Challenges in the Accessibility of Data Visualization: Lessons from an Evaluation of a Dam Safety System

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Abstract. Introduction: *Data visualization is vital for data exploration, and ensuring its accessibility for all, especially those with disabilities, is crucial; however, despite existing web accessibility guidelines, specific guidance for data visualization remains limited.* ***Objective:*** *To assess the accessibility of a Brazilian dam safety data platform.* ***Methodology:*** *An expert inspection was conducted using screen readers to evaluate the platform's compliance and usability.* ***Results:*** *Findings revealed issues with unobserved web accessibility guidelines, inherent inaccessibility in off-the-shelf data exploration components, and design choices that complicate interactive data exploration for visually impaired users, offering insights into accessibility challenges in data visualization and underscoring the need for more comprehensive guidelines and future research.*
Keywords *Accessibility, Data Visualization, Geographical data, Human-Data Interaction, Dam Safety.*

Resumo. Introdução: *A visualização de dados é vital para a exploração de informações, e garantir sua acessibilidade para todos, especialmente pessoas com deficiência, é crucial; no entanto, apesar das diretrizes de acessibilidade web existentes, a orientação específica para a visualização de dados ainda é limitada.* ***Objetivo:*** *Avaliar a acessibilidade de uma plataforma brasileira de dados de segurança de barragens.* ***Metodologia:*** *Foi realizada uma inspeção especializada utilizando leitores de tela para verificar a conformidade e a usabilidade da plataforma.* ***Resultados:*** *Os achados revelaram problemas com diretrizes de acessibilidade web não observadas, inacessibilidade inerente em componentes prontos para exploração de dados e escolhas de design que dificultam a exploração interativa de dados por usuários com deficiência visual, oferecendo insights sobre os desafios de acessibilidade na visualização de dados e ressaltando a necessidade de diretrizes mais abrangentes e futuras pesquisas.*

Palavras-Chave *Acessibilidade, Visualização de Dados, Dados Geográficos, Interação Humano-Dados, Segurança de Barragens.*

1. Introduction

Data visualization is an essential tool for understanding complex datasets and extracting meaningful insights in various fields, including science, engineering, healthcare, and finance. It is also increasingly used in everyday life to inform decision making, such as tracking personal finance, monitoring health metrics, and understanding social trends. Given its importance, data visualization should be accessible to everyone, including people with disabilities, in the same way as web content should be accessible, as defined by the Web Content Accessibility Guidelines (WCAG) [W3C 2024].

Several studies have explored approaches to making data visualizations more accessible, particularly for people with visual disabilities. For instance, Srinivasan et al. [Srinivasan et al. 2023] developed a system called Azimuth that generates accessible interactive dashboards for screen reader users. Gorniak et al. [Gorniak et al. 2024] introduced VizAbility, a tool that combines keyboard navigation with natural language model interactions to make graphs accessible to individuals with visual impairments. Seo et al. [Seo et al. 2024] investigated the accessibility of statistical visualizations for blind people through multimodal data representations.

Despite these efforts, there is still a lack of comprehensive guidance on how to make data visualizations accessible, especially in certain contexts such as information available on governmental websites. A previous study by Capeleti et al. [Capeleti et al. 2023] evaluated usability aspects in human-data interaction in the context of a dam safety data exploration platform. However, the study did not examine accessibility aspects for people with visual disabilities.

This study presents emerging results from the analysis of the accessibility of a data interaction platform focused on dam safety information in Brazil. The analysis involved an accessibility inspection conducted by experts using screen readers. The results reveal issues related to consolidated web accessibility guidelines not observed by designers, problems connected to the inaccessibility of off-the-shelf data exploration components, and design decisions that may make the use of interactive data exploration harder for people with visual disabilities than for sighted people. This work contributes by providing insights into the specific accessibility challenges of data visualization platforms and highlighting the need for more comprehensive guidelines in this area.

To conduct this study, we inspected the data visualization system of the official dam monitoring system in Brazil, the Sistema Nacional de Informações sobre Segurança de Barragens (SNISB). Inspections were conducted using Google Chrome, and we used two popular screen reader software solutions, JAWS and NVDA, to evaluate accessibility from the perspective of visually impaired users. The inspection process was divided into three structured stages to cover different aspects of accessibility: interactive evaluation, keyboard navigation, and screen reader testing.

This study is directly aligned with Challenge 5 – Human-Data Interaction from the II GranDIHC-BR research agenda (2025–2035) [Coleti et al. 2024], which emphasizes the need to develop more inclusive, transparent, and meaningful ways of interacting with

data. By investigating accessibility barriers in data visualization platforms, particularly in the context of critical public systems such as dam safety monitoring, we demonstrate that human-data interaction still lacks solutions that effectively consider user diversity. Our findings reinforce the urgency of creating new approaches that ensure equitable access to data exploration and interpretation, thereby expanding the potential of human-data interaction as a tool for citizenship and informed decision-making, as advocated by GranDIHC-BR. By focusing accessibility aspects, the paper also deals with Challenge 3 - Plurality and Decoloniality in HCI [de Oliveira et al. 2024].

The rest of this paper is structured as follows: Section 2 describes related work connected to accessibility in data visualization and human-data interaction. Section 3 describes the methods used in this study, including the study design, application evaluated, inspection procedures, and data classification and analysis. Section 4 presents the results of the accessibility inspections conducted by experts, highlighting violations covered by WCAG as well as other issues beyond its scope. Finally, Section 5 concludes the paper and suggests directions for future work.

This section introduces key concepts and related studies that explore accessibility approaches in data visualization and human-data interaction. It goal is to highlight gaps in the field of human-data interaction area and showcase the progress made in this area through existing research.

2. Related work

This section presents related work investigating the accessibility of interactive systems for data analysis.

Data visualization and human-data interaction for individuals with visual impairments present unique challenges. Addressing these, recent research explores various approaches to enhance accessibility, focusing on screen reader compatibility, multimodal representations, and improved interaction paradigms.

Several studies highlight the persistent difficulties faced by screen reader users when interacting with dashboards and data visualizations. Srinivasan [Srinivasan et al. 2023] introduced Azimuth, a system designed to generate more accessible interactive dashboards for blind or low vision (BLV) users. While Azimuth improved accessibility, challenges remained, particularly regarding the initial learning curve for new users and efficient navigation between interactive elements. Similarly, Fan et al. [Fan et al. 2023] conducted an extensive investigation into the accessibility of web-based data visualizations for screen reader users, revealing that even popular visualizations often fail to meet basic accessibility criteria, despite WCAG 2.1 compliance. This underscores a significant gap between theoretical compliance and practical usability. Joyner et al. [Joyner et al. 2022] further explored the difficulties designers face in creating inclusive graphical representations, noting that many visualizations lack adequate alternative text, textual descriptions, and keyboard compatibility, making them inaccessible to screen readers. These studies collectively emphasize the need for more robust design guidelines and tools that genuinely support screen reader interaction.

Beyond traditional screen reader support, multimodal approaches show considerable promise for enhancing data accessibility. Seo [Seo et al. 2024] introduced

MAIDR, a system that combines sonification and textual descriptions with tactile representations through dynamic Braille displays. This multimodal strategy significantly improved the accuracy of statistical visualization interpretation for blind users, highlighting the potential of integrating diverse sensory inputs. While not directly focused on visual impairment, AlAbdulaali [AlAbdulaali et al. 2022] explored multimodal interactive dashboards for disaster management, demonstrating how the integration of text, audio, video, and image data can enhance information presentation and decision-making—a principle that could be extended to accessibility for various disabilities.

Innovations in interaction design and AI-driven solutions are also contributing to improved accessibility. Gorniak [Gorniak et al. 2024] developed VizAbility, a tool that makes graphs accessible through a combination of keyboard navigation and natural language model (LLM) interactions. This approach allows users to explore graphs using verbal questions and commands, providing a more intuitive and flexible interaction experience. For individuals with motor disabilities, Weru [Weru et al. 2024] introduced OpenKeyNav, a JavaScript library that enables complex keyboard interactions for web-based data visualization tools, effectively replicating mouse-based functionalities and improving overall efficiency for keyboard users. These tools demonstrate the power of re-imagining interaction paradigms to cater to diverse accessibility needs.

Furthermore, a broader understanding of dashboard usability, even outside the context of visual impairment, provides valuable insights for accessible design. Siette [Siette et al. 2023] conducted a systematic review on the usability and acceptability of clinical dashboards in aged care, revealing mixed usability results and highlighting general accessibility barriers such as navigation difficulties and inadequate text size. Likewise, Almasi [Almasi et al. 2023] reviewed usability evaluation tools for healthcare dashboards, noting that most studies rely on generic instruments, which may not fully capture the nuances of dashboard usability. Ansari [Ansari 2024] examined the usability of public health data dashboards, identifying issues like unclear color schemes, inconsistent structure, and limitations in interactivity, all of which are critical considerations for accessible design. Finally, Lazar [Lazar et al. 2017] investigated the feasibility of a dashboard for monitoring U.S. federal website accessibility, showcasing potential data visualizations for tracking compliance but also underscoring challenges in standardizing automated tools and ensuring data reliability. These studies, while not exclusively focused on visual impairment, provide a foundational understanding of usability challenges and potential solutions that can be applied to create more inclusive data experiences for all users.

3. Methods

This study analyzed a dashboard presenting information on Brazilian dams. Data were gathered through a specialized evaluation, the methodology, application, and analysis processes are detailed in the following subsections.

3.1. Study Design

This study adopted an exploratory approach, focusing on inspecting the dashboard to identify accessibility issues, compare them with WCAG 2.2 [W3C 2024] guidelines, and analyze their root causes. Given the nature of the study, the methodological choices were

made to ensure a comprehensive assessment of the dashboard's accessibility limitations and challenges.

The evaluation was conducted by an expert in Human-Computer Interaction (HCI) with experience in accessibility analysis. The expert examined the system to identify barriers affecting usability and accessibility, using the Web Content Accessibility Guidelines (WCAG 2.2) [W3C 2024] as a reference and analyzing the inherent limitations of the tools used.

3.2. Application Evaluated

The official dam monitoring system in Brazil is the *Sistema Nacional de Informações sobre Segurança de Barragens* (SNISB)[1]. Its primary objective is to ensure transparency and facilitate oversight by regulatory agencies and society regarding dam conditions nationwide. The system consolidates data from various regulatory bodies and dam management authorities, providing a centralized source of information in Figure 1.

SNISB was chosen for this evaluation due to its relevance in the Brazilian scenario. The system had the participation of members of the research group, which led to access to documentation and features to aid in the evaluation. The system was also the focus of a previous study with its usability evaluation considering aspects of Human-Computer Interaction [Capeleti et al. 2023]. Brazil had numerous accidents with dams in recent years. Effective systems that can be used by the population for monitoring dam safety are crucial for social oversight and protection in case of accidents.

Figure 1. The National Dam Safety Information System (SNISB), or Sistema Nacional de Informações sobre Segurança de Barragens in Portuguese, is Brazil's official monitoring system for dam safety.

3.3. Inspection Procedures

To ensure consistent and reliable testing, we used a notebook equipped with a Ryzen 7 processor, 24GB of RAM, and an NVIDIA GTX 1650 graphics card, running Windows

[1] https://www.snisb.gov.br/portal-snisb/consultar-barragem

11. The tests were conducted using Google Chrome, one of the most widely used browsers, ensuring compatibility with modern web technologies. Additionally, we used JAWS[2] and NVDA[3], two of the most popular screen reader software solutions, to evaluate accessibility from the perspective of visually impaired users.

3.3.1. Inspection Process

The inspection process was divided into three structured stages to cover different aspects of accessibility:

1. First Inspection – Interactive Evaluation In this initial phase, the dashboard was manually explored using a mouse to identify usability and accessibility issues. The goal was to observe how users with full visual and motor abilities would interact with the interface. We examined:

- Element behavior – Clicking on interactive components such as buttons, filters, and charts to see their responses.
- Titles and labels – Checking if elements were correctly labeled and informative.
- Color contrast and readability - ensure that text and graphical elements met accessibility contrast requirements.
- Font size – Verifying if text elements were large enough to be readable without magnification.
- Navigation links - Testing whether the external and internal links were properly functioning and descriptive.

2. Second inspection - Keyboard navigation The second phase focused on assessing the keyboard-only navigation experience, crucial for users who rely on the keyboard instead of a mouse. The following aspects were evaluated:

- Navigability – Determining whether all elements could be accessed using only the keyboard.
- Focus order - Checking if navigation followed a logical sequence, allowing users to move through the dashboard in a structured manner.
- Keyboard traps – Identifying areas where users might get stuck because they could not move forward or backward using the keyboard.
- Shortcut accessibility – Verifying whether standard keyboard shortcuts worked as expected within the interface.

3. Third inspection - Screen Reader testing In the final stage, we tested the dashboard using screen readers (JAWS and NVDA) to understand how visually impaired users experience the interface. We focus on:

- Element descriptions - Assess whether screen readers could properly interpret and announce interface components, including buttons, menus, and interactive elements.
- Skipping blocks – Testing the ability to bypass large sections of content, improving efficiency in navigation.

[2]https://www.tecassistiva.com.br/catalogo/jaws/
[3]https://www.nvaccess.org/

- Chart interaction - Evaluate how screen readers interpret graphs, whether they provide meaningful data, or if users only receive partial or incomplete information.

As violations were identified, they were documented along with the type of violation, its location, and a detailed description of the issue.

3.4. Data Classification and Analysis

After conducting the inspection and recording all identified accessibility violations, we proceeded with a detailed analysis to classify and understand the nature of these issues. This process involved two key steps:

- **Checking Compliance with WCAG 2.2[W3C 2024]:** We assessed each identified violation against the Web Content Accessibility Guidelines (WCAG) to determine whether it was explicitly covered by these standards. This step helped us understand if the issue represented a failure in meeting widely accepted accessibility requirements or if it was an accessibility best practice not explicitly mandated by WCAG.
- **Reviewing Power BI Documentation [4]:** We examined the official Power BI documentation to distinguish between issues caused by tool limitations versus those resulting from problem code. The goal was to determine whether Power BI inherently lacked certain accessibility features or if the issue was due to problem code or dashboard design.
  We also explored whether Power BI offered any built-in workarounds for identified problems, such as enabling certain settings or using alternative design approaches.

3.5. Classification of Issues

Based on this analysis, we categorized the problems into two main groups:

- **Tool Limitations:** These are issues caused by restrictions or missing accessibility features within Power BI itself. For example, some interactive charts do not provide full data descriptions when accessed through a screen reader, and the tool does not allow for direct modification of the tab order in certain elements. Even though Power BI offers some accessibility features, they are often available only in the restricted version or do not fully address the needs of users relying on assistive technologies.
- **Coding Issues:** These problems stem from how elements are structured or configured within the dashboard. Examples include failing to provide alternative text for images, improper grouping of interactive elements, or not following a logical focus order when navigating with a keyboard. In many cases, these issues can be resolved by adjusting the design, applying best practices, or using Power BI's built-in accessibility settings effectively.

This classification helped us determine which violations could be fixed through configuration and coding adjustments and which were beyond the control of the developer due to Power BI's limitations.

[4] https://learn.microsoft.com/en-us/power-bi/

3.6. Ethical aspects

This research study did not involve human participants other than the researchers themselves. For this reason, the study is exempt from approval by a research ethics committee.

4. Results

This section presents the results of accessibility inspections conducted by experts, highlighting violations covered by WCAG as well as other issues beyond its scope. Additionally, it addresses problems related to code limitations and tool constraints.

4.1. Results of expert evaluation

Tables 1 and 2 provide a detailed analysis of the accessibility guideline violations identified during the inspection of the data visualization system. Table 1 focuses on issues related to coding, while Table 2 highlights the tool's limitations. Both tables are organized by guideline, describing the specific issue encountered. Some of the main highlights from this table include several instances of missing alternative text for images (violating guideline 1.1.1), which is a common accessibility issue. There are also violations related to keyboard navigation (guideline 2.1.2), focus order (2.4.3), and link purpose (2.4.9), indicating potential barriers for users who rely on keyboard input or screen readers. Additionally, the table reveals a lack of consistent navigation (3.2.3) and meaningful sequence (1.3.2).

4.2. Problems Related to Tool limitations

Some of the issues identified during the inspection stem from tool limitations, as shown in Table 3. These limitations may be directly linked to the tool's licensing model, which includes: (i) a restricted version (available only to licensed members of the organization) and (ii) a public version (accessible via a public link).

Features, such as keyboard navigation in keyboard traps, along with auto-contrast and graph-to-table conversion, are exclusive to the restricted version, as illustrated in Figure 2. Location: This functionality is not currently available in Power BI.

One of the frequently encountered issues, which is also acknowledged as a limitation in the official Power BI[5] documentation, is the inability of screen readers to read data in charts, as illustrated in Figure 3. The chart features an X-axis with category labels for each column and a Y-axis that displays numerical values. However, when using screen readers, only the labels and titles are read aloud, making it impossible for users to determine the actual data values presented in the chart.

4.3. Coding Problems

Accessibility violations, such as the embedding of graphical elements (e.g., cards) within textual fields, often originate from suboptimal coding practices that compromise the semantic structure of the content. These practices impede accurate parsing and interpretation by assistive technologies, such as screen readers. Figure 4 illustrates this violation.

[5] https://learn.microsoft.com/en-us/power-bi/create-reports/desktop-accessibility-consuming-tools

Table 1. Coding Problems

Violations Guideline	Description issue
3.3.5. Help	Dashboard without help option
2.5.5. Target Size (Enhanced)	Font size in filters, update date and results is small
1.1.1. Non-text Content	Image on export selection button without description
1.1.1. Non-text Content	Image on full base button without description
3.2.3. Consistent Navigation	The elements do not follow an order, making it difficult to understand
1.3.2. Meaningful Sequence	The elements do not follow an order, making it difficult to understand
2.4.3. Focus Order	"The elements in logical order (shuf- fled sequence)"
2.4.10. Section Headings	The elements do not have a section or grouping
3.1.2. Language of Parts	The Snisb code filter is numeric with no description of what it is about
2.4.9. Link Purpose (Link Only)	Button access interactive panel (no link description)
2.4.9. Link Purpose (Link Only)	"Understand classifications button (no link description)"
2.4.9. Link Purpose (Link Only)	Export selection button (no link description)
2.4.9. Link Purpose (Link Only)	Full base button (no link description)
4.1.1. Parsing (Obsolete and removed)	Elements that use the proper name suggested by the tool, such as slicer, were not renamed
Code filter without code description	Snisb code filter has no code description
Nested card with text	Text field with break for card with numeric values

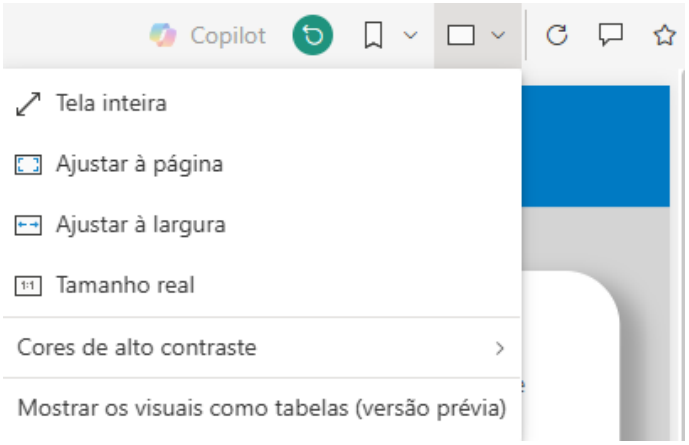

Figure 2. Restricted version tool features in Power BI and accessibility typically refer to the limitations in accessibility-enhancing functionalities present in free or basic Power BI licenses compared to paid versions.

The SNISB code filter presented in Figure 5 displays only numerical values, presuming that users are already familiar with the meaning of each code. This lack of

Table 2. Tools Limitations

Violations Guideline	Description problem
2.1.2. No Keyboard Trap	The selection input box allows you to move to another element using the keyboard or mouse
2.4.1. Bypass Blocks	Did not group the elements, does not allow skipping group of elements
2.4.8. Location	The selected filters marking does not appear
High contrast	The auto-contrast is not enabled
Transformation of graphs into tables	The function to transform graphs into tables is not enabled
Reading graphical data	Screen readers cannot read data from graphs, only reading captions and text

Table 3. Problems Related to Tools limitation

Guideline	Problem
2.1.2. No Keyboard Trap	Restricted version
2.4.1. Bypass Blocks	Restricted version
2.4.8. Location	Not implementing
High contrast	Restricted version
Transforming graphs into tables	Restricted version
Reading graphical data	Tool limitation

Figure 3. Bar charts in Power BI effectively visualize categorical data.

Figure 4. This is a dashboard display showing a key piece of information as both text and a value.

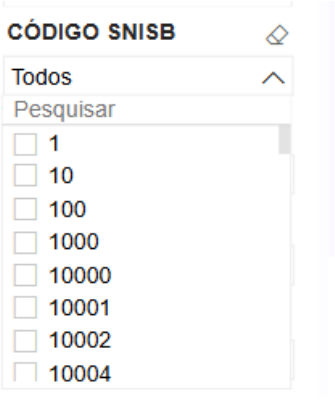

Figure 5. This field filters data using the SNISB code.

descriptive labels poses an accessibility problem.

The dashboard exhibits accessibility violations, notably the presence of images without descriptive text, as illustrated in Figure 6. The absence of alternative text prevents assistive technologies, such as screen readers, from conveying the content and purpose of

these images.

Figure 6. This figure refers to a graphical button, presented as an image, that allows users to download the complete dataset.

The filters and interactive elements of the dashboard lack semantic and visual grouping, as shown in Figure 7. This disorganization impairs accessibility, as it may prevent users from comprehending the relationships between the interface elements and efficiently navigating the content.

Furthermore, the dashboard lacks an integrated help or guidance feature to help users interpret the results, filters, and calculated measures. This lack of contextual assistance reduces user autonomy and impedes accessibility, especially for those unfamiliar with the layout of the dashboard or the underlying analytical processes.

Figure 7. This issue refers to instances where the dashboard presents several filters that lack proper visual or structural grouping.

A significant issue that adversely affects the user experience pertains to the navigation sequence and focus order. As illustrated in Figure 8, the reading order of elements when navigating via keyboard is illogical, complicating the navigation process. For example, the first element in the focus sequence is positioned as the last item in the filter chain, while the third and fourth elements are placed among the final components of the dashboard. Conversely, the sixth element is located among the initial components, further disrupting the logical flow of navigation.

5. Discussion

The results obtained highlight a series of accessibility violations that significantly compromise the usability of dashboards, especially for people with disabilities. These problems include the absence of alternative text for images, improper grouping of

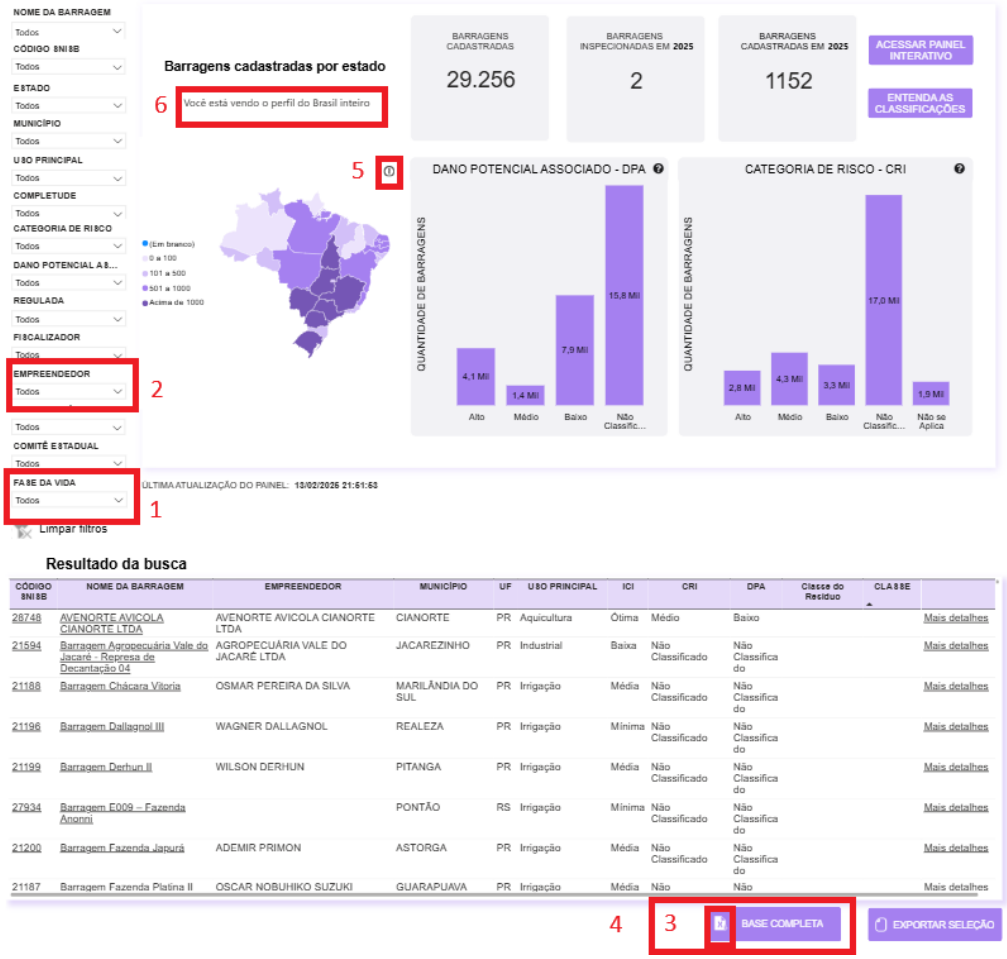

Figure 8. This figure outlines the intended navigation order for the SNISB dashboard, guiding users, especially those with accessibility needs, through its interactive elements.

elements, and illogical navigation sequences. Such errors, often stemming from poor coding practices, could be avoided by adopting guidelines such as the Web Content Accessibility Guidelines (WCAG) 2.2 [W3C 2024] and by making appropriate use of features provided by the visualization platforms themselves.

However, a substantial portion of the observed limitations goes beyond development practices and arises from restrictions imposed by the tool itself—in this case, the public version of Power BI. Essential accessibility features — such as high contrast mode, viewing active filters, and converting charts to tables — are only available in the licensed version, creating a systemic barrier to digital inclusion. This finding reinforces discussions in the literature, such as those [Srinivasan et al. 2023], which emphasize the importance of designing dashboards that are natively compatible with screen readers and keyboard navigation.

The most critical limitation lies in the inability of screen readers to interpret data presented in charts — a limitation that cannot be overcome by coding best practices alone. Although Power BI offers some workarounds, such as converting charts into tables, these are limited, situational, and in some cases, unavailable in the free version of the tool. This

scenario is supported by previous search by Fan et al. [Fan et al. 2023], who demonstrate how the accessibility of graphical visualizations on the web remains inadequate even in critical situations, such as during the COVID-19 pandemic.

In this context, the literature suggests promising paths. For instance, tools like Azimuth [Srinivasan et al. 2023], specifically developed to enable dashboard reading for users with visual impairments, and conversational AI-based approaches, such as Vizability [Gorniak et al. 2024], offer alternative models to overcome the barriers imposed by conventional tools. From a technical standpoint, [Weru et al. 2024] proposes solutions like OpenKeyNav, which enhances keyboard navigation in web-based visualization tools, reinforcing the importance of supplementary strategies to bridge existing gaps.

Furthermore, studies such as those by Almasi et al. [Almasi et al. 2023] and Capeleti et al. [Capeleti et al. 2023] underscore the importance of rigorous usability evaluation methodologies, both through user testing and heuristic analysis, which can help identify failures early and lead to the development of more effective solutions. It is also essential to consider multimodal approaches in dashboard design, as discussed by AlAbdulaali et al. [AlAbdulaali et al. 2022], who advocate for the use of various interaction channels (voice, touch, keyboard) to make interfaces more inclusive.

It becomes clear that improving dashboard accessibility requires a dual approach: i) on the one hand, empowering developers and ensuring compliance with accessible best practices; ii) on the other hand, action from software providers, who must ensure that fundamental resources for digital inclusion are not limited to paid versions.

The present study presented many common features in terms of accessibility problems encountered in previous studies analyzing the accessibility of data visualization tools. However, it presents novel contribution by analyzing the root cause of such problems, with important reflections from the emerging results that can lead to important future research.

6. Conclusion and Future Work

This study aimed to analyze the accessibility of a data interaction platform focused on dam safety information in Brazil, seeking to identify and understand the specific accessibility challenges posed by such platforms and to highlight the need for more comprehensive guidelines in this area.

The method consisted of an accessibility inspection conducted by experts using screen readers, focusing on the official dam monitoring system in Brazil, the Sistema Nacional de Informações sobre Segurança de Barragens (SNISB). The inspection process was divided into three structured stages to cover different aspects of accessibility: interactive evaluation, keyboard navigation, and screen reader testing. The results revealed several issues, including violations of consolidated web accessibility guidelines, problems related to the inaccessibility of off-the-shelf data exploration components, and design decisions that may hinder interactive data exploration for people with visual disabilities.

These results contribute to advancing the understanding of accessibility in data visualization by providing empirical evidence of the specific challenges encountered in a

real-world data interaction platform. Compared to related work, this study goes beyond evaluating the accessibility of individual visualizations or dashboards by examining a comprehensive data interaction system. While previous research has highlighted the importance of accessibility in data visualization and proposed various techniques and tools to improve it, this study demonstrates that significant accessibility barriers still exist in practice, even in systems that are expected to adhere to web accessibility guidelines.

This study has some inherent methodological limitations. These include: i) The accessibility evaluation was conducted by a single specialist. While expertise is crucial, this approach can introduce biases and potentially miss problems that additional evaluators, with different perspectives, might identify. ii) The tests were performed on a single browser (Google Chrome), which limits the comprehensiveness of the results, as the accessibility experience can vary significantly across other browsers and user environments. iii) The methodology focused on the qualitative identification and description of problems, meaning there was no formal quantification of the issues found. This prevents a more detailed analysis of the frequency or relative impact of each violation, which could offer a more complete picture of the severity of accessibility barriers in the system.

As future work, we plan to conduct studies involving users with different disabilities to gather a broader understanding of their experiences and needs. Additionally, we intend to explore and evaluate different techniques available in the literature to prototype alternative interfaces for exploring interactive data in a more accessible manner. By combining user-centered design approaches with technical solutions, we aim to contribute to the development of more inclusive and accessible data visualization platforms that empower all users to explore and understand data, regardless of their abilities.

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