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Analysis of Responsiveness and Accessibility of BPS Kota Tebing Tinggi Website Using Multi-Device Testing and Audit Tools

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Abstract

Introduction: The development of information technology encourages government agencies to provide effective and inclusive digital services through official websites.
Objective: This study aims to analyze the quality of appearance, technical performance, accessibility, and SEO optimization on the BPS Kota Tebing Tinggi website as a means of distributing public information.
Method: The test method was conducted using two approaches: Chrome DevTools to evaluate responsiveness across devices (desktop, tablet, smartphone), and Google Lighthouse to measure performance, accessibility, best practices, and SEO.
Results: The test results showed that the website was visually responsive on a variety of devices, although there were still obstacles such as large banners and data tables that did not fully fit the smartphone screen. Meanwhile, the results of Lighthouse's audit resulted in a Performance score of 32, Accessibility 86, Best Practices 75, and SEO 100, which indicates the need for significant improvements especially in page load speed and JavaScript execution efficiency. Key recommendations include image optimization, script minification, library updates, and improved button accessibility and heading structure.
Conclusion: With the combination of these two methods, the study confirms that DevTools is superior in assessing the user experience directly, while Lighthouse serves as a supporting tool for standardized technical audits. The results of the research are expected to be a reference for BPS Tebing Tinggi City in improving the quality of fast, responsive, and inclusive digital services.

Keywords: Website, DevTools, Lighthouse, Responsiveness, Accessibility.

Introduction

The development of information and communication technology (ICT) has driven fundamental changes in the way government agencies interact with the public. In this era of digital transformation, the official website has evolved from just a static information media to the main platform for information delivery, data publication, and the implementation of digital public services [1]. Efforts to implement and develop websites for the digitization of information technology and as a public information media have proven to be crucial, both at the level of government agencies [2] as well as at the village level [3]. The website now functions as the digital face of the institution that reflects the quality, efficiency, and transparency of the services provided. Therefore, the quality of government websites is now not only reviewed from the completeness of the content, but also from the usability, display responsiveness, and loading performance [4].

To detect the lack of responsiveness, this study uses the Web Quality Evaluation approach. This method integrates User Experience simulations through Multi-Device Testing and technical audits based on the Core Web Vitals standard using Google

Lighthouse. This approach was chosen because it is able to validate the quality of information systems from two crucial dimensions simultaneously: the convenience of visual interaction for users and the efficiency of the system's technical performance.

The relevance of this responsiveness is supported by the fact of shifting internet user behavior in Indonesia. A survey by the Indonesian Internet Service Providers Association (APJII) in 2024 noted that of the 221 million internet users in Indonesia, 74.3% of them access the internet through mobile networks [5]. The fact that smartphones dominate this confirms that the development of public websites can no longer focus only on the desktop display [6], rather, it is absolutely necessary to adopt a cross-device approach (multi-device access).

The process of answering the challenge of mobile access, the Responsive Web Design (RWD) approach has become the industry standard [7]. RWD is a design approach that allows the interface and content of a site to adapt automatically to different screen sizes [8]. A review of the literature (state of the art) shows a strong correlation between the implementation of RWD and improved quality of user experience. A study found that the implementation of responsive design has a significant impact on usability [9], Improve User Experience (UX) [10], and proves to be more accessible on mobile devices [11], with increasing adoption across government sites [12].

Although RWD is a recognized solution, its implementation in the public sector still faces two major technical challenges: performance and accessibility. In terms of performance, websites with slow load times have a direct impact on the user experience and have the potential to increase bounce rates [13]. Another study on e-government websites in Indonesia also shows that performance issues are still a common obstacle [14]. In terms of accessibility, many public service websites are not able to serve all groups, including people with disabilities. Various studies evaluating government websites [15], Academic [16], and health found recurring accessibility problems, such as low color contrast ratios, the absence of alt text, and non-semantic heading structures.

The Central Statistics Agency (BPS) of Tebing Tinggi City, as an official statistical data provider institution, relies heavily on its website to distribute publications and census data to the public. A slow or unresponsive website can hinder the dissemination of this important data. This study proposes a statement of scientific novelty through the use of a double evaluation methodology to analyze the quality of the BPS Tebing Tinggi City website. This study combines two tools.

Chrome Developer Tools, to conduct multi-device testing to simulate visual responsiveness from a user experience (UX) perspective. Google Lighthouse, as a standardized automated audit tool to measure four technical metrics: Performance, Accessibility, Best Practices, and SEO.

This study specifically highlights the analysis of the website of the Central Statistics Agency (BPS) of Tebing Tinggi City. The urgency of selecting this object is based on the important role of BPS as the only official source in providing sectoral statistical data for local governments. Operational failures on this site not only hinder the dissemination of information, but can also reduce public trust in the transparency of the institution's performance [17]. In order to detect these lack of responsiveness, this study uses the Web Quality Evaluation approach [18]. This method integrates User Experience simulation through Multi-Device Testing and technical audits based on the Core Web Vitals standard using Google Lighthouse [19].

This study analyzes websites from three main perspectives in Information Systems to ensure the success of digital services: (1)

Usability, which is reviewed from the responsiveness of cross-device displays; (2) Service Utility, which is evaluated through accessibility standards so that data can be enjoyed by all; and (3) User Retention, which is measured through speed performance and SEO optimization. These three aspects are analyzed to ensure that the website is not only technically functional, but also able to attract the interest of the public to access it on a sustainable basis [20].

Method

This study uses a quantitative descriptive approach with the evaluation technique of Black Box Testing. This method was chosen because it focuses on testing the functionality and quality of the interface (front-end) based on the specifications of the user's needs, without the need to dissect the internal code structure (source code) of the program [21]. The evaluation framework refers to the ISO/IEC 25010 software quality model, on the characteristics of usability and performance efficiency. The object of the research is the main page (homepage) of the official website of BPS Tebing Tinggi City (https://tebingtinggikota.bps.go.id).

Data collection and evaluation were carried out for one month, starting from January 6, 2025, to February 6, 2025. The analysis process is carried out through two stages of complementary testing instruments:

1. Multi-Device Testing (Visual Responsiveness Analysis) This stage aims to validate the implementation of Responsive Web Design (RWD) to ensure interface consistency across different screen sizes [22]. The test was conducted using the viewport simulation feature in Chrome DevTools. The website view is inspected at the three device resolution breakpoints that represent most users today:

- Desktop: 1920 x 1080-pixel resolution.
- Tablet: 768 x 1024-pixel resolution.
- Smartphone: 360 x 640-pixel resolution.

The visual aspects analyzed include the consistency of the layout, the functionality of the menu navigation, the legibility of the typography, and the proportionality of the media elements (images and tables). This test is crucial given that the high fragmentation of mobile devices demands the flexibility of an adaptive interface [23].

2. Automated Technical Audit (Website Quality Analysis) This method is used to obtain objective quantitative data regarding the technical health of the website. The tests were conducted using Google Lighthouse, an open-source automated auditing tool that is the industry standard in modern web performance measurement [24]. The audit was carried out with a standard configuration of mobile emulation and 4G network *throttling* to simulate real user conditions. The assessment was conducted based on four main metrics with a score scale of 0–100:

- Performance: Measures page load speed based on Core Web Vitals metrics such as First Contentful Paint (FCP), Largest Contentful Paint (LCP), and Time to Interactive (TTI).
- Accessibility: Assess website inclusivity for users with disabilities by referring to the Web Content Accessibility Guidelines (WCAG) standard, including checking for all text, contrast ratio, and keyboard navigation [25].
- Best Practices: Evaluate security and modern development standards, such as the use of the HTTPS protocol and the security of JavaScript libraries.
- SEO: Examining basic technical elements that affect visibility in search engines, such as the validity of meta tags and crawling structures.

Results and Discussion

Multi-Device Testing (DevTools)

Visual responsiveness testing was performed using *Chrome DevTools* on three

major device resolutions. The test results are summarized at:

Table 1. Cross-Device Visual Responsiveness Test Results

Aspects tested	Desktop (1920×1080)	Tablet (768×1024)	Smartphone (360×640)
Layout & Display	B	B	B
Menu Navigation	B	B	B
Font Size & Text Readability	B	B	B
Figures & Data Tables	B	B	TB
Interactivity	B	B	B

Description: B (Good); TB (Not Good)

As shown in Table 1, key findings were identified on the *smartphone display*. Although the *layout* and navigation adapt well, there are two significant *usability* issues , the *banner* size is too large and the data table is unresponsive, requiring users to *scroll horizontally* to view the data.

Technical Audit (Lighthouse)

Technical audit testing using Google Lighthouse provides quantitative scores in four main categories. Key findings from this audit are visually summarized on:

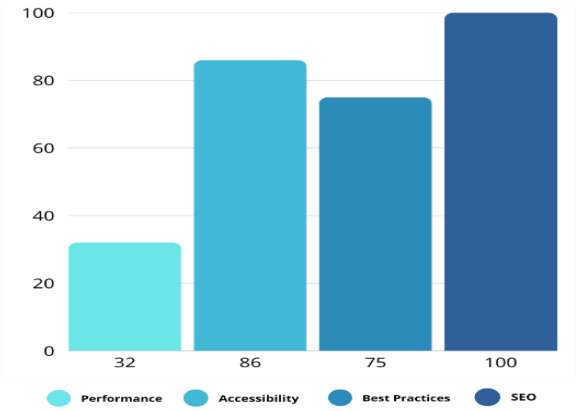

Figure 1. Chart Shoes Lighthouse.

Technical Audit (Lighthouse) The results of a technical audit using Google Lighthouse reveal significant quality disparities between test variables. In terms of SEO, the website recorded a perfect score (100/100), which indicates that the meta-data, crawling, and indexing structure is very optimal for search engines. However, this positive achievement is inversely proportional to the Performance aspect which is at a critical level with a score of only 32/100. This low performance was due to poor Core Web Vitals metrics, where Largest Contentful Paint (LCP) reached 4.5 seconds and Time to Interactive (TTI) touched 5.2 seconds. An in-depth analysis shows that the root of these performance problems lies in the large uncompressed banner image size and JavaScript execution that blocks the main rendering. Meanwhile, the Accessibility (86/100) and Best Practices (75/100) aspects showed moderate results, with minor improvements to the interactive element labels for screen readers and security library updates.

Implications of Findings Based on the synthesis of these data, the key findings of this study show that BPS Kota Tebing Tinggi has succeeded in building a strong discoverability (SEO) foundation, but fails to ensure user retention due to slow loading performance and inconsistent data display on mobile devices. The problem of data tables requiring horizontal scrolling on mobile displays is the most critical usability barrier that hurts the principle of public service inclusivity. Without improvements to image asset compression and responsive table layout adjustments, the website risks losing its relevance to the majority of users who are now dominated by smartphone users.

Validity and Comparison of Methods A comparative analysis of the two methods used confirms that a single approach is not enough to evaluate the quality of information systems holistically. There is an interesting contradiction in the findings: although Lighthouse gives an SEO score of 100 which theoretically indicates a "mobile-friendly" website, manual testing with Chrome DevTools actually found a fatal visual flaw in the form of data tables truncated on a smartphone screen. This proves that the

automated audit method (Lighthouse) has limitations because it is only able to assess the code behind the scenes, but fails to validate the visual context. Therefore, in the context of user experience (UX) evaluation, the Multi-Device Testing method with DevTools has proven to be superior and valid to Lighthouse because it is able to represent user convenience in real terms. However, for standardizing server-side technical performance, Lighthouse remains the most essential instrument.

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Conclusion

Based on the results of the analysis and testing of the BPS Kota Tebing Tinggi website using Chrome DevTools and Google Lighthouse, it can be concluded that several important things can be concluded as follows: the results of the test with DevTools show that the BPS Kota Tebing Tinggi website is able to adjust the appearance on various devices (desktop, tablet, and smartphone). Key elements such as headers, navigation menus, banners, and main content are well accessible. However, there are still obstacles to banner sizes that are too large and data tables that do not fully adjust the appearance of the smartphone screen, causing horizontal scrolling. Based on the results of Lighthouse's audit, the website's performance score is still relatively low (32/100). The main factors for this are large image sizes, long JavaScript execution times, and the lack of implementation of optimization techniques such as lazy-loading. This condition causes the loading time to be slow and reduces user comfort. The accessibility score is at 86/100 which is relatively good, but not completely disability-friendly. Some elements such as buttons without accessible labels, low color contrast ratios, and inconsistent heading structures need to be improved to be more inclusive for all users. The website also received a score of 75/100 for best practices, indicating the persistence of old JavaScript libraries and long execution times, which can cause compatibility and security issues if not updated. Meanwhile, in the SEO aspect, the website obtained a perfect score (100/100), indicating that technically the website is very optimal for search engines and is an important capital for BPS Tebing Tinggi in increasing the visibility of statistical data in the digital realm. Overall, DevTools has proven to be superior at evaluating cross-device visual responsiveness and convenience, as the results directly reflect the user experience, while Lighthouse is more of a technical evaluation tool for assessing performance, accessibility, best practices, and SEO. The combination of the two provides a comprehensive picture of the quality of the website, both in terms of appearance and internal technical side.

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