Quality assessment of corporates' sustainability web pages from accessibility, usability and security perspectives: Türkiye evidence

Şirketlerin sürdürülebilirlik web sayfalarının erişilebilirlik, kullanılabilirlik ve güvenlik perspektiflerinden kalite değerlendirmesi: Türkiye örneği

Sıla Azer YÜKSEL[1], silaazereryilmaz@gmail.com

Serhat PEKER [2], serhat.peker@bakircay.edu.tr

Corporate sustainability web pages reflect strategies to mitigate environmental impact, crucial for long-term business continuity. In this manner, ensuring accessibility, usability, and security in these pages is essential. This article evaluates the quality of sustainability web pages of corporates from accessibility, usability, and security perspectives. Our sample consists of 71 Turkish companies and the analysis was conducted on their sustainability web pages using TAW, GTmetrix, SUCURI, Google Mobile-Friendly, and Dead Link Checker automatic online testing tools. Thus, the results show indicate a necessity to enhance the overall quality of sustainability web pages among Turkish corporations. The findings of this research also address the major problems and serve as constructive feedback for web administrators and developers, guiding them towards enhancements in accessibility, usability, and security aspects of these web pages. Therefore, this research seeks to provide valuable insights into the performance of these web pages, thereby contributing to the advancement of corporate sustainability communication and transparency.

Kurumsal sürdürülebilirlik web sayfaları, uzun vadeli iş sürekliliği için çok önemli olan çevresel etkiyi azaltma stratejilerini yansıtmaktadır. Bu bağlamda, bu sayfalarda erişilebilirlik, kullanılabilirlik ve güvenlik gibi kriterlerin sağlanması oldukça önemlidir. Bu makale, kurumsal sürdürülebilirlik web sayfalarının kalitesini erişilebilirlik, kullanılabilirlik ve güvenlik perspektiflerinden değerlendirmektedir. Örneklemimiz 71 Türk şirketinden oluşmaktadır ve analiz, TAW, GTmetrix, SUCURI, Google Mobile-Friendly ve Dead Link Checker otomatik çevrimiçi test araçları kullanılarak sürdürülebilirlik web sayfaları üzerinde gerçekleştirilmiştir. Sonuçlar, Türk şirketleri arasında sürdürülebilirlik web sayfalarının genel kalitesinin artırılması gerektiğini göstermektedir. Bu araştırmanın bulguları aynı zamanda temel sorunları ele almakta ve web yöneticileri ve geliştiricileri için yapıcı bir geri bildirim işlevi görerek onları bu web sayfalarının erişilebilirlik, kullanılabilirlik ve güvenlik yönlerinde iyileştirmeler yapmaya yönlendirmektedir. Dolayısıyla bu araştırma, söz konusu web sayfalarının performansına ilişkin değerli bilgiler sunmayı ve böylece kurumsal sürdürülebilirlik iletişimi ve şeffaflığının ilerlemesine katkıda bulunmayı amaçlamaktadır.

Keywords: Human-computer interaction (HCI), web accessibility, web usability, web evaluation tools, corporate web page

Anahtar Kelimeler: İnsan-bilgisayar etkileşimi, web erişilebilirliği, web kullanılabilirliği, web değerlendirme araçları, kurumsal web sayfaları

---

[1] Sorumlu yazar, Department of Management Information Systems, İzmir Bakircay University, İzmir, Turkey; Senior Quality Assurance Specialist, Veripark Yazılım A.Ş.; ORCID: 0000-0003-0947-2963

[2] Assoc.Prof.Dr., Department of Management Information Systems, İzmir Bakirçay University, 35665 İzmir, Turkey; ORCID: 0000-0002-6876-3982

1. INTRODUCTION

Sustainability information refers to the data provided by businesses concerning the wider economic, environmental, social, and ethical impacts of their operations (Rowbottom and Lymer, 2009). Corporate sustainability involves various aspects of how businesses interact with society, including corporate citizenship, social responsibility, sustainable management (Bansal and Song, 2017). It also influences both corporate reputation and financial performance. All these factors have led companies to adopt more proactive approaches to sustainability management and reporting (Dawkins, 2005; Nielsen and Thomsen, 2009). Companies mostly utilize their websites as a platform for reporting on their sustainability efforts. This typically involves dedicating specific web pages to detail their sustainability initiatives, goals, and related information. Thus, by showcasing their sustainability practices online, firms can enhance transparency, accountability, and credibility in addressing corresponding concerns.

On the other hand, the quality of websites is very important for organizations to enhance their competitive advantage and portray their identity and institutional image. There are various factors influence the quality of websites. Among these, accessibility, usability, and security are frequently used in the quality assessment of websites. Web accessibility refers to the ease with which both people with disabilities and elderly individuals can access web resources, as outlined in the Web Content Accessibility Guidelines (WCAG 1.0 and 2.0) proposed by the W3C(Web Accessibility Initiative (WAI) | W3C). Usability stands out as another critical factor for websites, especially for those intended for public use. This measure indicates how efficiently and easily users can navigate the website to obtain the desired service (Nielsen, 2000). When a website is slow or challenging to navigate, user dissatisfaction grows, increasing the probability that they will abandon the site. In addition to accessibility and usability, security is a crucial factor for websites, as it heightens the likelihood of attacks if the system is outdated and communication lacks encryption (Macakoğlu, Peker and Medeni, 2023).

This study aims to evaluate the quality of sustainability web pages belonging to 71 Turkish companies from the perspectives of accessibility, usability, and security. Using automatic testing tools, these web pages are examined to provide up-to-date insights into their performance. By identifying potential issues and areas for improvement, our study seeks to offer valuable suggestions to enhance the effectiveness and reliability of corporate sustainability communication on these web pages.

The rest of this study is organized as follows: Section 2 conducts a literature review, examining research by various scholars on website usability, accessibility, and security, with a specific focus on corporate websites. Section 3 outlines the data definition used in the study, describes the tools employed for site analysis, and elaborates on the evaluation process. Section 4 presents the results obtained from the accessibility, usability, security analyses, and mobile-friendly tests. The study concludes with a final section summarizing key findings and proposing potential future research directions.

2. LITERATURE REVIEW

2.1. Web accessibility, usability and security

The evaluation of website accessibility aims to confirm equal access to information for all individuals, including those with disabilities (Web Accessibility Initiative (WAI) | W3C). The WCAG 2.0 accessibility model is structured around four core principles: perceivable, operable, understandable, and robust (WCAG) 2.0, 2008). Crafted to be adaptable across different web technologies, WCAG can be assessed using a combination of automated testing tools and human evaluation methods (Barricelli et al., 2021). Numerous studies have explored website accessibility analysis, often employing automatic evaluation tools such as AChecker, TAW, WAVE, and Sort Site to identify potential issues (Kaur, Diksha Dani and Gaurav Agrawal, 2017).

Usability is a critical aspect of website design, focusing on how effectively users can navigate and access content. Usability analysis employs two main testing approaches: either evaluating all pages or specifically prioritizing the home page for accessibility by developers (Csontos and Heckl, 2021). The significance of usability in online behaviors has been underscored in studies within the fields of human-computer interaction (HCI) and information systems (IS) research. Various studies across education, social media, and government sectors have assessed website usability (Venkatesh and Agarwal, 2006). These evaluations often utilize automated tools like the WAWE tool, W3C's HTML Validation Service, and others. They analyze aspects such as content, accessibility, design, page analysis, mobile readiness, performance, search engine optimization, usability, and security. This provides insights into the strengths and weaknesses of websites across different domains (Karaim and Inal, 2019).

In addition to usability and accessibility, security is a crucial aspect in website evaluation. While it may seem slightly distant from the former two, the significance of website security is deemed equally or even more crucial (Csontos and Heckl, 2021). Ratnasingam (2002) underscores the substantial challenge of security, emphasizing the potential for hackers to compromise or destroy applications. Various research in the literature, including security analyses of websites, were examined to explore this aspect further. Dukes et al. (2013) conducted a comparative assessment of manual testing methods and automated tools for vulnerability detection. They found that a combination of expert observation and manual testing is more effective in identifying errors. During the security analysis, researchers investigate the status of approximately 7000 distinct domains concerning malware presence, inclusion on blacklists, and software currency. To identify potentially dubious circumstances McAfee SiteAdvisor, APIs like Sucuri SiteCheck, Google Safe Browsing, and Norton, which are accessible through various reputable web browsers, are employed (Macakoğlu, Peker and Medeni, 2023).

Table 1. Related work on web accessibility, usability and security

Ref.	Sector	Dimension	Tools& Techniques
Adepoju et al. (2016)	Government	Accessibility	TAW, Site Analyzer
Alsmadi & Abu-Shanab (2016)	Government	Security	Rapid7Security Tool, Penetration Testing Tool
Kamal et al. (2016)	Education	Accessibility	Achecker
Akgül& Vatansever (2016)	Government	Accessibility, Usability	TAW, AChecker, eXaminator, Total Validator, EvalAccess 2.0, HERA
Kesswani & Kumar (2016)	Education	Accessibility	Hera, TAW
Gopinath et al. (2016)	Government	Accessibility	GooglePageSpeedinsight, WAWE, GoogleMobile-FriendlyTest, Pingdom tool, and PowerMapper
Youngblood & MacKiewicz (2012)	Government	Accessibility	Achecker, TAW, WAWE, SortSide
Ismailova& Kimsanova (2017)	Education	Accessibility, Usability	EvalAccess2.0, Website Optimization
Yerlikaya & Durdu (2017)	Education	Accessibility	SortSide
Ismailova & Inal (2017)	Government	Accessibility	TAW
Gonçalves et al. (2018)	E-Commerce	Accessibility, Usability	SortSide
Elisa (2020)	Government	Accessibility, Usability, Security	WAVE, w3clink, sortside, Pingdom, Google speed insigh, Acunetix Web Vulnerability Scanner tool
Kaur et al. (2017)	Health	Accessibility, Usability, Security	TAW, WebSiteOptimization
Kurt (2017)	Education	Accessibility	Achecker, Google's Mobile Friendly test tool
Kuzma et al. (2017)	Health	Accessibility	TAW
Akgül (2018)	Banking	Accessibility, Usability, Security	WebSiteOptimization, Fast Link Checker, Pingdom, PageSpeed Google
Ismail & Kuppusamy (2022)	Education	Accessibility	AChecker, WAVE, and aXe
Karaim & Inal (2019)	Government	Accessibility, Usability	Achecker, TAW
Agrawal et al. (2019)	Airline	Accessibility, Usability	TAW, Pingdom, Websitepulse,
Oyefolahan et al. (2019)	Banking	Accessibility, Usability	Wawe, Achecker
Bilal et al. (2019)	Government	Accessibility, Usability	Achecker, Gtmetrix, online Google Mobile-friendly tool.
Zarish et al. (2019)	Education	Usability	Qualidator, Website Grader, Website Analyzer

		Accessibility, Usability, Security	EvalAccess2.0, AChecker online, WebSiteOptimization tool.
Paul & Das (2020)	Government		
Verkijika & De Wet (2020)	Education	Accessibility	TAW, Google Mobile-friendly test tool
Alsaeedi (2020)	Education	Accessibility	WAWE
Hamid et al. (2020)	E-Commerce	Accessibility, Usability	Achecker, TAW
Fatima et al. (2020)	Banking	Accessibility, Usability	Wave, TAW, Achecker
Ismail et al. (2020)	Education	Accessibility	Achecker, WAVE, aXe
Csontos & Heckl (2021)	Government	Accessibility, Usability, Security	WAVE, Sucuri, Gtmetrix
Akgül (2021)	Education	Accessibility, Usability	Achecker, SUCURI Sitecheck
Al-Sakran & Alsudairi (2021)	Government	Accessibility, Usability	TAW, Google Mobile-friendly test tool
Alhadreti (2021)	Health	Accessibility	Achecker
Wen Jun et al. (2021)	Social Media	Usability	Pingdom, GTmetrix, Website Grader
Barricelli et al. (2021)	Education	Accessibility	Achecker
Nour (2022)	Fintech	Accessibility, Usability	MAUVE++, WAVE, Dead Link Checker
Jasem et al. (2022)	Banking	Accessibility	WAWE, Achecker
Macakoğlu & Peker (2023)	Health	Accessibility, Usability, Security	TAW, Deadlink Checker online test tool, the Google Mobile-friendly test tool
Macakoğlu et al. (2023)	Education	Accessibility, Usability, Security	TAW, GTmetrix, Sucuri

2.2. Overview of Corporate Websites

In today's world, websites have become increasingly pervasive, playing a crucial role in the success of a wide array of organizations across various sectors. They are indispensable not only in industry and commerce but also in financial services, government administrations, healthcare, culture, entertainment, and numerous other fields (Fogli and Guida, 2015). These websites are commonly referred to as corporate websites, as they share a unified purpose: to support and promote the endeavors of an organization, whether they are economic, cultural, or social in nature (Adams and Frost, 2004).

There are studies in the literature for accessibility analysis of corporate websites Leitner et al. (2016) utilized an automated online tool (Total Validator) and guided interviews with managerial interviews. This study uncovered that private-sector websites exhibited better accessibility outcomes than those in the public sector, with only 12% of the latter complying with web accessibility principles. Singh and Singh (2020) undertook a study to scrutinize the

corporate knowledge available on the websites of 100 prominent Indian companies recorded on the Bombay Stock Exchange (BSE). Their research also sought to pinpoint the factors influencing the extent of disclosure. The research revealed a positive correlation between company magnitude and listing age with enhanced web accessibility. Additionally, it highlighted those companies with lower market risk exhibit a greater concern for the online accessibility of corporate information. In one of the recent studies, Conte et al. (2022) investigated the adherence to principles promoting the social inclusion of disabled users, specifically focusing on the accessibility of corporate websites maintained by sustainable firms. The findings revealed that a significant majority of corporate websites fall short of meeting accessibility guidelines, with variations noted in accordance with sector and geography. Interestingly, the study also highlighted those businesses, irrespective of their industry or geographical origin, exhibit adherence to W3C standards according to the results.

In the literature, there are quality analysis studies as well as accessibility analysis of corporate websites. Fogli and Guida (2015) intended to investigate four notion related to quality: use quality, internal quality, final quality, and initial quality. This research presents a recent quality model for websites, which includes a set of main features, sub-features and, structures that define the website's whole quality. One of the recent quality analysis studies is on the evaluation of airline corporate websites: Agrawal et al. (2019) assessed the website quality of Indian airlines, focusing on principles like accessibility, usability, and readability through online automation tools. The evaluation of usability included parameters like page size, loading time, and the presence of broken links, among others.

Based on the extensive literature review provided, the focus on sustainability web pages within the corporate sector remains relatively unexplored. This study aims to fill this crucial gap by comprehensively assessing the accessibility, usability, and security aspects of sustainability web pages belonging to Turkish companies.

3. METHODOLOGY

3.1. Data

This research examines the sustainability web pages of companies listed in BIST-30 and XSD25, focusing on their accessibility, usability, and security. BIST-30 represents the top 30 companies in terms of trading volume and market value on the Istanbul Stock Exchange, while XSD25 represents companies with high sustainability performance and liquidity also listed on the Istanbul Stock Exchange. Throughout the study, "XSD25 (yes)" refers to companies listed in the XSD25, while "XSD25 (no)" refers to those not listed in it. Similarly, "BIST 30 (yes)" indicates companies listed in the BIST-30, and "BIST 30 (no)" represents those not listed in it.

Initially, 76 companies from the XUSRD (Sustainability index) were selected, but five were excluded due to the absence of sustainability web pages. The remaining 71 companies' sustainability web pages were thoroughly evaluated, and the evaluated web pages are listed in the Appendix. Additionally, the distribution of data for XSD25 and BIST-30 companies is presented in Figure 1.
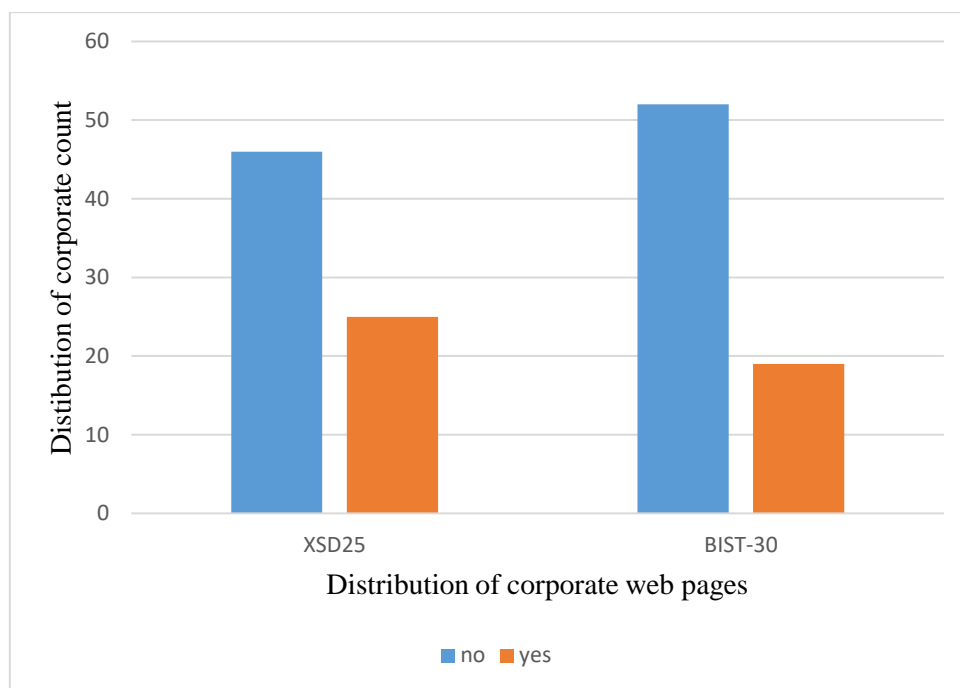

Figure 1. **Distribution of corporate web pages according to the list on XSD25 and BIST 30**

3.2. Tools and techniques

The TAW (TAW| Web Accessibility and W3C Standardization Services) one of the automated testing tools was used to analyze companies' sustainability web pages. The sustainability pages of the corporate selected for the study were assessed using the TAW test tool according to WCAG 2.0. WCAG is a set of standards designed to develop the accessibility of web content for people with visual, hearing, cognitive, or motor impairments. The TAW tool provides a summary and detailed report of accessibility guides broken down into operable, understandable, perceivable and robust categories (Pădure and Independentei, 2019). The

report presents findings from the analysis of companies' sustainability web pages using TAW. The statuses for each success criterion are categorized as follows: 'No problem found,' 'Problem found,' 'Unable to perform automatic review', and "Recommended for human review'. Given the scope of this research, only the findings regarding the categories of 'No problem found' and 'Problem found' were discussed and considered in this report.

The GTmetrix automated testing tool (GTmetrix | Website Performance Testing and Monitoring) was used to analyze the usability of the corporate webpages. GTmetrix is a comprehensive tool designed to track website performance and web performance. It offers valuable insights into the functionality and speed of websites by analyzing various metrics, such as the size of the web page, the number of requests required to load it, and the page load time. These metrics are crucial for assessing the effectiveness of a website and identifying areas for improvement in user experience. GTmetrix provides a detailed report, enabling users to calculate the web page's comprehensive speed score and rating. Factors such as loading speed, total page size, and the overall number of requests are taken into account. Overall, GTmetrix serves as a valuable tool for website optimization, allowing users to make informed decisions to enhance their website's performance and user satisfaction. GTmetrix displays the Google Lighthouse test performance score and evaluates the website's functionality in various ways. The GTmetrix Grade reflects a web page's speed, determined by its performance score across six critical parameters. These parameters include Speed Index (SI), Cumulative Layout Shift (CLS), First Contentful Paint (FCP), Total Blocking Time (TBT), Largest Contentful Paint (LCP) and Time to Interactive (TTI).

The performance score is calculated by comparing each parameter against predetermined threshold values. In our research, we focused on examining Total Blocking Time, Speed Index, First Contentful Paint, and Fully Loaded Time. Fully Loaded Time represents the time it takes for a web page to fully loaded time, including data loading and JavaScript code execution completion (Macakoğlu, Peker and Medeni, 2023). However, it is important to note that it may not be a definitive performance indicator for users. First Contentful Paint (FCP) measures how quickly text, graphics, and other content load and render on a web page. The Speed Index (SI) indicates how rapidly visible content fills up on a web page. SI serves as a useful benchmark for page performance as it correlates with other performance indicators (GTmetrix | Website Performance Testing and Monitoring). Total Blocking Time (TBT) quantifies the duration of user delays in interacting with a website. It holds significant weight, comprising 25% of the performance score among all metrics (Macakoğlu, Peker and Medeni, 2023).

The Sucuri automated testing tool (Sucuri- Complete Website Security, Protection & Monitoring) was utilized to analyze corporate web pages for security. This tool generates reports containing information such as the website's risk level, server type and version, usage of TLS (SSL), the programming language or engine used for development, and additional relevant details. The Dead Link Checker (Free Broking Link Checking Tool-Dead Link Checker) automated tool was used to assess broken links on corporate web pages and Google Mobile-Friendly testing tool was used to analyze website responsiveness on mobile devices (Google Mobile Friendly Testing).

4. RESULTS

4.1 Accessibility Results

Web accessibility entails ensuring that web pages and web applications are designed and developed to be accessible to individuals with disabilities and all users. In this section, we present the accessibility findings for prospective student websites using the TAW automated testing tool, which focuses on web accessibility and W3C standardization services.

Using the TAW tool, we analyzed 71 websites (seven web pages could not be tested because no results were obtained when using the Taw tool). These evaluations revealed that these websites had unmet accessibility needs at compliance level AA. Upon examining the distribution of errors across all assessed web pages, it was found that the perceivable principle had the highest error rate, accounting for approximately 62.19% of errors, while the robust principle demonstrated the lowest error percentage at 6.77%. Figure 2 illustrates the incidence of accessibility issues per web page, categorized according to the four foundational principles: perceivable, operable, understandable, and robust. Notably, web pages listed in the XSD25 exhibited the fewest errors per web pages across all principles.
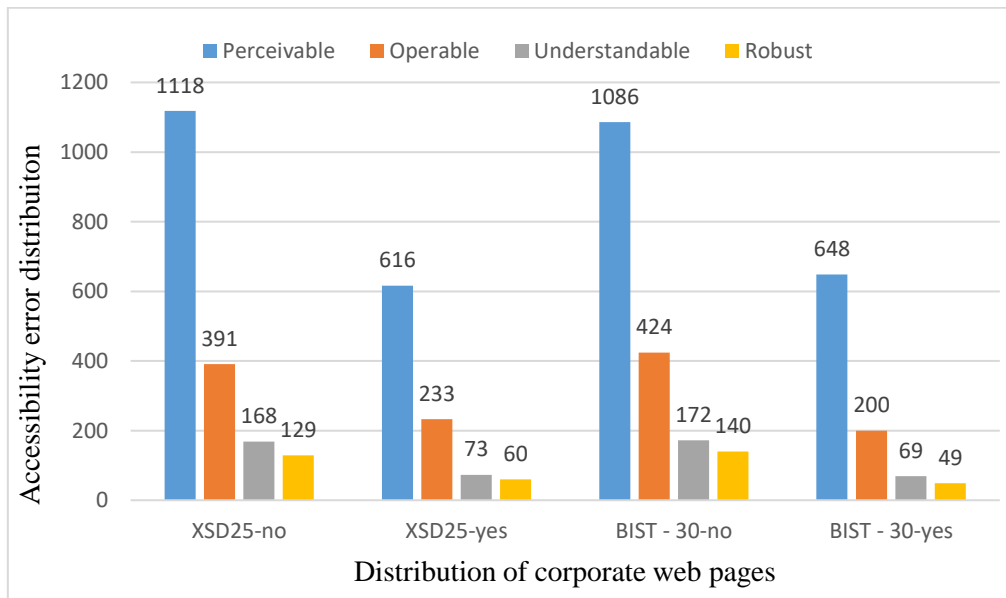

Figure 2. Accessibility error distribution of corporate sustainability web pages according to four fundamental principles

Table 2 displays companies with the highest and lowest performance based on the total number of errors per web page. Enerjisa Enerji A.Ş., Anadolu Anonim Türk Sigorta Şirketi, and Türkiye İş Bankası A.Ş. exhibited the fewest errors per web page, followed by Mavi Giyim Sanayi ve Ticaret A.Ş. and Türkiye Vakıflar Bankası T.A.O. On the other hand, Arçelik A.Ş., Şekerbank T.A.Ş., Yapı ve Kredi Bankası A.Ş., DO & CO, and Zorlu Enerji Elektrik Üretim A.Ş. had the highest number of accessibility errors per web page.

Table 2. Top and bottom 5 corporates in the ranking of accessibility errors per web page

Corporate	XSD25	BIST 30	Number of errors per web page
Enerjisa Enerji A.Ş.	yes	no	1
Anadolu Anonim Türk Sigorta Şirketi	no	no	1
Türkiye İş Bankası A.Ş.	yes	yes	1
Mavi Giyim Sanayi ve Ticaret A.Ş.	no	no	2
Türkiye Vakıflar Bankası T.A.O.	no	no	2
…		…	…
Zorlu Enerji Elektrik Üretim A.Ş.	no	no	122
DO & CO	no	no	132
Yapı ve Kredi Bankası A.Ş.	yes	yes	146
Şekerbank T.A.Ş.	no	no	171
Arçelik A.Ş.	yes	yes	294

Table 3 presents a comprehensive overview of control points specified in the WCAG 2.0 guidelines and their distribution among companies, with a focus on BIST-30 and XSD25 companies. The 'overall' column summarizes the total number of violations for each control point, along with the percentage of companies that violated it.

Within the scope of BIST 30 and XSD25 companies results, the table provides the quantity of accessibility errors per web page within each checkpoint, ensuring an overview of web pages violating designated checkpoints. Notably, the highest number of accessibility errors were observed at compatibility level A. Summarizing the findings, the most commonly breached success criteria included 1.1.1 (Text alternative missing), 1.3.1 (Info and Relationships), and 2.4.4 (Link Purpose in Context), each with violation rates surpassing 85% across web pages. Additionally, 3.3.2 (Labels or instructions) and 4.1.2 (Name, Role, Value) emerged as commonly breached criteria. Conversely, 2.2.1 (Timing Adjustable) was the least frequently violated checkpoint, suggesting the presence of headings that explain the purpose and subject matter of pages intended for prospective students. Notably, more than 64% of web pages demonstrated compliance with checkpoint 3.1.1 (Language of Page), indicating a default language comprehensible to the program across all pages.

The observation reveals that nearly all of the web pages affiliated with listed in the BIST 30 companies violate checkpoints 1.1.1 (Non-Text Content) and 2.4.4 (Link Purpose in Context).

Table 3. Failure to meet success requirements at adherence level A

Success Criteria	XSD25 & BIST 30									
	Overall		XSD25-yes (n=20)		XSD25-no (n=44)		BIST 30-yes (n=16)		BIST 30-no (n=48)	
	%	Total	%	Avg	%	Avg	%	Avg	%	Avg
1.1.1 - Non-text Content	89.06	951	85	18.82	88.63	15.77	93.75	21.46	87.5	14.97
1.3.1 - Info and Relationships	85.93	855	80	18,43	88.63	14.35	87.5	23.28	85.41	12.9
2.2.1 - Timing Adjustable	1.56	1	0	0	2.27	1	0	0	2.08	1
2.4.2 - Page Titled	3.125	2	5	1	2.27	1	6.25	1	2.08	1
2.4.4 Link Purpose (In Context)	90.62	621	90	13.26	90.9	9.72	93.75	13.26	89.58	9.81
3.1.1 Language of Page	35.93	23	60	1	25	1	43.75	1	33.33	1
3.2.2 - On Input	32.81	29	45	1.33	27.27	1.58	56.25	1.33	25	1.41
3.3.2 Labels or instructions	68.75	188	65	4.54	70.45	4.38	68.75	4.54	68.75	4.18
4.1.2 - Name, Role, Value	64.06	189	70	4.45	61.36	4.77	68.75	4.45	62.5	4.66

4.2. Usability Results

The dimensions and loading durations of 71 potential corporate web pages were investigated using the online assessment tool GTmetrix. Notably, six web pages within the dataset could not undergo testing account of timeout and security concerns. The assessment yielded performance grade results denoted on a scale from A to F, with A denoting the highest performance grade and F signifying the lowest.

Table 4. Distribution of GTmetrix ranks

GTmetrix Grade (A-F)	Number of web pages
A (excellent)	3 (4.61%)
B (good)	7 (10.77%)
C (average)	16 (24.62%)
D (below average)	19 (29.24%)
E (bad)	14 (21.53%)
F (very bad)	6 (9.23%)

Table 4 shows the distribution of performance ranks among the evaluated web pages. While 4.61% of the sustainability web pages examined achieved an A performance score, the highest percentage of total sustainability web pages exhibited C, D and E performances.
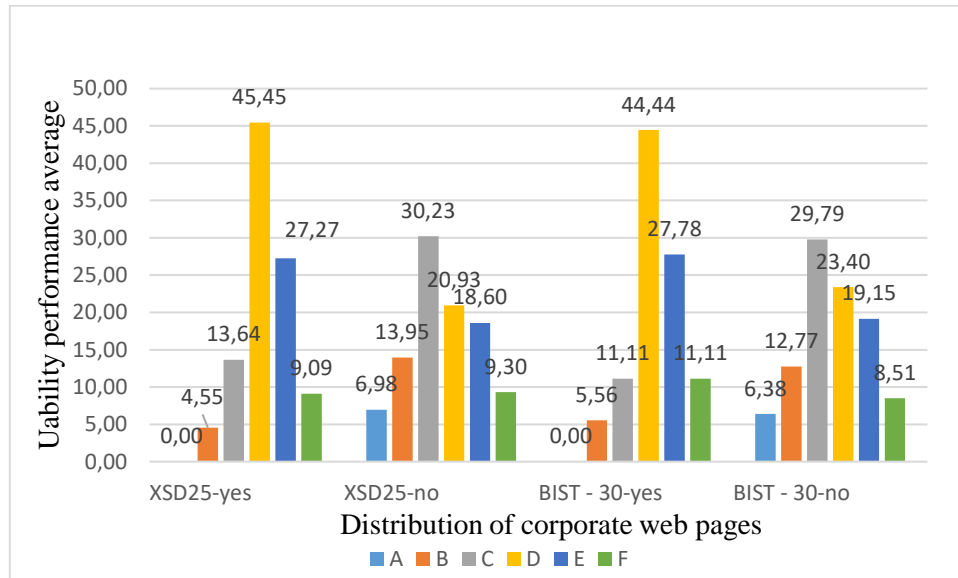

Figure 3. Percentage of performance grades (A-F) by corporates

The distribution percentages of companies categorized according to their ownership of XSD25 and BIST 30 companies are shown in Figure 3. It is seen that corporate web pages, especially those listed in the XSD25 (XSD25- yes) and BIST 30 (BIST 30-yes), perform below average for "A" performance.

Table 5 provides an overview of the performance quality metrics of web pages based on the XSD25 and BIST-30 companies. The full loading time of a corporate's web page is not listed in the BIST-30 but is listed in the XSD25 exceeded 94 seconds. Additionally, a detailed list of the first five and last five corporates based on the mean full loading time of web pages is presented.

Among the listed companies, Mavi Giyim Sanayi ve Ticaret A.Ş. demonstrated the best performance with a loading time of less than 2 seconds. Conversely, Doğuş Otomotiv Servis ve Ticaret A.Ş. had the longest full loading time, followed by Galata Wind Enerji A.Ş., Logo Yazılım Sanayi ve Ticaret A.Ş., Doğan Şirketler Grubu Holding A.Ş., and Pınar Süt Mamülleri Sanayi A.Ş."

Table 5. **Quality performance summary of web pages by corporates**

Performance Metrics	XSD25 & BIST 30			
	XSD25-yes	**XSD25-no**	**BIST 30-yes**	**BIST 30-no**
	(n=22)	(n=43)	(n=18)	(n=47)
Fully Loaded Time (s)				
Min.	2.1	1.4	2.1	1.4
Mean	8.3	5.3	7.8	5.6
Max.	94.8	63.6	17.4	94.8
First Contentful Paint (s)				
Min.	1.1	0.236	1.1	0.236
Mean	2.4	1.03	2.75	2.2
Max.	13.2	12	13.2	12
Speed Index (s)				
Min.	1.4	0.448	1.4	0.448
Mean	3.45	3.2	3.75	2.9
Max.	13.2	14.6	13.2	14.6
Total Blocking Time (ms)				
Min.	0	0	0	0
Mean	0	50	2	0
Max.	407	666	407	666

In this research, the general page sizes of sustainability web pages were also taken into account. Table 7 examines general area sizes and determines threshold ranges according to general averages. Notably, on average, 81.75% of businesses had a page weight below 4MB, which is generally considered respectable performance.

Table 6. Ranking of corporates by average fully loaded times

Corporate	XSD25	BIST 30	Fully loaded time (s)
Mavi Giyim Sanayi ve Ticaret A.Ş.	no	no	1.4
Türkiye Vakıflar Bankası T.A.O.	no	no	1.6
Bim Birleşik Mağazalar A.Ş.	yes	yes	2.1
Akenerji Elektrik Üretim A.Ş.	no	no	2.2
Polisan Holding A.Ş.	no	no	2.2
…		…	…
Pınar Süt Mamülleri Sanayi A.Ş.	no	no	19.8
Doğan Şirketler Grubu Holding A.Ş.	yes	no	26.5
Logo Yazılım Sanayi ve Ticaret A.Ş.	no	no	35.6
Galata Wind Enerji A.Ş.	no	no	63.6
Doğuş Otomotiv Servis ve Ticaret A.Ş.	yes	no	94.8

In addition, the page widths of the web pages of companies that not listed in the XSD25 (no) and BIST 30 (no) were smaller than those of companies that listed in the BIST-30 (BIST-30 yes) and XSD25 (XSD25 yes). The web pages of companies, not listed in the BIST-30, load faster than other sustainability web pages and have the potential to cause a slowdown in clicks and loading.

Table 7 Distributions of overall sizes of corporate web pages

Total Page Size (MB)	Number of web pages			
	XSD25-yes	XSD25-no	BIST 30-yes	BIST 30-no
	(n=22)	(n=43)	(n=17)	(n=47)
0 – 3.59 (very good)	17(%77.27)	37(%86.04)	13(%76.47)	41(%87.23)
4 –5.9 (good)	2 (%9.09)	2(%4.65)	2(%11.76)	2(%4.25)
6 – 7.9 (average)	0 (%0)	2 (%4.65)	0 (%0)	2(%4.25)
8 – 9.9 (bad)	1 (%4.54)	1 (%2.32)	0 (%0)	2(%4.25)
10 and above (very bad)	2 (%9.09)	1(%2.32)	2 (%11.76)	0(0%)

Table 8 lists the top five corporate sustainability web pages by number of web pages ranging from 0 – 1.4 MB (very good), 8 – 9.9 (bad) and 10 and above (very bad). In this context, the best web page in loading is Türkiye Vakıflar Bankası T.A.O and the worst web page in loading is Arçelik A.Ş.

Table 8 Ranking of corporates according to total gage size (mb)

Company	XSD25	BIST 30	Total Page Size (MB)
Türkiye Vakıflar Bankası T.A.O.	no	no	0.00399MB
Aksigorta A.Ş.	no	no	0.37MB
Akfen Gayrimenkul Yatırım Ortaklığı A.Ş.	no	no	0.648MB
DO & CO	no	no	0.708MB
Ülker Bisküvi Sanayi A.Ş.	no	no	0.725MB
…		…	…
İş Yatırım Menkul Değerler A.Ş.	no	no	8.62
Doğuş Otomotiv Servis ve Ticaret A.Ş.	yes	no	9.06
Türkiye Şişe ve Cam Fabrikaları A.Ş.	yes	yes	11.9
Esenboğa Elektrik Üretim A.Ş.	no	no	22.9
Arçelik A.Ş.	yes	yes	28.9

4.3. Security Results

As part of the security investigation, we assessed the risk levels of the corporate sustainability web pages using the SUCURI tool. The tool categorizes risk levels into Minimum, Low, Medium, High, and Critical. Notably, more than 50% of the analyzed web pages showed a low risk level. However, no web pages were found to have high or critical risk levels. Figure 4 illustrates the distribution of risk levels for enterprises based on the XSD25 and BIST-30 companies. The analysis reveals that the majority of risk levels fall within the low and medium categories across both XSD25 and BIST-30 companies. Furthermore, a significant portion of web pages belonging to businesses not listed in the BIST-30 companies was found to have low risk levels.
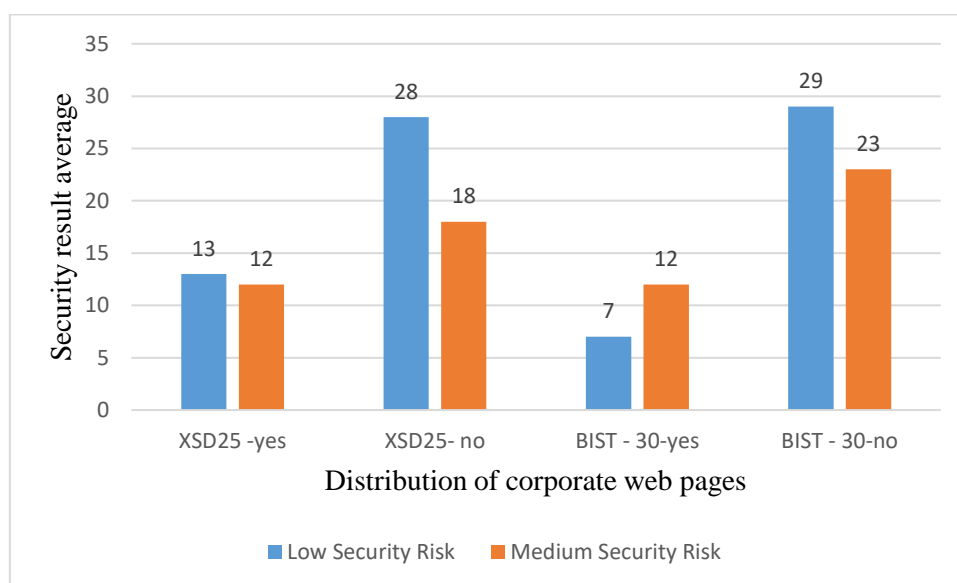
Figure 4. Percentage of security risk levels of the web pages of corporates

Table 9 provides an overview of the distribution of web servers. Upon examination of the entire distribution, it is evident that the most commonly used web server is Microsoft-IIS 10.0, accounting for approximately 22.26% of usage. Following closely is the Apache web server, with a usage percentage of 5.63%. Figure 5 illustrates the distribution of web server types according to the XSD25 and BIST-30 companies. Consistently, Microsoft-IIS 10.0 emerges as the predominant choice, being the most frequently used web server across almost all corporates, followed by Apache. This trend underscores the widespread adoption of Microsoft-IIS 10.0 in the web server landscape.

Table 9. Distribution of web servers by web pages

Type of web server	Number of web pages
Microsoft-IIS 10.0	8(%22.26)
Nginx	2(%2.81)
LiteSpeed	1(%1.40)
Pepyaka 1.19.10	1(%1.40)
Microsoft-IIS 8.5	1(%1.40)
Nginx 1.18.0	1(%1.40)
Unknown	52(%73.23)

4.4. Mobile Friendly Results

The testing was conducted using the Google Mobile-Friendly Testing Tool. Out of the 71 web page contents, 70 underwent testing, while one web page was excluded due to an error indicating that Google could not use its URL. As illustrated in Figure 6, the mobile responsiveness of these 70 web pages was assessed. Of the tested web pages, 91 percent (64) successfully passed the mobile compatibility test, while 9 percent (6 web pages) did not meet

the criteria for mobile compatibility. It is worth noting that the excluded web page was not evaluated due to an unavailable error from Google.
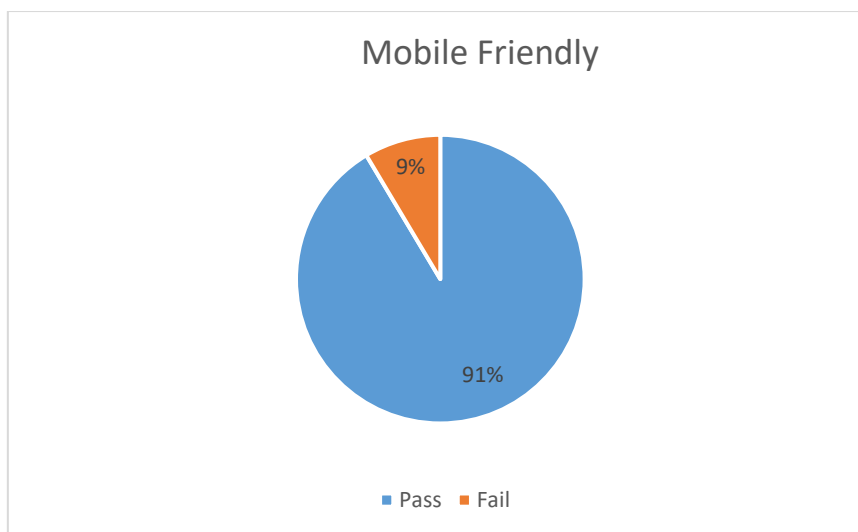

Figure 5 Mobile friendly results

4.5. Broken Links Results

The Dead Link Checker an automated testing tool was employed to evaluate the presence of broken links on the web pages of 71 companies. The results of this analysis are outlined in Table 10. Out of the total number of company web pages assessed, 376 were found to have broken links. Additionally, only approximately 0.15% of business web pages were free of broken links, indicating that this issue was prevalent across the board. Interestingly, the corporates not listed in the XSD25 and BIST 30 were found to have the highest number of broken links.

Table 10. Broken links results

	# of URLs checked Average	Broken Links		
		Min	Avg	Max
XSD25-yes	1689.84	1	56.44	297
XSD25-no	1537.66	0	54.41	376
BIST - 30-yes	1702.94	0	45.5	297
BIST - 30-no	1549.9	0	104.16	376

5. CONCLUSION

In evaluating the quality of sustainability web pages for companies, three crucial factors stand out: accessibility, usability, and security. This research analyzed the accessibility, usability, and security of 71 Turkish company sustainability web pages by using online automated testing tools such as TAW, GT Metrix, Sucuri SiteCheck, and Dead Link Checker.

The findings revealed significant accessibility shortcomings in these corporate sustainability web pages. Consequently, it is apparent that these web pages do not meet the necessary standards for effective and satisfactory use by all stakeholders. The TAW tool found no errors at conformance level AA, but the results revealed that none of the evaluated web pages met the minimum conformance level A. Upon comparing error occurrences per corporate web page, those not listed in the XSD25 performed better, while those not listed in the BIST-30 performed poorly. This investigation highlights that the most frequently violated control compliance points at level A include 1.1.1 - Out of Text Content and 2.4.4 - Link Purpose (In Context). As a result, we advise developers and administrators to adhere to guidelines such as WCAG 2.0 when creating web pages with a wide range of stakeholders.

In assessing usability, we examined the loading times, performance scores, and page sizes of corporate's sustainability web pages. The results of the page performance control indicate that 9% of the web pages have performance values below the acceptable threshold. Upon review, the best performance was observed companies are not listed both in BIST 30 and XSD25, while the worst performance was noted in companies are listed both in BIST 30 and XSD25. Additionally, longer page load times are linked to higher HTTP request counts and larger page sizes. We suggest optimizing image sizes, reducing query numbers, and minimizing web page size. By utilizing web optimization tools, developers can enhance page performance through consolidation or compression of CSS, HTML, and JavaScript content.

In the examination of security measures on corporate sustainability web pages, it was observed that companies are not listed both in XSD25 and BIST 30 demonstrated the highest level of performance. Regarding SSL encryption, findings revealed that over 95% of the assessed web pages ensure secure communication. Additionally, 38% of the evaluated web pages publicly disclose version information of their web servers, thereby increasing the vulnerability to potential hacking attempts. It is imperative to emphasize the importance of implementing robust security measures to mitigate the risk of cyber-attacks and ensure secure communication channels.

These results contribute to the expanding body of research concerning the accessibility, usability, and security of corporate sustainability web pages, particularly within the context of Turkey. They will inspire developers of Turkish company sustainability web pages to reassess and enhance their efforts in aligning with WCAG 2.0 standards, thereby ensuring accessibility for all users. Furthermore, this study provides valuable insights for those who will work with automatic online tools in the future, emphasizing the need to increase web page accessibility and make them suitable for every user. Additionally, supplementing the findings of this study with comprehensive user testing could further enhance our understanding of accessibility issues.

Appendix: Corporate lists

Corporate	Web Page Link
Aksigorta A.Ş.	https://www.aksigorta.com.tr/online-faaliyet-raporu-2021/surdurulebilirlik-politikasi/
Enerjisa Enerji A.Ş.	https://www.enerjisa.com.tr/tr/surdurulebilirlik
Anadolu Anonim Türk Sigorta Şirketi	https://www.anadolusigorta.com.tr/surdurulebilirlik
Türkiye İş Bankası A.Ş.	https://www.isbank.com.tr/bankamizi-taniyin/surdurulebilirlik
Mavi Giyim Sanayi ve Ticaret A.Ş.	https://www.mavi.com/sustainability/index.html
Türkiye Vakıflar Bankası T.A.O.	https://www.vakifbank.com.tr/yatirimci-iliskileri-surdurulebilirlik--vakifbank.aspx?pageID=1024
Pegasus Hava Taşımacılığı A.Ş.	https://www.pegasusyatirimciiliskileri.com/tr/kurumsal-yonetim/surdurulebilirlik
İş Finansal Kiralama A.Ş.	https://www.isleasing.com.tr/Sites/1/content/Surdurulebilirlik/2021/tr/m-4-0.html
Naturel Yenilenebilir Enerji Ticaret A.Ş.	https://www.naturelenerji.com.tr/surdurulebilirlik
Türk Telekomünikasyon A.Ş.	https://www.ttyatirimciiliskileri.com.tr/tr-tr/sosyal-sorumlu-yatirim/sayfalar/surdurulebilirlik
Çimsa Çimento Sanayi ve Ticaret A.Ş.	https://cimsa.com.tr/surdurulebilirlik/
Pınar Süt Mamülleri Sanayi A.Ş.	https://www.pinar.com.tr/surdurulebilirlik/surdurulebilirlik/Surdurulebilirlik/3383/3819/0
Türkiye Sınai Kalkınma Bankası A.Ş.	https://www.tskb.com.tr/hizmetler/surdurulebilir-bankacilik
Kerevitaş Gıda Sanayi ve Ticaret A.Ş.	https://www.kerevitas.com.tr/tr/yatirimci-iliskileri/surdurulebilirlik
Türk Hava Yolları A.O.	https://investor.turkishairlines.com/tr/kurumsal-yonetim/surdurulebilirlik
Aksa Enerji Üretim A.Ş.	https://www.aksaenerji.com.tr/tr/surdurulebilirlik/
Aydem Yenilenebilir Enerji A.Ş.	https://www.aydemyenilenebilir.com.tr/surdurulebilirlik
Anadolu Efes Biracılık ve Malt Sanayii A.Ş.	https://www.anadoluefes.com/sayfa/1/232/surdurulebilirlik
Akiş Gayrimenkul Yatırım Ortaklığı A.Ş.	https://akisgyo.com/surdurulebilirlik-yaklasimimiz
İskenderun Demir ve Çelik A.Ş.	https://www.isdemir.com.tr/surdurulebilirlik/yaklasimimiz/
Galata Wind Enerji A.Ş.	https://www.galatawindenerji.com/surdurulebilirlik/
AG Anadolu Grubu Holding A.Ş.	https://www.anadolugrubu.com.tr/sayfa/1/379/anadoludan-yarinlara
Sun Tekstil Sanayi ve Ticaret A.Ş.	https://www.suntekstil.com.tr/surdurulebilirlik-yolculugumuz/
QUA Granite Hayal Yapı ve Ürünleri Sanayi Ticaret A.Ş.	https://surdurulebilirlik.qua.com.tr/
Esenboğa Elektrik Üretim A.Ş.	https://www.esenbogaelektrik.com.tr/
Türkiye Garanti Bankası A.Ş.	https://www.garantibbvainvestorrelations.com/tr/entegre-faaliyet-raporu-2021/surdurulebilirlik.aspx
Türk Traktör ve Ziraat Makineleri A.Ş.	https://www.turktraktor.com.tr/surdurulebilirlik-yaklasimimiz
Vestel Elektronik Sanayi ve Ticaret A.Ş.	https://www.vestelyatirimciiliskileri.com/surdurulebilirlik/surdurulebilirlik-stratejisi.aspx
Doğan Şirketler Grubu Holding A.Ş.	https://www.doganholding.com.tr/surdurulebilirlik/genel-bakis/
Logo Yazılım Sanayi ve Ticaret A.Ş.	https://www.logo.com.tr/logo-surdurulebilirlik
Akfen Gayrimenkul Yatırım Ortaklığı A.Ş.	https://www.akfengyo.com.tr/tr/yatirimci-iliskileri/surdurulebilirlik-ve-kurumsal-yonetim
Akçansa Çimento Sanayi ve Ticaret A.Ş.	https://www.akcansa.com.tr/surdurulebilirlik/akcansada-surdurulebilirlik/
Aygaz A.Ş.	https://kurumsal.aygaz.com.tr/kurumsal/surdurulebilirlik-yonetimi
Kordsa Teknik Tekstil A.Ş.	https://www.kordsa.com/tr/surdurulebilirlik/default/surdurulebilirlik/273/0/0
Akbank T.A.Ş.	https://www.akbankinvestorrelations.com/tr/surdurulebilirlik/

Tav Havalimanları Holding A.Ş.	https://tavhavalimanlari.com.tr/tr-TR/surdurulebilirlik
Turkcell İletişim Hizmetleri A.Ş.	https://www.turkcell.com.tr/tr/hakkimizda/kurumsal-iletisim/surdurulebilirlik
Aselsan Elektronik Sanayi ve Ticaret A.Ş.	https://www.aselsan.com/tr/surdurulebilirlik
Tat Gıda Sanayi A.Ş.	https://www.tatgida.com.tr/tr/surdurulebilirlik-stratejisi/
Hacı Ömer Sabancı Holding A.Ş.	https://yatirimciiliskileri.sabanci.com/tr/surdurulebilirlik/default/Kurumsal-Yonetim-ve-Surdurulebilirlik/7/63/0
Akenerji Elektrik Üretim A.Ş.	https://www.akenerji.com.tr/surdurulebilirlik
Polisan Holding A.Ş.	https://polisanholding.com/surdurulebilirlik/surdurulebilirlik_v17
Enka İnşaat ve Sanayi A.Ş.	https://www.enka.com/sustainability/tr/
Türkiye Halk Bankası A.Ş.	https://www.halkbank.com.tr/tr/bankamiz/surdurulebilirlik/surdurulebilirlik/surdurulebilirlik-organizasyonu.html
Otokar Otomotiv ve Savunma Sanayi A.Ş.	https://www.otokar.com.tr/surdurulebilirlik/surdurulebilirlik
Petkim Petrokimya Holding A.Ş.	https://www.petkim.com.tr/surdurulebilirlik
Global Yatırım Holding A.Ş.	https://globalyatirim.com.tr/tr/77-yatirimci-iliskileri/surdurulebilirlik
Bizim Toptan Satış Mağazaları A.Ş.	https://www.bizimtoptan.com.tr/s/surdurulebilirlik
TÜPRAŞ - Türkiye Petrol Rafinerileri A.Ş.	https://www.tupras.com.tr/surdurulebilirlik-ilkeleri
İş Yatırım Menkul Değerler A.Ş.	https://www.isyatirim.com.tr/tr-tr/bizi-taniyin/hakkimizda/Sayfalar/surdurulebilirlik.aspx
Bim Birleşik Mağazalar A.Ş.	https://www.bim.com.tr/Categories/691/surdurulebilirlik.aspx
Koç Holding A.Ş.	https://www.koc.com.tr/surdurulebilirlik
Aksa Akrilik Kimya Sanayii A.Ş.	https://www.aksa.com/tr/surdurulebilirlik/k-297
Ülker Bisküvi Sanayi A.Ş.	https://www.ulker.com.tr/tr/toplum-icin/surdurulebilirlik
Türkiye Şişe ve Cam Fabrikaları A.Ş.	https://sustainability.sisecam.com/tr
Karsan Otomotiv Sanayii ve Ticaret A.Ş.	https://www.karsan.com/tr/surdurulebilirlik/surdurulebilirlik-raporu
Tekfen Holding A.Ş.	https://www.tekfen.com.tr/surdurulebilirlik-vizyonu-3-4
Anadolu Hayat Emeklilik A.Ş.	https://www.anadoluhayat.com.tr/surdurulebilirlik
Albaraka Türk Katılım Bankası A.Ş.	https://www.albaraka.com.tr/tr/hakkimizda/surdurulebilirlik
Brisa Bridgestone Sabancı Lastik Sanayi ve Ticaret A.Ş.	https://www.brisa.com.tr/surdurulebilirlik/
Zorlu Enerji Elektrik Üretim A.Ş.	https://www.zorluenerji.com.tr/tr/surdurulebilirlik/surdurulebilirlik-yonetimi/
DO & CO	https://www.doco.com/surdurulebilirlik-oncelikler/?lang=tr
Yapı ve Kredi Bankası A.Ş.	https://www.yapikredi.com.tr/yapi-kredi-hakkinda/surdurulebilirlik/
Şekerbank T.A.Ş.	https://www.sekerbank.com.tr/hakkimizda/surdurulebilir-bankacilik/
Arçelik A.Ş.	https://www.arcelikglobal.com/tr/surdurulebilirlik/genel-bilgi/
Coca-Cola İçecek A.Ş.	https://www.cci.com.tr/s%C3%BCrd%C3%BCr%C3%BClebilirlik
Doğuş Otomotiv Servis ve Ticaret A.Ş.	https://www.dogusotomotiv.com.tr/tr/surdurulebilirlik/surdurulebilirlik-1/surdurulebilirlik1
Ereğli Demir ve Çelik Fabrikaları T.A.Ş.	https://www.erdemir.com.tr/surdurulebilirlik/yaklasimimiz/
Ford Otomotiv Sanayi A.Ş.	https://www.ford.com.tr/ford-deneyimi/surdurulebilirlik
Migros Ticaret A.Ş.	https://www.migroskurumsal.com/surdurulebilirlik
Tofaş Türk Otomobil Fabrikası A.Ş.	https://www.tofas.com.tr/Surdurulebilirlik/GenelBakis

REFERENCES

Adams, C.A. and Frost, G. (2004) The Development of Corporate Web-Sites and implications for Ethical, Social and Environmental Reporting through these Media.

Adepoju, S.A., Shehu, I.S. and Bake, P. (2016) Accessibility Evaluation and Performance Analysis of e-Government Websites in Nigeria, Journal of Advances in Information Technology, 7(1), 49–53. Available at: https://doi.org/10.12720/jait.7.1.49-53.

Agrawal, G., Kumar, D., Singh, M. and Dani, D. (2019) Evaluating accessibility and usability of airline websites, in Communications in Computer and Information Science. Springer Verlag, 392–402. Available at: https://doi.org/10.1007/978-981-13-9939-8_35.

Akgül, Y. (2018) Banking Websites in Turkey: an Accessibility, Usability and Security Evaluation, Journal of Business Research - Turk, 10(1), 782–796. Available at: https://doi.org/10.20491/isarder.2018.396.

Akgül, Y. (2021) Accessibility, usability, quality performance, and readability evaluation of university websites of Turkey: a comparative study of state and private universities, Universal Access in the Information Society, 20(1), 157–170. Available at: https://doi.org/10.1007/s10209-020-00715-w.

AkgüL, Y. and Vatansever, K. (2016) Web Accessibility Evaluation of Government Websites for People with Disabilities in Turke', Journal of Advanced Management Science, 201–210. Available at: https://doi.org/10.12720/joams.4.3.201-210.

Alhadreti, O. (2021) An Accessibility Evaluation of the Websites of Top-ranked Hospitals in Saudi Arabia, International Journal of Advanced Computer Science and Applications, 12(1), 692–698. Available at: https://doi.org/10.14569/IJACSA.2021.0120180.

Alsaeedi, A. (2020) Comparing web accessibility evaluation tools and evaluating the accessibility of webpages: Proposed frameworks, Information (Switzerland), 11(1). Available at: https://doi.org/10.3390/info11010040.

Al-Sakran, H.O. and Alsudairi, M.A. (2021) Usability and Accessibility Assessment of Saudi Arabia Mobile E-Government Websites, IEEE Access, 9, 48254–48275. Available at: https://doi.org/10.1109/ACCESS.2021.3068917.

Alsmadi, I. and Abu-Shanab, E. (2016) E-government website security concerns and citizens' adoption, Electronic Government, an International Journal, 12(3), 243–255.

Bansal, P. and Song, H.C. (2017) Similar but not the same: Differentiating corporate sustainability from corporate responsibility, Academy of Management Annals, 11(1), 105–149. Available at: https://doi.org/10.5465/annals.2015.0095.

Barricelli, B. R., Casiraghi, E., Dattolo, A. and Rizzi, A. (2021) 15 Years of Stanca Act: Are Italian Public universities websites accessible?, Universal Access in the Information Society, 20(1), 185–200. Available at: https://doi.org/10.1007/s10209-020-00711-0.

Bilal, M., Yu, Z., Song, S. and Wang, C. (2019) Evaluate Accessibility and Usability Issues of Particular China and Pakistan Government Websites, in In 2019 2nd International Conference on Artificial Intelligence and Big Data (ICAIBD). IEEE, 316–322.

Conte, F., Coppola, C., Sardanelli, D., Vollero, A. and Siano, A. (2022) Accessibility and social inclusion: an empirical investigation on the adoption of World Wide Web Consortium guidelines on corporate websites, SINERGIE, 89(107).

Csontos, B. and Heckl, I. (2021) Accessibility, usability, and security evaluation of Hungarian government websites, Universal Access in the Information Society, 20(1), 139–156. Available at: https://doi.org/10.1007/s10209-020-00716-9.

Dawkins, J. (2005) Corporate responsibility: The communication challenge, Journal of Communication Management, 108–119. Available at: https://doi.org/10.1108/13632540510621362.

Free Broking Link Checking Tool-Dead Link Checker (no date). Available at: https://www.deadlinkchecker.com/. Accessed 15 Oct 2021 (Accessed: 22 February 2024).

Dukes, L., Yuan, X. and Akowuah, F. (2013) A Case Study on Web Application Security Testing with Tools and Manual Testing. In 2013 Proceedings of IEEE Southeastcon. Available at: https://doi.org/10.1109/secon.2013.6567420.

Elisa, N. (2020) Usability, Accessibility and Web Security Assessment of E-government Websites in Tanzania, arXiv preprint arXiv: 2006.1425 [Preprint].

Fatima, K., Bawany, N.Z. and Bukhari, M. (2020) Usability and accessibility evaluation of banking websites, in 2020 International Conference on Advanced Computer Science and Information Systems, ICACSIS 2020. Institute of Electrical and Electronics Engineers Inc., 247–256. Available at: https://doi.org/10.1109/ICACSIS51025.2020.9263083.

Fogli, D. and Guida, G. (2015) A practical approach to the assessment of quality in use of corporate web sites, Journal of Systems and Software, 99, 52–65. Available at: https://doi.org/10.1016/j.jss.2014.09.006.

Gonçalves, R., Rocha, T., Martins, J., Branco, F., and Au-Yong-Oliveira, M. (2018) Evaluation of e-commerce websites accessibility and usability: an e-commerce platform analysis with the inclusion of blind users, Universal Access in the Information Society, 17(3), 567–583. Available at: https://doi.org/10.1007/s10209-017-0557-5.

Google Mobile Friendly Testing (no date). Available at: https://search.google.com/test/mobile-friendly (Accessed: 22 February 2024).

Gopinath, S., Senthooran, V., Lojenaa, N., and Kartheeswaran, T. (2016) Usability and accessibility analysis of selected government websites in Sri Lanka, in Proceedings - 2016 IEEE Region 10 Symposium, TENSYMP 2016. Institute of Electrical and Electronics Engineers Inc., 394–398. Available at: https://doi.org/10.1109/TENCONSpring.2016.7519439.

GTmetrix (2009) Website Performance Testing and Monitoring. Available at: https://gtmetrix.com/ (Accessed: 22 February 2024).

Hamid, S., Bawany, N.Z. and Zahoor, K. (2020) Assessing ecommerce websites: Usability and accessibility study, in 2020 International Conference on Advanced Computer Science and Information Systems, ICACSIS 2020. Institute of Electrical and Electronics Engineers Inc., 199–204. Available at: https://doi.org/10.1109/ICACSIS51025.2020.9263162.

Ismail, A. and Kuppusamy, K.S. (2022) Web accessibility investigation and identification of major issues of higher education websites with statistical measures: A case study of college websites, Journal of King Saud University - Computer and Information Sciences, 34(3), 901–911. Available at: https://doi.org/10.1016/j.jksuci.2019.03.011.

Ismail, A., Kuppusamy, K.S. and Paiva, S. (2020) Accessibility analysis of higher education institution websites of Portugal, Universal Access in the Information Society, 19(3), 685–700. Available at: https://doi.org/10.1007/s10209-019-00653-2.

Ismailova, R. and Inal, Y. (2017) Web site accessibility and quality in use: a comparative study of government Web sites in Kyrgyzstan, Azerbaijan, Kazakhstan and Turkey, Universal Access in the Information Society, 16(4), 987–996. Available at: https://doi.org/10.1007/s10209-016-0490-z.

Ismailova, R. and Kimsanova, G. (2017) Universities of the Kyrgyz Republic on the Web: accessibility and usability, Universal Access in the Information Society, 16(4), 1017–1025. Available at: https://doi.org/10.1007/s10209-016-0481-0.

Jasem, Z., AlMeraj, Z. and Alhuwail, D. (2022) Evaluating breast cancer websites targeting Arabic speakers: empirical investigation of popularity, availability, accessibility, readability, and quality, BMC Medical Informatics and Decision Making, 22(1). Available at: https://doi.org/10.1186/s12911-022-01868-9.

Kamal, I. W., Alsmadi, I. M., Wahsheh, H. A. and Al-Kabi, M. N. (2016) Evaluating Web Accessibility Metrics for Jordanian Universities, International Journal of Advanced Computer Science and Applications, 7(7), 113–122.

Karaim, N.A. and Inal, Y. (2019) Usability and accessibility evaluation of Libyan government websites, Universal Access in the Information Society, 18(1), 207–216. Available at: https://doi.org/10.1007/s10209-017-0575-3.

Kaur, A., Diksha Dani and Gaurav Agrawal (2017) Evaluating the accessibility, usability and security of Hospitals websites: An exploratory study, in. 2017 7th international conference on cloud computing, data science & engineering-confluence. IEEE, 674–680.

Kesswani, N. and Kumar, S. (2016) Accessibility analysis of websites of educational institutions, Perspectives in Science, 8, 210–212. Available at: https://doi.org/10.1016/j.pisc.2016.04.031.

Kurt, S. (2017) Accessibility of Turkish university Web sites, Universal Access in the Information Society, 16(2), 505–515. Available at: https://doi.org/10.1007/s10209-016-0468-x.

Kuzma, J., Law, J., Bell, V. and Williams, N. (2017) A study of global hospital websites for accessibility compliance, European Journal of Business and Social Sciences, 6(06), 15–28.

Leitner, M.L., Strauss, C. and Stummer, C. (2016) Web accessibility implementation in private sector organizations: motivations and business impact, Universal Access in the Information Society, 15(2), 249–260. Available at: https://doi.org/10.1007/s10209-014-0380-1.

Macakoğlu, Ş.S. and Peker, S. (2023) Accessibility evaluation of university hospital websites in Turkey, Universal Access in the Information Society, 22(3), 1085–1093. Available at: https://doi.org/10.1007/s10209-022-00886-8.

Macakoğlu, Ş.S., Peker, S. and Medeni, İ.T. (2023) Accessibility, usability, and security evaluation of universities' prospective student web pages: a comparative study of Europe, North America, and Oceania, Universal Access in the Information Society, 22(2), 671–683. Available at: https://doi.org/10.1007/s10209-022-00869-9.

Nielsen, A.E. and Thomsen, C. (2009) Investigating CSR communication in SMEs: a case study among Danish middle managers, Business ethics: A European review, 18(1), 83–93.

Nielsen, J. (2000) Designing Web Usability.

Nour, R. (2022) An Assessment of Accessibility and Usability of Saudi Online FinTech Services for People with Disabilities, Computational and Mathematical Methods in Medicine, 2022. Available at: https://doi.org/10.1155/2022/8610844.

Oyefolahan, I. O., Sule, A. A., Adepoju, S. A. and Babakano, F. J. (2019) Keeping with the Global Trends: An Evaluation of Accessibility and Usability of Nigerian Banks Websites, International Journal of Information Engineering and Electronic Business, 11(2), 44–53. Available at: https://doi.org/10.5815/ijieeb.2019.02.06.

Pădure, M. and Independentei, S. (2019) Exploring the differences between five accessibility evaluation tools Costin Pribeanu Academy of Romanian Scientists. Available at: www.totalvalidator.com.

Paul, S. and Das, S. (2020) Accessibility and usability analysis of Indian e-government websites, Universal Access in the Information Society, 19(4), 949–957. Available at: https://doi.org/10.1007/s10209-019-00704-8.

Ratnasingam, P. (2002) The importance of technology trust in Web services security, Information Management and Computer Security, 10(5), 255–260. Available at: https://doi.org/10.1108/09685220210447514.

Rowbottom, N. and Lymer, A. (2009) Exploring the use of online corporate sustainability information, Accounting Forum, 33(2),176–186. Available at: https://doi.org/10.1016/j.accfor.2009.01.003.

Singh, H. and Singh, A. (2020) Factors influencing web accessibility of corporate information: Indian evidence, International Journal of e-Business Research, 16(3), 1–19. Available at: https://doi.org/10.4018/IJEBR.2020070101.

Sucuri (2007) Complete Website Security, Protection & Monitoring'. Available at: https://sitecheck.sucuri.net/ (Accessed: 22 February 2024).

TAW (2009) Web Accessibility and W3C Standardization Service. Available at: https://www.tawdis.net/index (Accessed: 22 February 2024).

Venkatesh, V. and Agarwal, R. (2006) Turning visitors into customers: A usability-centric perspective on purchase behavior in electronic channels, Management Science, 52(3), 367–382. Available at: https://doi.org/10.1287/mnsc.1050.0442.

Verkijika, S.F. and De Wet, L. (2020) Accessibility of South African university websites, Universal Access in the Information Society, 19(1), 201–210. Available at: https://doi.org/10.1007/s10209-018-0632-6.

(WCAG) 2.0 (2008) Web Content Accessibility Guidelines. Available at: https://www.w3.org/TR/WCAG20/ (Accessed: 26 February 2024).

Web Accessibility Initiative (WAI) | W3C (2005). Available at: https://www.w3.org/WAI/fundamentals/accessibility-intro/ (Accessed: 26 February 2024).

Jun, T. W., Xiang, L. Z., Ismail, N. A., Goy, W. and Yi, R. (2021) Usability evaluation of social media websites, International Research Journal of Modernization in Engineering Technology and Science, 3(01), 216–221. Available at: https://web.wechat.com/.

Yerlikaya, Z. and Durdu, P.O. (2017) Evaluation of accessibility of university websites: A case from turkey, in Communications in Computer and Information Science. Springer Verlag, 663–668. Available at: https://doi.org/10.1007/978-3-319-58753-0_94.

Youngblood, N.E. and MacKiewicz, J. (2012) A usability analysis of municipal government website home pages in Alabama, Government Information Quarterly, 29(4), 582–588. Available at: https://doi.org/10.1016/j.giq.2011.12.010.

Zarish, S.S., Habib, S. and Islam Muhammed (2019) Analyzing Usability of Educational Websites Using Automated Tools, In 2019 International Conference on Computer and Information Sciences (ICCIS), 1–4.