated that their website is built to handle contents from both languages, Arabic and English, however, when Arabic content is entered to their CMS, it gets converted into HTML syntax that is hard to work with and therefore makes it difficult to work with. Finally, some interviewees stated that for their organization Web accessibility is not a major consideration because they do not feel the need. To quote: "*If you are an engineer ... um ... then you need to have access to other tools and equipment rather than PC. Accessibility or Web accessibility from my perspective is not a major consideration.*"

4. Conclusions, Limitations, and Future Research
In this paper, the importance of Web accessibility at large and in the state of Qatar specifically was considered. The results of auditing a sample of the most prominent Qatari websites using international accessibility guidelines (WCAG V1.0, WCAG V2.0) and the existing Qatar Web accessibility standards were reported. The results showed that none of 30 selected websites successfully passed all tests. However, the results from auditing did not provide much insight into the reasons for the lack of accessibility, necessitating interviews with CIOs and IT managers. The interviews played a vital role in addressing the gaps found in the literature, along with determining what actions are needed to improve the current state of Web accessibility compliance and who is responsible for implementing them. The interviews helped gain insights into the mindset of CIOs and senior managers, who either do not see the importance of web accessibility or ignore it due to time and cost considerations.

The paucity of reports of such studies in the literature suggests an increased need for research in this area. The methodology detailed in this paper serves as a useful guide for other interested researchers and practitioners. There are several challenges, however. The first is the need to supplement automated checks with manual checks. This brings in both resource and time constraints for the study. In the absence of prior studies that developed questionnaires targeted towards accessibility, we adapted questions from related areas such as security and

privacy. Finally, recruiting potential stakeholders such as CIOs and IT managers was difficult and required several emails and phone calls. Given that this study used a convenience sample the results cannot be generalized, pointing to the need for a more exhaustive study. Such future studies also should focus on studying the needs of different user categories such as motor, visual, or cognitive impairment. Studying the accessibility level of the websites would result in providing generic conclusions, but studying how the needs of each of the user categories are met, shows how severe an accessibility problem is with respect to each kind of impairment (Brajnik et al., 2011).

A major barrier to web accessibility compliance is the lack of enforcement of regulations. Some of interviewees reported that they are aware of the international accessibility guidelines (WCAG V1.0, WCAG V2.0). However, none of them were aware of the existing local Web accessibility standards or guidelines. Thus another future study would be the determination of whether the local accessibility standards are appropriate and effective in serving the local needs of the population.

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Appendix 1. Manual Checklist Criteria

Category	Criteria
Contrast & Color	Does the site use the appropriate number of colors? (3 to 4)
	Does the site use an appropriate background?
	Is the contrast used legible?
	Is the site colorblind friendly?
	Does the page pass AA with regular text?
	Does the page pass AAA with regular text?
	Does the page pass AA with larger text?
	Does the page pass AAA with larger text?
Layout, Design & CSS	Does the site avoid the use of Flash, Frames or Tables as its structural layout?
	Does the site use CSS and DIV elements for website layout and design?
	Can you tab from the start to the end of the page without any breaks?
	Are text portions and objects on the site re-scalable with relative sizing?
	Are the headings nested properly?
	Are the headings named appropriately?
	Does the page make use of an appropriate grid system?

Magnification Tool	Are the gaps between the lines sufficient so as to not confuse users operating under high magnification?
Text	Is the minimum font size, CSS 100%, 12 points?
	Are open typeface fonts such as Verdana or Arial being used?
ALT Text	Does the ALT text description make sense when read out of context?
Links	Are the menu links, text links and image links in the website appropriately descriptive?
	Is there any redundancy or ambiguity in link phrases?