Unveiling Developer Perspectives: A Survey on Accessibility Practices and Requirements in Software Development

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Abstract. The World Health Organization has stated that disabilities are a natural part of the human experience and nearly everyone will experience temporary or permanent disabilities at some point in their lifetime. Approximately 1.3 billion individuals, which is roughly 16% of the global population, struggle with disabilities such as visual, auditory, physical, speech, cognitive, learning, and neurological impairments. The quality of software depends on non-functional characteristics such as availability, maintenance, performance, reliability, scalability, security, and usability. Non-functional requirements are crucial for the success of software projects. In this context, accessibility plays a critical role in emphasizing the importance of non-functional requirements in software development. We conducted a survey of software development professionals to identify their understanding, awareness, and level of adopted practices in accessibility. Our study revealed the need for comprehensive accessibility curricula, accessible training programs, and better collaboration between academia, industry, government agencies and advocacy groups. By leveraging collective expertise and resources, stakeholders can work together to advance accessibility initiatives and address common challenges to develop accessible software. Establishing partnerships to share best practices, develop guidelines, and support organizations striving to improve accessibility in their products and services will create a more inclusive digital landscape.

Keywords: Software development · Accessibility requirements · Empirical research · survey · Accessibility education

1 Introduction

According to the World Health Organization (WHO), disability is a natural part of the human experience. It is estimated that nearly everyone will experience disabilities at some point in their lives. Approximately 1.3 billion individuals, or roughly 16% of the global population, are affected by disabilities such as visual, auditory, physical, speech, cognitive, learning, and neurological impairments [19].

In Brazil, data from the 2010 IBGE[1] census indicates that 46 million individuals (23.9% of the population) have some form of disability [7]. More recent data from the IBGE National Health Survey (PNS) conducted in 2019 estimated that Brazil has 17.3 million people with disabilities, which is approximately 8.4% of the population aged two years and older [8].

As individuals age, they become more susceptible to disabilities. The 2010 census data shows that those between the ages of 40 and 59 are particularly prone to visual impairments, followed by motor and auditory difficulties [7]. These disabilities are often linked to an aging population and the onset of chronic health conditions that typically occur with age.

Barriers in physical and digital environments can prevent individuals with disabilities from fully participating in society on an equal basis. It is essential to address these barriers to make it easier for people with disabilities to navigate their daily lives [19].

Software requirements can be functional or non-functional. Functional requirements define what a system should do, while non-functional requirements (NFR) define how it should be done [4]; accessibility typically falls under NFR. The quality of a software is directly related to non-functional characteristics like availability, maintenance, performance, reliability, scalability, security, and usability. However, they are often described as hard to define and given less priority in agile software development, thus needing better documentation [3].

Accessibility in software development is crucial for meeting legal requirements and providing an inclusive user experience for all, including those with disabilities [14]. Prioritizing software accessibility allows developers to expand their user base and provide equal opportunities for everyone to access and use technology. Consequently, various initiatives and countries have implemented laws and policies to emphasize the significance of accessibility [16].

However, creating legally compliant systems is a significant challenge in the requirements engineering community, particularly in industries like finance and healthcare [6]. Laws and regulations can be complex, and their constant amendments make it difficult for system developers to interpret and derive requirements from them [11]. Despite the availability of legal reference techniques, legal expertise is often necessary to identify relevant laws and regulations and comprehend their statements relating to information technology (IT) [6].

Several studies have focused on understanding the development and design of accessibility to specific disabilities [9]. For instance, previous research investigated accessibility issues in Android apps [1] and webpages [15]. However, the limited attention given to accessibility in software development has changed gradually over the years. Studies showing how practitioner's perceive accessibility [2,17], the adoption of new models that promote the integration of methodologies and techniques, as well as specific accessibility activities [18], into the web and software development processes [16] and the incorporation of accessibility

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[1] IBGE (Instituto Brasileiro de Geografia e Estatística) is a Brazilian government agency responsible for collecting and disseminating official statistics, geography, cartography, geodetics, and environment information.

subjects into higher education curricula [5] are known initiatives to address this issue. Small steps towards a better world.

After analyzing 59 eligible responses in a survey aimed at understanding the varying levels of awareness, knowledge, and practices in accessibility among software development professionals, this study reports on diverse perspectives and experiences within the industry. Our findings highlight the multifaceted nature of accessibility considerations, from differences in educational background to challenges in implementing accessibility requirements. Furthermore, this study identifies potential areas for improvement, including the need for comprehensive accessibility curricula, accessible training programs, and increased collaboration among academia, industry, government agencies and advocacy groups. These insights offer valuable information on the current state of accessibility in the software industry, and provide a foundation for future initiatives aimed at promoting accessibility and creating a more inclusive digital environment for all.

The paper is structured as follows: Section 2 describes the research methodology, Section 3 presents the survey results, Section 4 discusses the findings, and Section 5 summarizes the study and suggests future directions.

2 Research Methodology

Goal and Research Questions. We aimed to identify the primary factors, obstacles, and compromises encountered by developers when addressing the accessibility and accessibility requirements in software development. We posed the following two research questions. We sought to enhance the understanding of the present accessibility landscape in software development and offer practical advice for enhancing accessibility methodologies and requirements.

[RQ1] How do technology professionals perceive and learn about accessibility and accessibility requirements?

[RQ2] What are the prevalent reasons for considering or neglecting accessibility requirements for software projects/products?

Questionnaire Design. We conduced an online survey following the personal survey guidelines by Kitchenham and Pfleeger [10]. To ensure complete confidentiality, we utilized an anonymous survey platform. Additionally, before deploying the questionnaire, we subjected it to a rigorous review process with three researchers. The feedback we received from them guided us in making revisions, which led to the final version of the survey, which can be found at `https://doi.org/10.6084/m9.figshare.25447204.v1`.

Drawing inspiration from previous studies conducted by Bi et al. [2] and Miranda et al. [13], our survey design consisted of multiple-choice and free-text questions arranged into three sections: (1) Demographic information, (2) Education and professional experience, and (3) Accessibility-related inquiries.

Populations and Sampling Method. We aimed to identify the accessibility practices within the Brazilian software development industry. For this purpose, we directed our survey towards software practitioners in Brazil. Given the challenge of accurately determining the size of our target population and

meeting the requirements of a probabilistic sampling method, we have opted for a non-probabilistic sampling method to ensure comprehensive participation. Through this approach, we aim to give all relevant professionals the chance to contribute to our survey. We implemented a multifaceted recruitment strategy to ensure a diverse range of responses. We shared the survey link across various WhatsApp groups and encouraged respondents to share it with their professional networks. Additionally, we leveraged LinkedIn groups to expand the reach of our survey. The survey was open for two weeks.

Despite our efforts, we only received 74 responses. However, to ensure the accuracy and reliability of our results, we excluded responses from individuals with no direct IT experience or those with incomplete surveys, resulting in 59 eligible responses for analysis.

Limitations. This study acknowledges the concerns regarding both external and internal validity. The external validity of the study is potentially compromised owing to the limited sample size and the use of convenience and purposive sampling methods, which may introduce bias and restrict the generalizability of the findings. To address this issue, efforts have been made to enhance the diversity of the sample by selecting respondents with varied backgrounds, teams, ages, genders, and roles. However, internal validity is threatened by reliance on self-reported data recollection, which may be influenced by recall bias and social desirability bias. To mitigate these biases, measures, such as emphasizing honesty, ensuring anonymity, and promoting voluntary participation, were implemented. Despite these limitations, this study considers its findings to be a valuable starting point for sharing preliminary results within the Requirements Engineering community, given the exploratory nature of the research.

3   Preliminary Results

Demographics. Out of the 59 survey respondents, half were male, 42.37% were female, and 3.39% were non-binary or third-gender. Most of them were young professionals, in the 25-34 range as shown in Table 1. Regarding educational background, most respondents held master's degrees (28.81%) or incomplete college degree (28.81%). Computer Science is among the most popular field of study (23.73%), followed by Software Engineering (15.25%) and Information Systems (18.64%). One third of the respondents are not from an IT field (Biomedical Informatics). Most respondents had up to 10 years of work experience. Regarding job roles, almost half identified as developers, followed by researchers (13.95%), and project managers (5.81%). It is worth noting that many respondents held more than one job role. Almost half of respondents worked for companies with 500 or more employees.

Table 2 provides a comprehensive summary that explains the correlation between the survey questions and the corresponding research inquiries in a concise manner.

Accessibility Educational Background. Respondents expressed varying perspectives on the extent to which accessibility topics were covered. A minority,

Table 1. Summary of Respondents Profile

Category	Subcategory	Count	%
Gender	Male	32	54.24
	Female	25	42.37
	Non-binary/Third Gender	2	3.39
Age	18-24	17	28.81
	25-34	28	47.46
	35-44	11	18.64
	45-54	3	5.08
Highest Level of Education	Doctorade	8	13.56
	Master's	17	28.81
	Incomplete Undergraduate Studies	17	28.81
	Complete Undergraduate Studies	15	25.42
	Complete Technical Education	1	1.69
	High School	1	1.69
Field of Study/Major	Computer Science	14	23.73
	Systems Analysis and Development	3	5.08
	Software Engineering	9	15.25
	Design	2	3.39
	Information Systems	11	18.64
	Other	20	33.9
Work Experience	Less than a year	3	5.08
	1-3 years	12	20.34
	3-5 years	11	18.64
	5-10 years	16	27.12
	10-15 years	8	13.56
	15-20 years	5	8.47
	Other	4	6.78
Job Role	Project Manager	5	5.81
	Project Owner	3	3.49
	Software Architect	5	5.81
	Developer	38	44.19
	Consultant	2	2.33
	Tester	5	5.81
	Designer	4	4.65
	Researcher	12	13.95
	Other	9	13.95
Number of Employees	1 − 10	10	16.95
	11 − 49	7	11.86
	50 − 249	5	8.47
	250 − 499	2	3.39
	500 ou mais	28	47.46
	I Don't Know	7	11.86
Company Sector	Health	12	12.63
	Education	7	7.37
	Government	5	5.26
	Human Resources	2	2.11
	Enterprise Resource Planning (ERP)	5	5.26
	e-Commerce	6	6.32
	Financial	14	14.74
	IT	28	29.47
	IT Consulting	6	6.32
	Other	10	10.53

Table 2. Summary of Research Questions

Research Questions	Survey Questions
RQ1	During your education, was the topic of accessibility in software/web development addressed sufficiently? Have you had any professional experience related to accessibility? In this experience, what nature of activity did you work on? What type of product did you have this experience with? Are you familiar with laws (e.g., Brazilian Inclusion Law) and public policies that require accessibility in IT products, ensuring the rights of people with disabilities to access information and communication? How familiar are you with the Web Content Accessibility Guidelines (WCAG)? WCAG is a set of guidelines developed by the World Wide Web Consortium (W3C) to make web content more accessible to people with disabilities. The main goal is to ensure that websites and applications are usable by a wide range of users, including those with visual, auditory, motor, cognitive, and other disabilities. How familiar are you with assistive technologies? Assistive technology refers to any device, equipment, software, or system designed to improve the functionality and independence of people with disabilities. These technologies can be physical or digital and are developed to help people with physical, cognitive, sensory, or communication disabilities. The goal of assistive technology is to reduce or eliminate barriers faced by people with disabilities, allowing them to perform daily tasks, participate in social activities, and access information more easily and effectively. (e.g., screen readers, adaptive keyboards and mice, voice recognition systems). What is your level of familiarity with software adaptations for the disabilities mentioned below? If your company were to offer an optional training on accessibility today, how would you rate your interest in attending this training?
RQ2	Does the company you currently work for care about and implement accessibility when developing projects/products? When your company develops a software solution/product, at which stage of development is accessibility taken into account? If you had to implement an accessibility feature in your project today, how would you feel? If you had to develop a project/product that required accessibility today, how would you rate your knowledge and skills in this area? If your company decided to include accessibility in all projects/products, what would be the perceived difficulty level for you and your team to include it? More specifically, if you or your team had to use specific accessibility guidelines, such as WCAG, to implement any accessibility adaptation requirement in the product (e.g., error prevention, status messages, etc.), what would be your perceived difficulty level? In your opinion, what are the main reasons to consider accessibility requirements in software projects/products? In your opinion, what are the main reasons why accessibility requirements are not considered in software projects/products? Considering your professional experience, how do you perceive the communication between UI/UX professionals and developers in a team during the implementation of accessibility in software products?

comprising 3.39% of respondents, felt that their education thoroughly addressed accessibility. However, a substantial portion (32.20%) deemed the coverage insufficient, highlighting the need to improve educational programs to equip future professionals with accessibility.

Software Accessibility Professional Experience. When asked about previous experience, only 10.17%reported extensive experience, while almost half indicated little to no experience, indicating a potential deficiency in skills and knowledge. Most of them worked in development-related activities, with nearly half of the respondents engaged in this aspect. Additionally, testing and requirement gathering were also common activities (33.74%). Also, when asked about the type of product they had experience with, the Web emerged as the most prominent, with almost half of the respondents indicating experience in this area. However, there was also notable involvement in mobile and desktop, highlighting the need for accessibility efforts across various platforms.

Integration of Accessibility in Project/Product Development within Current Company Practices. Our data reveal a mixed landscape when evaluating companies' approaches to accessibility. While some organizations exhibit a strong commitment to accessibility, 11.86% , others lag behind, with 16.95% admitting that accessibility is never considered. This diversity underscores the importance of advocating accessibility initiatives within corporate settings and fostering a culture of inclusivity.

Familiarity with Accessibility Laws and Guidelines (WCAG). Most of the respondents (38.98%) confessed they were unfamiliar with them. Nevertheless, approximately 32.20% of the respondents reported being moderately familiar, implying considerable awareness within the surveyed group. Regarding the Web Content Accessibility Guidelines (WCAG), 35.59% expressed a lack of familiarity, suggesting a potential gap in knowledge regarding these standards.

Assistive Technology. The responses varied regarding familiarity with assistive technologies. While 20.34% reported being moderately familiar and 11.86% very familiar, nearly an equal percentage (25.42%) indicated that they were unfamiliar with them.

Software Adaptations for Different Types of Disabilities. We found that the respondents had varying degrees of familiarity with it, as shown in Figure 1. The highest level of familiarity was with visual impairments, with 8% of respondents being extremely familiar and 14% being very familiar. On the other hand, cognitive impairments had the lowest level of familiarity, with 54% of respondents being unfamiliar.

Incorporating Accessibility Throughout Development Lifecycle. Implementation was the most cited stage, 22.08% of the responses. However, requirements were only considered in 10.39%, and one-third of respondents were uncertain about where accessibility was considered, which suggests a potential lack of clarity or consistency in the development processes.

Interest in Optional Accessibility Training. Most respondents expressed an interest in attending optional accessibility training provided by their com-
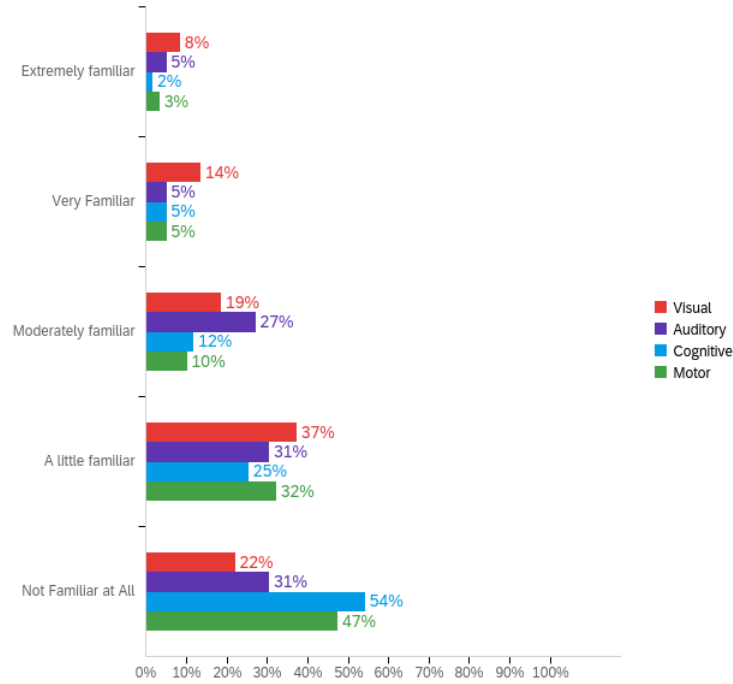
Fig. 1. Level of familiarity with software adaptations for disabilities

panies (84.74%). This underscores the team's commitment to enhancing their understanding and proficiency in accessibility principles and practices.

Self-rated Knowledge and Skills in Accessibility. Many respondents reported that their knowledge was partially or extremely insufficient (30.51%), indicating potential challenges or gaps in their skills and knowledge.

Perceived Difficulty Level of Including Accessibility in All Projects/Products by the Company. Most respondents expressed that it would be a difficult task, 35.59% responded that it would be partially difficult, and 18.64% extremely difficult.

Reasons Why Accessibility Requirements are Often Neglected. 44 out of 59 respondents, 74.58%, identified the lack of knowledge as a significant obstacle (see Figure 2). This indicates that software development teams may not fully understand the principles and practices of accessibility, making it challenging to prioritize and effectively define accessibility requirements and implement it.

Lack of Specialists. Over half of the respondents (52.54%) reported that the lack of dedicated accessibility experts in development teams can lead to neglecting accessibility requirements during project planning and execution.

Lack of Time. It emerged as an obstacle, with 31 out of 59 respondents (52.54%) citing it as an obstacle. In the fast-paced world of software develop-
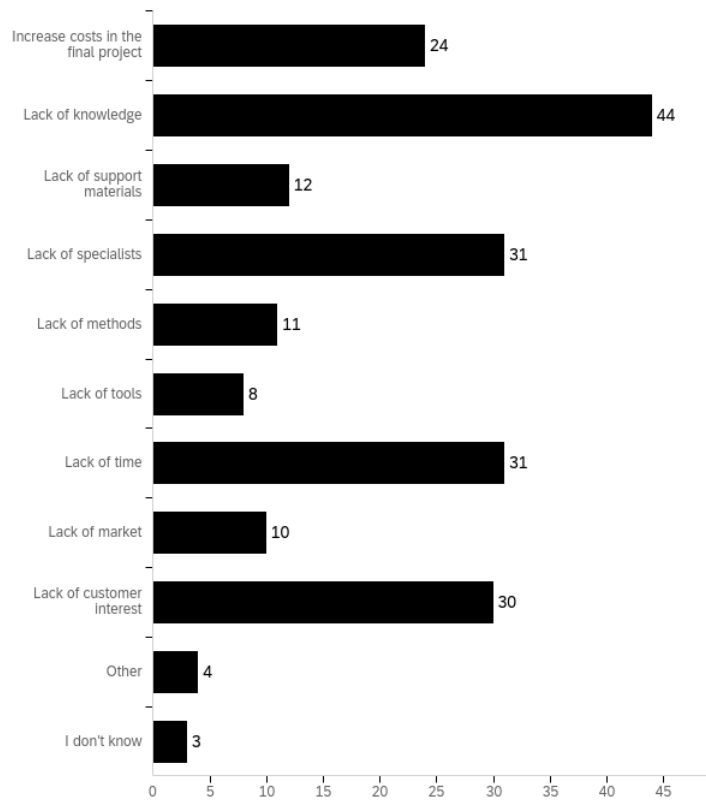
Fig. 2. Why accessibility requirements are **not** considered in software

ment, tight deadlines and competing priorities can force teams to make difficult decisions regarding where to allocate their time and resources. Unfortunately, accessibility considerations may be deprioritized to meet immediate project milestones.

Lack of Client Interest. 30 out of 59 respondents (50.85%) identified it as a challenge. This suggests that even when development teams are committed to integrating accessibility features, they may face resistance or disinterest from clients who fail to prioritize accessibility in their project requirements. Without client buy-in, development teams may struggle to justify the investment in time and resources needed to implement accessibility effectively.

Final Product Budget. With 24 out of 59 respondents (40.68%) expressing concern about the increase in the product's final price. Although many accessibility requirements can be executed at minimal cost, the perception of increased expenses may discourage organizations from investing in accessibility initiatives.

Lack of Market. 10 out of 59 respondents (16.95%) cited a lack of demand for accessible products as a hindrance. This highlights a broader systemic issue

in which the needs and preferences of users with disabilities are frequently over-looked in the marketplace. Without a strong demand for accessible products, organizations may struggle to justify the investment in accessibility.

Lack of Accessibility Resources. Several identified the absence of support materials as a challenge, with 12 out of 59 respondents (20.34%) indicating this. Additionally, 11 out of 59 respondents (18.64%) reported a lack of methods as a challenge, as did 8 out of 59 respondents (13.56%) regarding the scarcity of tools. It is crucial to have accessible resources and documentation to guide development teams in effectively integrating accessibility requirements.
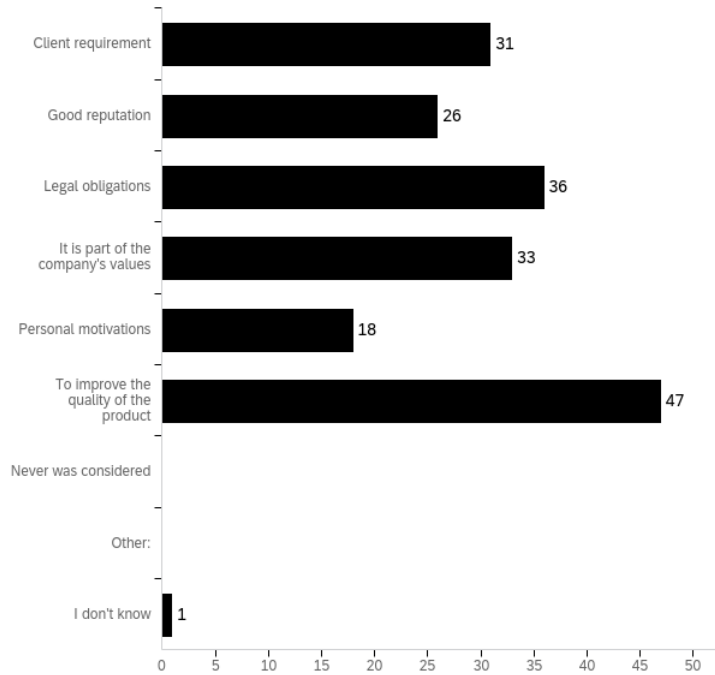

Fig. 3. Why accessibility requirements are considered in software

Reasons Why Accessibility Requirements are Implemented. 36 out of 59 respondents (52.54%) cited legal obligations as a critical motivator for implementing accessibility requisites (see Figure 3). This underscores the fact that accessibility is not merely a matter of preference; it is often mandated by law and regulation. Compliance with these legal standards is not just about avoiding penalties; it is also about ensuring equal access to technology for all people, regardless of their abilities.

Product Quality. Our data revealed that a vast majority of respondents 47 out of 59 (79.66%) recognized the critical role of accessibility in enhancing

product quality. Organizations can enhance their user experience and reach a wider audience by improving software accessibility and reducing usability issues.

Client Request. Seems to be a important reason for accessibility implementation, as 31 out 59 respondents (52.54%) pointed out. Clients may prioritize accessibility for various reasons, such as compliance with legal requirements or to expand their customer base. By fulfilling these client requests, organizations not only meet immediate project requirements, but also demonstrate their commitment to inclusivity and accessibility, fostering stronger client relationships and enhancing their reputation in the market.

Company's Value. It is also a reason why accessibility is implemented, as 33 out 59 respondents (55.93%), pointed out. Many organizations prioritize inclusivity and diversity as part of their corporate culture, and considering accessibility is a natural extension of these values. Incorporating accessibility into products shows social responsibility and inclusivity, resonating with like-minded employees, customers, and stakeholders. By integrating accessibility into their products, organizations demonstrate commitment to social responsibility and inclusivity, resonating with employees, customers, and stakeholders who share these values.

Good Reputation. A total of 26 out of 59 respondents (44.07%) emphasized the importance of considering accessibility requirements to maintain a good reputation. Organizations that prioritize accessibility are viewed more positively by customers, stakeholders, and the public, which enhances their brand image and competitive advantage in the market. This underscores the multifaceted benefits of integrating accessibility requirements into software projects or products. These benefits extend beyond legal compliance and product quality, align with corporate values, and maintain a positive reputation. Therefore, considering accessibility is not only a legal or moral obligation but also a strategic imperative that drives business success and fosters a more inclusive society.

Communication between the Developers Team with the UX/UI Team. Opinions about the subject varied. One third believed that the communication was neither efficient nor inefficient, suggesting room for improvement. However, 27.12% found the communication adequate, indicating that there are some effective collaboration in addressing accessibility needs.

Respondents Insights. The participants were asked to provide any additional insights on the subject. One participant noted that the software industry may be overlooking the issue of accessibility, and that the absence of regulations hinders the development of higher accessibility requirements. Another participant indicated that corporations that prioritize profits often overlook the needs of all users, which may hinder progress toward accessibility goals. One participant also pointed out that a lack of knowledge and comprehension of pertinent laws and guidelines might contribute to the insufficient implementation of accessibility features. Additionally, one participant emphasized the significance of incorporating accessibility into all projects, regardless of familiarity with particular guidelines or standards. Another participant mentioned that the context of a software project or product, such as its type, can also affect the prioritiza-

tion of accessibility features. Lastly, one participant emphasized the urgent need for more discussions and actions on accessibility within the engineering field to ensure that software products are inclusive and accessible to all users.

4   Discussion

[RQ1] How do technology professionals perceive and learn about accessibility and accessibility requirements?

Evaluation of Awareness, Knowledge in Accessibility. Our study reveals a mixed landscape regarding technology professionals' knowledge and awareness of accessibility principles. Some participants demonstrate a solid understanding and implementation of accessibility principles into their work, while others acknowledge a lack of knowledge or awareness regarding accessibility laws, guidelines, and best practices. This perceived discrepancy suggests a wide variance in awareness among technology professionals, influenced by educational background, professional experience, and exposure to accessibility issues in their work environment.

Insufficient knowledge or awareness regarding accessibility laws and guidelines often results in the creation of products that are inaccessible to individuals with disabilities. To mitigate this issue, fostering improved collaboration among industry stakeholders, government agencies, and advocacy groups is essential. By harnessing their collective expertise and resources, these stakeholders can collaboratively drive accessibility initiatives forward and tackle common challenges associated with developing accessible software.

Enhancing collaboration among these entities facilitates a more comprehensive understanding of accessibility requirements and best practices. Industry players can leverage insights from government agencies and advocacy groups to ensure their products adhere to relevant accessibility standards and regulations. Meanwhile, government agencies can guide industry and advocacy groups, fostering a conducive environment for accessibility initiatives.

We also highlight that while many respondents are familiar with software adaptations designed for individuals with visual impairments, mere familiarity does not necessarily translate into proficiency in implementing them effectively. It is crucial to evaluate individuals' capabilities and experiences in implementing accessibility solutions effectively rather than just their awareness, these findings were also reported in studies conducted by Patel et al. [17] and Leite et al. [12].

Interestingly, academic background and professional experience seem to influence awareness and knowledge of accessibility to some extent. Some participants feel that their education adequately addressed accessibility, while others perceive a lack of proper coverage during their training. Similarly, professionals with different levels of experience report variations in familiarity with accessibility laws and guidelines, suggesting that exposure and practice in the field may play a role in awareness and knowledge of accessibility. These findings corroborate studies conducted by Patel et al. [17] and Bi et al [2].

[RQ2] What are the prevalent reasons for considering or neglecting accessibility requirements in software projects/products?

Practices and Barriers in Accessibility Implementation. Current practices among software development professionals regarding the consideration of accessibility in projects vary widely. While a significant portion demonstrates interest and even relative ease in incorporating accessibility requirements into their projects, others face considerable challenges. Common barriers include a lack of familiarity with assistive technologies. Leite et al. [12] reported similar results. Uncertainty about when to consider accessibility during development stages was also reported by Patel et al. [17], as well as difficulties in communication and collaboration between UI/UX and development teams.

It is evident that there is an urgent need to overcome these barriers to ensure accessibility is a priority in all software projects. This may require both enhancing individual skills of professionals and organizational changes to promote a culture of inclusion and awareness of accessibility.

Impact of Education and Training in Accessibility. Education plays a crucial role in raising awareness and promoting good practices among software development professionals regarding accessibility [5]. However, our data suggests that a significant proportion of respondents do not feel that their education adequately addressed accessibility. This highlights the need for a review of educational curricula to ensure more comprehensive coverage of the topic. A similar conclusion was drawn by the study conducted by Patel et al. [17].

Furthermore, interest and willingness to participate in accessibility training appear to positively influence the practice of implementing accessibility requirements. Many respondents expressed interest in attending optional accessibility training, suggesting a collective desire to improve skills and knowledge.

5   Conclusion

Our study examined the extent of accessibility awareness, knowledge, practices, and obstacles among software development professionals. This study underscores the significance of continuous education and training in terms of accessibility. Collaboration between educational institutions and industries is vital to enhance the accessibility of software engineering. Incorporating comprehensive accessibility curricula; designing and implementing inclusive training programs; and nurturing partnerships between academia, industry, government agencies, and advocacy groups can advance accessibility initiatives. More research is needed to understand why accessibility is often overlooked. Legal obligations or client requests may not be prioritized. A better understanding of these issues can help requirement engineering students and professionals create effective strategies.

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