Evaluating the Performance of Community Forum Websites Through Analytical Tools

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Abstract: The use of websites has skyrocketed after the growth of the Internet. This makes web analysis an inevitable practice to maintain and deliver good user experience and performance. This study analyzes three community forms, namely community forum 1, community forum 2 and community forum 3. The evaluation of these community forums are performed on the basis of evaluation metrics like: First Contentful Paint (FCP), Largest Contentful Paint (LCP), Curved Layout Shift (CLS), Time to First Byte (TTFB) and Security Grading. These evaluations are made possible by free of cost tools like GTMetrix and PageSpeedInsights for website's performance analysis and Qyalys for security grading. The evaluation provides glimpses into efficiency and point out areas where websites could improve.The comparison and evaluation processes are applied on these community forums in order to provide better responsive websites and an overall good experience for the user.

1 INTRODUCTION

Community forums (Griffin and Roy, 2022) are the digital platforms that are similar to the social media websites (Malathi and Radha, 2016), where the individuals or a group of people engage themselves in discussions regarding specific subjects, share the information, and interact with one another. The forums are organised into various discussion boards or threads, thereby , permitting the members to put forward their own contents and concerns. Assessing the potency (Subbulakshmi et al., 2019) of the of community forums such as Community Forum 1, Community Forum 2, and Community Forum 3 makes it a necessary practice of keeping it up with the reflection of the metrices, to provide the users with the best user experience , engagement and the satisfaction. The users expect the websites (Thangam et al., 2016) to have the least loading time and the pages to be very responsive. A prolonged loading and the unresponsive page is a reflection of a performance dip which will further affect the number of active users, thereby rendering metrics like First Contentful Paint (FCP), Largest Contentful Paint (LCP) (Kravchenko et al., 2023), Cumulative Layout Shift (CLS), Time to First Byte (TTFB), and security protocols (H.M. et al., 2015) essential for sustaining a dynamic online community.

Additionally, WebPageTest (Catchpoint Systems, nd) includes a heavy testing environment which allows inspecting the site's performance at different browsers and under different connection speeds. Through this tool, crucial data with regard to loading time, progression in visuals, and resource usage can be detected, with a much better directed effort for the improvement in optimization compared to generic time-based approaches. In conclusion, it is as important to have an understanding of the dynamics at the community level as the technical drivers of the performance metrics that have been explored in this paper. An involved community propels user participation, fosters the creation of numerous discussions, and escalates the production of content. Using GTmetrix (Carbon60, nd), PageSpeed Insights (Google, nd), and WebPageTest to perform standard performance tests can improve this engagement to ensure that a user experiences no issues. This integrative approach, in addition to technical attributes, enhances user satisfaction in an attempt to promote increased community relevance. Constant assessment and improvement of such functioning holds potential for increasing the 'performance effectiveness', increasing retention levels and fortifying brand image –critical factors that determine success in the cut-throat con-

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text of reference to forums on the World Wide Web.

Section II outlines a review of the literature and the instruments used in Website analysis. In Section III, the testing and tools employed in this research agenda are described. Section IV describes the outcomes and evaluations obtained from experimentation prevailing with Section V inclusive of references.

2 RELATED WORK

The authors in the study (Akgül, 2024) examine Turkish government websites through looking at metrics such as the bounce rate, COC Variables which includes the mobile responsiveness, page rank as criteria which are accessibility, trust and security. In conclusion, the authors discovered that such sites are rather of low usability because of the units of user interfaces and diffused meanings reflected in numerous concepts. On a positive note, the websites performed reasonably well on public value dimensions, showcasing effective accessibility and secure infrastructure, which foster user trust. Although usability issues persist, the findings indicate that the websites align with public service goals, ensuring inclusiveness and building citizen confidence. Therefore, the study emphasizes the need for a balanced approach that enhances usability while preserving public values to create effective e-government platforms.

In their analysis of the top ten consumer goods companies, Ripa et al. (Rîpa and Nicolescu, 2023) reveal insights into the evolution of Customer Relationship Management (CRM) for 2021. Using publicly accessible data, they applied descriptive and comparative analyses across multiple CRM dimensions. The results indicate that the internal organization of CRM, encompassing process structuring and management, is the least developed area, highlighting gaps in the integration of CRM tools and strategies. However, a strong focus on customer engagement—which includes attention and customised services—has emerged as the most advanced component, underscoring the businesses' commitment to enhancing client experiences. According to the report, there are gaps between internal CRM alignment and external customer interaction, suggesting areas for improvement to effectively optimise management procedures.

Macakoglu et al. (Macakoğlu et al., 2023) conducted an assessment of usability ˘ and security for university websites in North America and Oceania, targeting prospective students. Their methodology involved the use of online automated testing tools to evaluate performance indicators like SSL encryption and loading times, alongside adherence to accessibility standards. Despite identifying no significant security vulnerabilities, the researchers noted page performance issues, particularly slow loading times, which could detract from user satisfaction. Their recommendations emphasize the importance of ongoing optimization for improved speed and responsiveness, along with a consistent commitment to accessibility standards to ensure equitable access for all users.

Kumar et al. (Kumar et al., 2021) utilize instruments such as SEOptimer and Website Grader to assess website usability, performance, and accessibility, with a focus on essential metrics like user experience and loading speed. Their assessment reveals that although numerous websites satisfy basic performance and usability criteria, specific aspects still need improvement. The authors recommend the merging of developer and user-centered improvements for superior website performance.

Web analytics procedures including page tagging and methods such as log file analysis are discussed comprehensively by Booth and others (Booth and Jansen, 2010), The authors describe their usefulness in measuring various visitor-related parameters such as traffic type and length of visit. Tagging of web pages can be done with coding which enables the provision of real time tracking. The detailed analysis of the log files provides the historical information regarding the servers logs. The authors suggest the use of these methodologies in combination to acquire a broader appreciation of the interaction rates. They recommend narrowing down the goal areas such as load time on a page .

In the study conducted by Alsaeedi et al. (Alsaeedi, 2020) two frameworks are introduced for evaluating web accessibility, specifically analyzing the effectiveness of tools such as WAVE and SiteImprove. Their results indicate that SiteImprove outperforms in detecting a broader array of accessibility challenges, including broken links and contrast issues, while also offering practical recommendations for developers. While WAVE is acknowledged for its ease of use, it falls short in thoroughly identifying more nuanced problems. The authors advocate for the utilization of various evaluation tools to achieve a more comprehensive understanding of accessibility compliance, highlighting the necessity of ongoing monitoring to ensure inclusivity for all users, particularly those with disabilities.

Andry et al. (Andry et al., 2019) apply the Webqual 4.0 framework to gauge the quality of the Lazada website, accentuating the relevance of usability, information quality, and service interaction. Their study demonstrates that well-structured menus, ap-

propriate content, and effectively designed interfaces are vital for increasing customer satisfaction by promoting more fluid navigation. These components significantly affect users' evaluations of the platform's dependability and ease of use, prompting the authors to recommend continuous advancements in these domains to uphold high engagement and satisfaction rates.

Hulya et al. (Başeğmez and Özdemir, 2023) use the GTmetrix automated testing tool to assess the online performance of companies in the BIST Technology Index. To provide a thorough performance ranking, the researchers use Grey Relational Analysis (GRA) to examine performance indicators including page size and speed index. According to their research, page load speed is important, but if it is the only focus, other important performance factors like visual stability and content optimisation may be missed. Because a diverse strategy is required to deliver high-quality user experiences, the authors advise using GTmetrix not only for performance assessment but also to improve content delivery and site layout.

The work of Gupta et al. (Gupta et al., 2024) includes an analysis of the Cooperative Store Management System is an e-commerce application developed on the MERN stack. His analysis, using Google's PageSpeed Insights tool, shows what needs optimization in different. There were other traditional web performance metrics, such as First Contentful Paint (FCP)as well as Time to Interactive (TTI). The findings suggest that advancements related to image reduction, or caching and JavaScript rendering are obligatory to improve the load speed and interactivity. In this article, the authors successfully pinpoint the significance of balancing aesthetics with functionality methods in loading the web page. For best results in regards to the use of this website, the screen resolution should be optimized to enhance the users' experience. Strategies such as lazy uploading images and getting rid of the things that slow down the page's loading are order of buy, which when coupled with sustained performance appraisal, is encouraged to sustain competitive advantage and improve the satisfaction of the users and conversion rates.

Nonetheless, the cross-sectional study conducted by Dobbala et al. (Dobbala and Lingolu, 2022) pays attention Web Vital – A set of UX data points that measure user engagement on the web — emphasizing effects of Largest Contentful Paint Meaning: The Largest Contentful Paint (LCP), First Input Delay (FID), and Cumulative Layout Shift (CLS) on user engagement. They also find out that low levels of performance in these areas are linked to high rates of bounces subsequently lower conversions thus decreasing revenues and users. retention. The authors therefore encourage the selection of those options that will ensure faster load times cross-functional times and enhance other interactions to raise global satisfactions, proposing the system-level optimization of web performance that incorporates technonomative and technical aspects of the system user-centric design.

An assessment of government and organizational homepages emphasizes many key issues regarding usability and accessibility affecting users interaction and participation across the site. While many sites indicate reasonable respect for the public values whatever these may be grows, such as clarity, security, and other factors, such as overlapping and confusion of interfaces language remain prevalent. In addition, the research discretize emphasizes their pioneering user-centred approach to realising efficient back end systems in virtue of improving performance. It means that optimization should be pushed to occur on an ongoing basis to make sure that a competitive position is kept benefit and make sure that Social media platform remain open and easy to navigate for every client the Library serves. Ultimately, balancing, termed here as Technical efficiency refers to the production of service closest to user needs for developing the technology more communication and contentedness.

3 EXPERIMENTATION

This section discuss about the tools that are employed to assess the website performance and the evaluation metrices that evaluates the user experience across the popular sites:Community Forum 1, Community Forum 2, and Community Forum 3. These tools includes GTmetrix, PageSpeed Insights, WebPageTest and Qualys. Each of these tools provides with the set of numbers that are associated with the goodness of the performance and understanding about the areas that needs improvements.

3.1 Tools Used

GTmetrix tool provides valuable insights into the website performance by assessing the page load times and the remedial work that are to be done in order to fix the problems. It focuses on finding out the components that are a setback and suggests a specific improvements. The following Figure 1 shows a snapshot of the tool.

PageSpeed Insights a website analysis software developed by Google , assesses the website on their

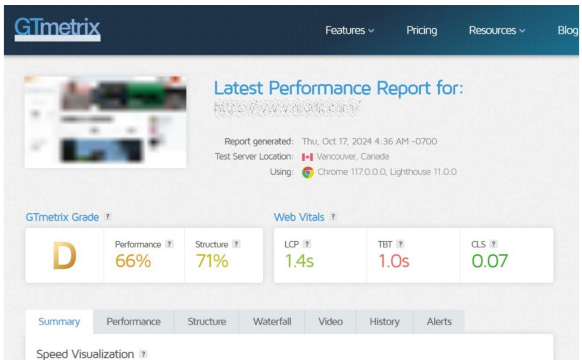

Figure 1: GTMetrix Tool

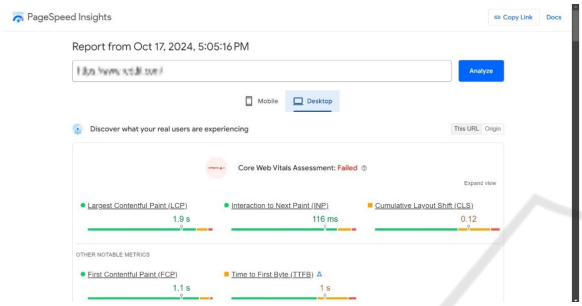

Figure 2: PageSpeed Insights tool.

accessibility and portability on difference devices like mobile and desktop. It generates a score based on various performance metrics and provides actionable suggestions to improve load times and user experience. The following Figure 2. represents a snapshot of the tool.

WebPageTest is an open source tool that allows users to test the speed and performance of their websites from various locations worldwide. It offers a comprehensive set of metrics, including filmstrip views, waterfall charts, and various timing measurements that help pinpoint performance issues. The following Figure 3 represents a snapshot of the tool.

Qualys(Qualys, Inc., nd) software tool plays a key role in evaluating server security by scanning multiple servers and assigning a security grade, ensuring robust protection of user data from the server side. The Figure 4 is a snapshot of the tool in action.

4 OBSERVATIONS AND ANALYSIS

The following tables 1, 2, and 3 provide the performance of each website for each evaluation metrix.

Figure 3: WebPageTest Tool

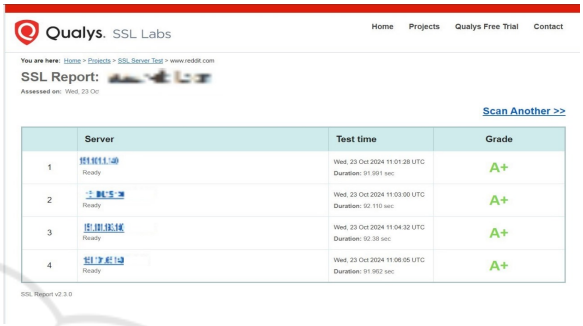

Figure 4: Qualys Tool

Table I provides a comparison of performance metrics for analyzing Community Forum 1 using GTmetrix, PageSpeed Insights, and WebPageTest. GTmetrix reports the fastest FCP at 286 ms, while PageSpeed Insights and WebPageTest show slightly longer FCP times of 1.1 and 1.12 seconds, respectively. LCP times are comparable across all tools, with WebPageTest showing a slight advantage at 1.90 seconds. CLS values are low, with WebPageTest reporting the smallest shift (0.06), indicating stable loading across the tools. GTmetrix records a high Full Load Time (FLT) of 9.2 seconds, while all tools consistently provide an A+ security grade, indicating strong security measures.

Table 2 compares the performance metrics of various tools for analyzing Community Forum 2. GTmetrix reports the lowest FCP (317 ms) and LCP (567 ms) times, indicating quicker initial loading performance. PageSpeed Insights and WebPageTest show higher FCP and LCP values, with WebPageTest being the slowest. CLS is low across all tools, signifying minimal layout shift during loading. GTmetrix also reports a longer Full Load Time (FLT) of 4.7 seconds, while all tools provide a consistent A+ security grade. Table 3 summarizes the analysis results for Community Forum 3. GTmetrix again shows the lowest FCP (480 ms) and LCP (785 ms) values, suggesting faster load times compared to the other tools. Both PageSpeed Insights and WebPageTest have slightly higher

Table 1: Comparison of various tools for analysing Community Forum 1.

Tool Name	GTmetrix	PageSpeed Insights	WebPageTest
FCP in ms	286 ms	1.1 sec	1.12 sec
LCP in ms	1.3 sec	1.9 sec	1.90 sec
Time to Interact	3.9 sec	-	-
CLS	0.12	0.11	0.06
TTFB in ms	161 ms	1 sec	0.60 sec
DOM CLT	1.2 sec	-	-
FLT	9.2 sec	-	-
Security Grade	A+	A+	A+

Table 2: Comparison of various tools for analysing Community Forum 2.

Tool Name	GTmetrix	PageSpeed Insights	WebPageTest
FCP in ms	317 ms	1.2 sec	1.99 sec
LCP in ms	567 ms	2.9 sec	3.58 sec
Time to Interact	537 ms	-	-
CLS	0.04	0.07	0.08
TTFB in ms	166 ms	0.6 sec	1.07 sec
DOM CLT	293 ms	-	-
FLT	4.7 sec	-	-
Security Grade	A+	A+	A+

Table 3: Comparison of various tools for analysing Community Forum 3.

Tool Name	GTmetrix	PageSpeed Insights	WebPageTest
FCP in ms	480 ms	1.1 sec	1.37 sec
LCP in ms	785 ms	1.2 sec	1.81 sec
Time to Interact	1.1 sec	-	-
CLS	0	0	0
TTFB in ms	137 ms	0.5 sec	0.69 sec
DOM CLT	609 ms	-	-
FLT	1.1 sec	-	-
Security Grade	A+	A+	A+

FCP and LCP times but still perform well. The CLS remains at zero across all tools, indicating a stable layout during loading. GTmetrix reports a lower FLT (1.1 seconds) for Community Forum 3, and all tools maintain an A+ security grade, highlighting strong security across the board.

Figures 5 to 9 depict the graphs plotted for each website based on their evaluation metrics. Figure 5 represents a bar chart that compares the First Contentful Paint (FCP) performance of three community forums across three different testing tools: GTmetrix, PageSpeed Insights, and WebPageTest. The x-axis represents the testing tools, and the y-axis represents the FCP time in milliseconds. The bars indicate that Community Forum 1 consistently outperforms the other two forums in terms of FCP, suggesting that it loads its initial content faster. Community Forum 2 consistently achieves faster LCP times than the other two forums, as measured by GTmetrix, PageSpeed Insights, and WebPageTest, as shown in Figure 6, suggesting that it has a more efficient rendering process for its largest content elements.

A comparison of TTI scores across three community forums in Figure 7 reveals that Community Forum 1 consistently outperforms the others in terms of becoming interactive, as measured by GTmetrix, PageSpeed Insights, and WebPageTest.

In Figure 8, the chart illustrates how Community Forum 1 consistently exhibits higher CLS scores compared to the other forums, suggesting that it faces more layout instability during page loading when evaluated by GTmetrix, PageSpeed Insights, and WebPageTest.

The bar chart in Figure 9 illustrates the Time to First Byte (TTFB) performance of the three community forums. The x-axis displays the testing tools, while the y-axis represents TTFB in milliseconds. The chart shows that Community Forum 1 consistently has the best TTFB performance, indicating a quicker initial server connection compared to the other two forums.

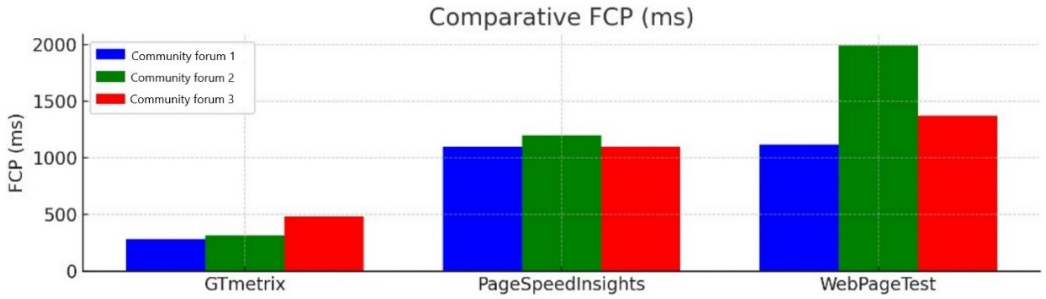

Figure 5: Comparison of FCP for the three websites.

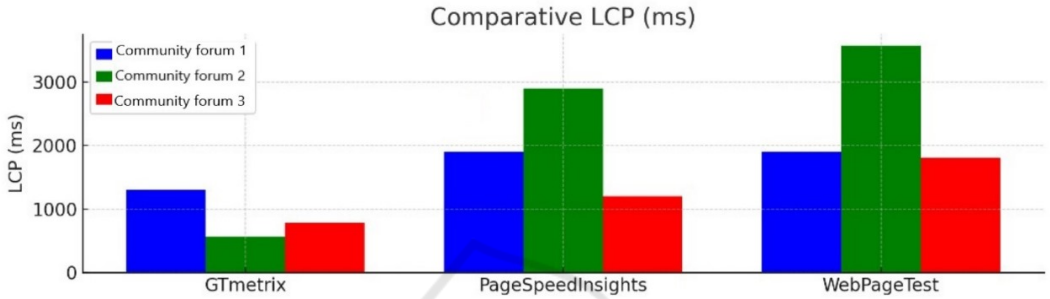

Figure 6: Comparison of LCP for the three websites.

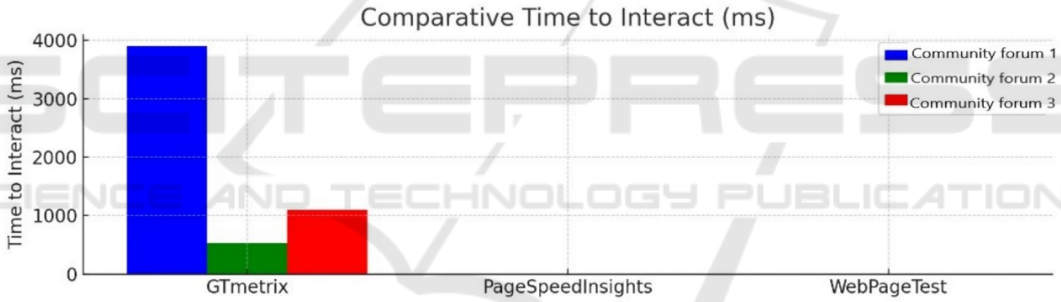

Figure 7: Comparison of Time to Interact for the three websites.

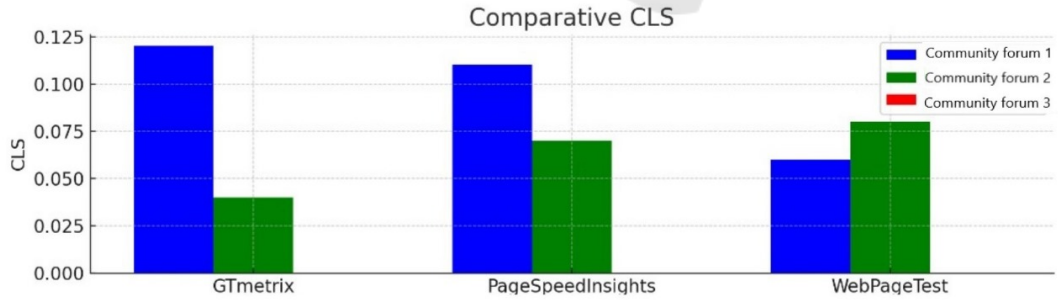

Figure 8: Comparison of CLS for the three websites.

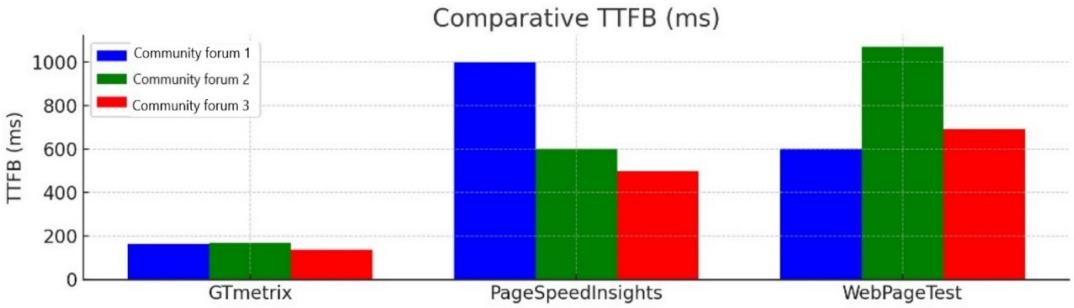

Figure 9: Comparison of TTFB for all three websites.

5 CONCLUSION

Overall, Community Forum 1 is the best performance-wise. It has the shortest First Contentful Paint at 286 ms. Additionally, it is one of the shortest Largest Contentful Paints at 1.3 sec. Its Cumulative Layout Shift is relatively low at 0.12, indicating good visual stability.

Community Forum 2 looks good with a CLS of 0.04, making it the most stable of the three under consideration, even if it is still slower than Community Forum 1 in terms of FCP and LCP. Community Forum 3 has the best TTFB at 137 ms but lags behind in FCP and LCP, which form the vital experience for a user.

In conclusion, Community Forum 1 could be the best performing, with Community Forum 2 following and Community Forum 3 in third place.

In the future, optimizing web performance in all metrics will be crucial to delivering the best possible user experience. While Community Forum 1 currently leads in overall performance, there are still opportunities for further improvements, such as minimizing layout shifts and reducing load times even more. For Community Forums 2 and 3, focusing on speeding up First and Largest Contentful Paint could significantly enhance user perception and engagement. Investing in continuous performance monitoring and optimization will ensure that these platforms can meet growing user expectations and stay competitive in an increasingly fast-paced digital environment.

REFERENCES

Akgül, Y. (2024). Evaluating the performance of websites from a public value, usability, and readability perspectives: a review of turkish national government websites. *Universal Access in the Information Society*, 23(2):975–990.

Alsaeedi, A. (2020). Comparing web accessibility evaluation tools and evaluating the accessibility of webpages: proposed frameworks. *Information*, 11(1):40.

Andry, J. F., Christianto, K., and Wilujeng, F. R. (2019). Using webqual 4.0 and importance performance analysis to evaluate e-commerce website. *Journal of Information Systems Engineering and Business Intelligence*, 5(1):23–31.

Başeğmez, H. and Özdemir, K. (2023). Website performance evaluation by grey relational analysis: a research on companies in bist technology and informatics index. *Acta Infologica*, 7(1):47–58.

Booth, D. and Jansen, B. J. (2010). A review of methodologies for analyzing websites. *Web technologies: Concepts, methodologies, tools, and applications*, pages 145–166.

Carbon60 (n.d.). Gtmetrix. Website Performance Testing Tool.

Catchpoint Systems (n.d.). Webpagetest. Website Performance Testing Tool.

Dobbala, M. K. and Lingolu, M. S. S. (2022). Web performance tooling and the importance of web vitals. *Journal of Technological Innovations*, 3(3).

Google (n.d.). Pagespeed insights. Website Performance Analysis Tool.

Griffin, L. and Roy, J. (2022). A great resource that should be utilised more, but also a place of anxiety: student perspectives on using an online discussion forum. *Open Learning: The Journal of Open, Distance and e-Learning*, 37(3):235–250.

Gupta, S., Khanna, P., Kumar, S., et al. (2024). E-commerce website performance evaluation: Technology, strategy and metrics. *Asian Journal of Research in Computer Science*, 17(6):114–125.

H.M., A., Tripty Singh, G., A., G., and Joseph, G. (2015). Web security: A prototype tool for detecting web application vulnerability. In *International Conference on Emerging Trends in Engineering, Business and Disaster Management (ICBDM 2015)*. Noorul Islam University, Kumaracoil, Tamilnad.

Kravchenko, Y., Leshchenko, O., Trush, O., Dakhno, N., and Krasnopyorov, P. (2023). Optimizing and improvement a web application using open source tools. In *IT&I*, pages 368–379.

Kumar, N., Kumar, S., and Rajak, R. (2021). Website performance analysis and evaluation using automated

tools. In *2021 5th International Conference on Electrical, Electronics, Communication, Computer Technologies and Optimization Techniques (ICEECCOT)*, pages 210–214. IEEE.

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.

Malathi, A. and Radha, D. (2016). Analysis and visualization of social media networks. In *2016 International Conference on Computation System and Information Technology for Sustainable Solutions (CSITSS)*, pages 58–63. IEEE.

Qualys, Inc. (n.d.). Ssl labs. SSL Testing Tool.

Rîpa, A. I. and Nicolescu, L. (2023). Customer relationship management. websites analysis of the top ten consumer goods companies. *Management Dynamics in the Knowledge Economy*, 11(4):352–371.

Subbulakshmi, S., Gopika, A., and Thomson, L. (2019). Enhanced ranking of websites based on credibility evaluation. In *2019 International Conference on Communication and Electronics Systems (ICCES)*, pages 2035–2040.

Thangam, S., Ramasamy, G., Sathya, P., and Ezra, K. (2016). A web based intelligent orchestration tool for smart city. *International Journal of Control Theory and Applications*, 9:109–113.