DIGITAL ACCESSIBILITY

ACROSS KUWAIT'S SOFTWARE DEVELOPMENT LANDSCAPE

Zainab AlMeraj

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Abstract

When designing and developing digital services it is important to consider equity and inclusion. However, in practice adopting and sustaining the development of accessible digital solutions has always been challenging, more so in countries that are relatively new to the concept of universal design, and physical and digital accessibility, and where legal sanctions are not yet established. This work investigates the software development scene in the State of Kuwait and analyses the responses of computing professionals regarding their skills, best practices, and procurement of accessible tech, and to their level of awareness towards people with disabilities. The findings reveal a low level of awareness of disability and digital accessibility amongst tech professionals. They also highlight a lack of available guidance, time management, training, legal enforcement, and coverage of fundamental concepts in higher education.

Introduction

According to the Web Accessibility Initiative (WAI),[1] Web accessibility means people with disabilities can perceive, understand, navigate, interact, and contribute to the Web regardless of age or ability. Web accessibility encompasses all disabilities that affect access to the Web, including visual, auditory, physical, speech, cognitive, and neurological disabilities. Hence, accessible technology, when created correctly, allows people to access information without modifications required to be carried out by the end user.[2] Improving the accessibility of software applications, including digital services and products, provides performance benefits to all users.[3] Therefore, it is imperative to begin building software applications with accessibility in mind from the start. However, it is still common for this area to lack adequate attention. It has been suggested that an improvement in application accessibility has occurred due to a shift in the tools used to create digital services,[4] rather than an increased understanding of accessibility itself.[5] In addition, challenges such as limited time to market, lack of awareness, training, and developer support are often cited as the main reasons for not embedding accessibility into applications.[6]

It is common in many countries for the accessibility of digital products to be enforced as a legal measure.[7] For example, accessible Web legislation in the United Kingdom (UK)[8] and European Union (EU),[9] are mostly guided by the World Wide Web Consortium (W3C) Web Content Accessibility Guidelines 2.0/2.1.[10] These are used to assist in making software products accessible.[11] However, evidence suggests that forcing accessibility by the

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[1] 'Making the Web Accessible', *Web Accessibility Initiative WAI*. Available at: https://www.w3.org/WAI/ (accessed 26 September 2023).

[2] Johnathan Lazar, Daniel Goldstein and Anne Taylor, *Ensuring Digital Accessibility Through Process and Policy* (Boston: Morgan Kaufmann, 2015), pp. 1–19.

[3] Juergen Sauer, Andreas Sonderegger and Sven Schmutz, 'Implementing Recommendations From Web Accessibility Guidelines', *Human Factors: The Journal of the Human Factors and Ergonomics Society* 58/4 (2016), pp. 611–29.

[4] John T. Richards, Kyle Montague and Vicki L. Hanson, 'Web Accessibility as a Side Effect', in: *Proceedings of the 14th International ACM SIGACCESS Conference on Computers and Accessibility* (New York: ACM, 2012), pp. 79–86.

[5] Vicki L. Hanson and John T. Richards, 'Progress on Website Accessibility?', *ACM Transactions on the Web* 7/1 (2013), pp. 1–30.

[6] Jonathan Lazar, Alfreda Dudley-Sponaugle and Kisha-Dawn Greenidge, 'Improving Web Accessibility: A Study of Webmaster Perceptions' *Computational Human Behavior* 20/2 (2004), pp. 269–88.

[7] Catherine Easton, 'Website Accessibility and the European Union: Citizenship, Procurement, and the Proposed Accessibility Act', *International Review of Law, Computers & Technology* 27/1,2 (2013), pp. 187–99.

[8] 'The Public Sector Bodies (Websites and Mobile Applications) Accessibility Regulations 2018', *UK Legislation*. Available at: https://www.legislation.gov.uk/uksi/2018/852/contents/made (accessed 26 September 2023).

[9] 'Directive 2016/2102 of the European Parliament and of the Council of 26 October 2016 on the Accessibility of the Websites and Mobile Applications of Public Sector Bodies', *EUR-Lex*. Available at: https://directive2102.eu/ (accessed 26 September 2023).

[10] 'Web Content Aaccessibility Guidelines (WCAG) 2.0', *W3C*. Available at: https://www.w3.org/TR/WCAG20/ (accessed 26 September 2023).

[11] Sarah Lewthwaite and Abi James, 'Accessible at Last? What Do New European Digital Accessibility

law has not led to enhanced accessible services in practice.[12,13]

Accessibility research has focused on the evaluation of a subset of technologies and promoting advocacy with a focus on developer awareness.[14] Contrary to popular belief, developers are not the only stakeholder in accessible technology development, these include c-level leaders, managers, designers, and quality assurance professionals.[15] The target is much broader and includes executives, higher management, designers, and quality assurance professionals.[16]

To understand where the perceived burden of adopting accessibility lies, we explore the State of Kuwait as an example of a country new to universal design and accessibility. In the country's' disability law, Kuwait does not mention digital accessibility or impose legal sanctions for inadequate accessibility.[17] A first attempt to promote accessible design and technology was proposed by the Public Authority for Disability Affairs (PADA), in 2018, who proposed a Digital Accessibility Framework based on WCAG 2.0.[18]

The goal in this work is to develop a general understanding of the current mindset surrounding tech, disability, and accessibility skills within the Kuwait technology landscape and the perceived barriers for adopting digital accessibility in Kuwait. Findings are valuable for state level stakeholders approaching accessibility adoption in countries that have yet to consider and establish laws and policies.

Laws Mean for Disabled People in the UK?', *Disabled Society* 35/8 (2020), pp. 1360–5.

[12] Yeliz Yesilada et al., 'Understanding Web Accessibility and its Drivers', in *Proceedings of the International Cross-Disciplinary Conference on Web Accessibility* (New York: ACM, 2012), pp. 1–9.

[13] Eric M. Velleman, Inge Nahuis and Thea van der Geest, 'Factors Explaining Adoption and Implementation Processes for Web Accessibility Standards Within eGovernment Systems and Organizations', *Universal Access in the Information Society* 16/1 (2017), pp. 173–90.

[14] Humberto L. Antonelli et al., 'A Survey on Accessibility Awareness of Brazilian Web Developers', *ACM International Conference Proceeding Series* (2018); Tingting Bi et al., 'Accessibility in Software Practice: A Practitioner's Perspective', *ACM Transactions on Software Engineering and Methodology* 31/4 (2022), pp. 1–26; Christopher Vendome et al., 'Can Everyone Use My App? An Empirical Study on Accessibility in Android Apps', *2019 IEEE International Conference on Software Maintenance and Evolution (ICSME)*, pp. 41–52; Shiya Cao and Eleanor Loiacono, 'The State of the Awareness of Web Accessibility Guidelines of Student Website and App Developers', in *International Conference on Human-Computer Interaction* (Cham, Switzerland: Springer, 2019), pp. 32–42; Nancy Alajarmeh, 'Evaluating the Accessibility of Public Health Websites: An Exploratory Cross-country Study', *Universal Access in the Information Society* 21/3 (2022), pp. 771–89.

[15] Yavuz Inal et al., 'Perspectives and Practices of Digital Accessibility: A Survey of User Experience Professionals in Nordic Countries', *Proceedings of the 11th Nordic Conference on Human-Computer Interaction: Shaping Experiences, Shaping Society* 63 (2020), pp. 1–11.

[16] Jane Seale et al., 'Engaging Ignored Stakeholders of Higher Education Accessibility Practice: Analysing the Experiences of an International Network of Practitioners and Researchers', *Journal of Enabling Technologies* 14/1 (2020), pp. 15–29; Shiri Azenkot, Margot J. Hanley and Catherine M. Baker, 'How Accessibility Practitioners Promote the Creation of Accessible Products in Large Companies', *Proceedings of the ACM on Human-Computer Interaction* 5/CSCW1 (2021), pp. 1–27

[17] 'Kuwait Law No. 8 of 2010 Concerning Rights of People with Disabilities', *International Labour Organization*. Available at: https://www.ilo.org/dyn/natlex/natlex4.detail?p_lang=en&p_isn=89501 (accessed 24 January 2023).

[18] 'Kuwait's Public Authority of the Disabled Showcases Project Achievements with UNDP', *UNDP Kuwait*. Available at: https://www.kw.undp.org/content/kuwait/en/home/presscenter/pressreleases/kuwait_s-public-authority-of-the-disabled-showcases-project-achi.html (accessed 26 September 2023).

Digital Accessibility Knowledge Around the World

A study targeting students and developers enrolled in software development courses at US universities showed that 55% of the participants had never taken web development courses that discussed web accessibility and 60% of the participants were unfamiliar with national and international accessibility guidelines (ADA, Section 508, WCAG) even though they are enforced and punishable by law.[19] A similar study in Sweden investigated whether accessibility topics were mentioned across 14 web development university courses. Surveys and interviews found that over 58% of the participants were unfamiliar with accessibility guidelines.[20]

Targeting user experience (UX) professionals in Turkey revealed that 37% did not know any international accessibility standard or guideline.[21] Although most participants were familiar with assistive technologies (95%), only a fraction reported having developed web applications for users with disabilities. A subsequent study investigating the current status of four Nordic country UX professionals' knowledge of accessibility, practices, challenges and organisational motivations found that around 34.7% of organisations believed that digital accessibility is an important asset.[22] Nearly 44.3% of organisations thought that digital accessibility was a moderately important asset. Furthermore, the results revealed that around 76.6% of UX professionals and designers had the most knowledge about digital accessibility.

An inquiry into web accessibility awareness within higher education in Jordan,[23] showed 67% of university web developers were unfamiliar with web accessibility guidelines. A further 83% admitted that they never performed accessibility testing before launching the websites. In Brazil, minimal software accessibility adoption has been noticed over a 10-year period.[24] It is worth noting that legislation in many countries has not guaranteed that services will be accessible.[25] Longitudinal studies have revealed a 15.8% improvement in accessibility awareness (35.7% of developers adopted best practices) despite laws and regulations put in place.

[19] Cao and Loiacono, 'The State of the Awareness of Web Accessibility Guidelines of Student Website and App Developers'.

[20] Mexhid Ferati and Bahtijar Vogel, 'Accessibility in Web Development Courses: A Case Study', *Informatics* 7/1 (2020).

[21] Yavuz Inal, Kerem Rızvanoğlu and Yeliz Yesilada, 'Web Accessibility in Turkey: Awareness, Understanding and Practices of User Experience Professionals' *Universal Access in the Information Society* 18/2 (2019), pp. 387–98.

[22] Yavuz Inal et al., 'Perspectives and Practices of Digital Accessibility: A Survey of User Experience Professionals in Nordic Countries', *Association for Computing Machinery* 63 (2020), pp. 1–11

[23] Iyad Abu Doush and Ikdam Alhami., 'Evaluating the Accessibility of Computer Laboratories, Libraries, and Websites in Jordanian Universities and Colleges', *International Journal of Information Systems and Social Change (IJISSC)* 9/2 (2018), pp. 44–60.

[24] André P. Freire, Cibele M. Russo and RPM Fortes, 'The Perception of Accessibility in Web Development by Academy, Industry and Government: A Survey of the Brazilian Scenario', *New Review of Hypermedia and Multimedia* 14/2 (2008), pp. 149–75; Humberto L. Antonelli et al., 'A Survey on Accessibility Awareness of Brazilian Web Developers', in *Proceedings of the 8th International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-Exclusion* (New York: Association for Computing Machinery, 2018).

[25] Velleman, Nahuis and van der Geest, 'Factors Explaining Adoption and Implementation Processes for Web Accessibility Standards Within eGovernment Systems and Organizations'.

Early work examining the adoption of accessible web practices identified three categories of influences on web accessibility: (a) Societal foundations, (b) Stakeholder perceptions and (c) Web development.[26] Another work devised a model describing factors that influence the adoption and implementation of accessibility across government. The factors included technical knowledge and experience for designing an accessible web, compatibility (in adopting accessibility standards within existing infrastructure), legislation, sponsorship (sponsoring external agents to oversee accessibility implementation), personal motivation, quality assurance, budget, careful selection, and procurement of external suppliers. We consider these in our survey design.

The implementation of accessibility requires more than simply creating standards and guidelines backed by regulations.[27] Limitations found in the summaries above prove how important it is to broaden the scope of the investigation to include all stakeholders involved in tech ideation, design, development, procurement, quality assurance and assessment.

Methodology

To build the surveys according to industry standards, we acquired the guidance of an international consulting company,[28] during the summer of 2020. The result of this collaboration was two surveys. Three sections of the survey were identical: about your company, participant background, participant level of understanding of various topics. The last section differed based on the survey target. The survey targeting senior-level ICT managers and executives included a section on business process and the survey targeting technical staff members (webmasters, developers, designers, content creators, admins, and UX/ UI professionals) included a technical section. All questions consisted of scales, multiple choice options and checklists. The final version of the surveys included 49 questions for senior management level and 43 questions for employee level. Subsequently, web-based surveys were created and administered via an online surveying tool.

Kuwait's ICT professionals' population size was estimated to be 22,000 in 2016.[29] With the lack of a skilled workforce, these numbers remain similar today.[30] An appropriate audience for this research was actively sought out over time. We first contacted pre-existing contacts before conducting a thorough search for potential applicants on LinkedIn using the location 'Kuwait'. Invitations were also distributed via direct email, published on the author's LinkedIn pages, and announced on social networking sites (Twitter and WhatsApp).

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[26] Jonathan Lazar, Alfreda Dudley-Sponaugle and Kisha-Dawn Greenidge, 'Improving Web Accessibility: A Study of Webmaster Perceptions', *Computers in Human Behavior* 20/2 (2004), pp. 269–88.

[27] John T. Richards and Vicki L. Hanson, 'Web Accessibility: A Broader View', in *Proceedings of the 13th International Conference on World Wide Web* (New York: Association for Computing Machinery, 2004).

[28] 'Empowering Oganisations Globally to Embed Digital Accessibility', *Hasell Inclusion*. Available at: https://www.hassellinclusion.com/ (accessed 26 September 2023).

[29] 'Consolidated Kuwait National ICT Indicators Report 2016', *Central Agency for Information Technology*. Available at: https://www.e.gov.kw/sites/kgoArabic/Forms/Final_Consolidated_English_Report_single_Pages.pdf (accessed 26 September 2023).

[30] 'A New Education Approach is Needed to Prepare MENA Youth to Shape the Future', *The World Bank*. Available at: https://www.worldbank.org/en/news/press-release/2018/11/11/a-new-education-approach-is-needed-to-prepare-mena-youth-to-shape-the-future (accessed 26 September 2023).

Data was collected during the first quarter of 2021. For management and c-level executives, a total of 159 responses were received, of which 74 were complete and used in this study. Just 91 fully completed replies were considered in the study out of a total of 196 for the employee level. As a result, the 165 survey results (with a 95% confidence level and an 8% margin of error) fairly represent the intended audience.

According to Baatard,[31] rewarding participants for their participation in a research study will improve the study's results. Via sponsorship, two incentives were provided for this study with the intention of helping the participants advance their knowledge. Senior-level ICT managers and executives had the choice of a flyer that outlined the necessity of taking accessibility into account and integrating it into business practices, as well as the advantages of accessible websites, and one that provided simpler steps to help them get started on their accessibility transformation. Technical staff members had the choice of a flyer explaining online accessibility from a technical standpoint and summarising the WCAG 2.1 principles to assist them in implementing accessibility by offering simple, easy-to-understand WCAG checklists. All participants had a chance to enter a raffle to win either of the two free online courses of two hours duration, sponsored by Deque system (1) Accessibility Fundamentals: Disabilities, Guidelines, and Laws, which is recommended for Managers, or (2) Web Accessibility Testing, which is recommended for Developers and Designers.

Results

In total, 165 participants successfully completed the surveys. However, since the surveys target two demographics: IT employees (n=91) and ICT managers (n=74), we present our findings in two parts sequentially for all the inquiries involved in this work.

Current mindset surrounding tech, disability and accessibility skills in Kuwait

Total ICT employee participants consisted of 91 technical employees, 62 males (68%) and 29 females (32%), with the majority 51 (56%) under the age of 30. For the educational levels, 4 (4.4%) had a diploma, 1 (1.1%) had a high school certificate, 62 (68.1%) were university graduates, 22 (24.2%) had a master's degree, and 2 (2.2%) had a PhD. 53 (58.2%) had a degree in Computer Science or ICT, 23 (25.3%) had a degree in Engineering, 5 (5.5%) had a degree in Administration or Management, and 10 (10%) had degrees in other areas. In terms of specialisation, 22% of the participants identified themselves as Web developer/programmers, 30% as software programmers and engineers, 10% as analysts and 8.8% as IT/product managers, 4.4% as designers and less representation was noticed in all other areas.

The total number of ICT employee participants consisted of 74 ICT managers, 61 males (82%) and 13 females (18%), with a majority 52 (70.27%) between the ages of 30-44. For the educational levels, 4 (5.41%) had a college diploma, 40 (54%) were university graduates, 23 (31%) had a master's degree, 7 (9.5%) had a PhD within the areas of Information and Communication Technology (ICT), Engineering and Management. All the participants had good/expert English and Arabic (only 4% claimed no experience in Arabic).

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[31] Gregory Baatard, 'A Technical Guide to Effective and Accessible Web Surveys', *Electronic Journal of Business Research Methods* 10/2 (2012), pp. 101–9.

Out of the total respondents in the manager-level survey, 89% indicated that their company was in the private sector: 45% corporate, 30% SME, 26% Startup; while only 11% were from the government and a total of 6 (8.11%) were not based in Kuwait. Of these, 62 (83.8%) mentioned having their own in-house development team: 38 (51.1%) developed all their company software and 21 (28.4%) developed some of the software and 15 (20.2%) either did not have a development team or did not know if they had one. The remaining 12 (17%) companies outsourced all their projects. According to responses, there is a good distribution between company sizes: under 10 employees (20, 27%), between 10-49 (15, 20%), 50-249 (13, 18%) to over 250 employees (26, 35%).

Table 1: ICT Employee Experience Levels

	Expert	**Advanced**	**Intermediate**	**Basic**	**Know Area**	**Don't Know Area**
Software development	16.5% (15)	29.7% (27)	27.5 (25)	19.8% (18)	5.5% (5)	1.1% (1)
UI design	9.9% (9)	22% (20)	29.7 (27)	24.2% (22)	6.6% (6)	7.7% (7)
UX design	8.8% (8)	9.9% (9)	30.8% (28)	28.6% (26)	12.1% (11)	9.9% (9)
Usability	12.1% (11)	18.7% (17)	31.9% (29)	18.7% (17)	11% (10)	7.7% (7)
Accessibility	8.8% (8)	15.4% (14)	29.7% (27)	26.4% (24)	13.2% (12)	6.6% (6)

Table 2: ICT Employee Training History

	Yes − Within the last 6 months	**Yes − Within the last 2 years**	**Yes − More than 2 years ago**	**No**
Software development	18.7% (17)	23.1% (21)	30.8% (28)	27.5% (25)
UI design	12.1% (11)	17.6% (16)	24.2% (22)	46.1% (42)
UX design	11% (10)	14.3% (13)	18.7% (17)	56% (51)
Usability	12.1% (11)	14.3% (13)	19.8% (18)	53.9% (49)
Accessibility	15.4% (14)	16.5% (15)	14.3% (13)	53.9% (49)

Table 1 offers a breakdown of the participant's areas of experience. ICT employee skills are diverse with a majority confirming intermediate levels of expertise in development, UI/UX, usability and/or accessibility. As for training, shown in Table 2, an overall majority have not received training in the latter areas within the last two years. This is likely due to their job function. Additionally, 47% of ICT employees whose areas involve development, UI/UX, usability and/or accessibility self- initiated their own skill development. There is a notice-able difference between self-initiated and employer-supported training (10% on average) indicating that employees need more training than that offered by their employers. Approx-imately 32% of ICT employees have reported receiving training in accessibility within the last 2 years, with around 13% claiming to have applied accessibility in all their projects but none expressed knowledge of international Web Content Accessibility Guidelines (WCAG).

As for managers-level experiences, shown in Table 3, most were highly skilled in their areas of work, with 54 (74%) representing the Technology and Telecommunication areas. Many had experience working for corporates and national companies, managing teams of up to 50 people including developers, designers, and business analysts. In terms of training attended by ICT managers (Table 4), 22% claimed to have been trained in accessibility in the last 2 years. However, only 2.7% reported always applying accessibility in their projects. Interestingly, some ICT managers have received training in UX/UI (19, 21%) within the last two years. Most of the training received was self-initiated (69%), a similar pattern was noticed earlier for IT employees.

Table 3: ICT Manager Experience Levels

	Expert	Advanced	Intermediate	Basic	Know Area	Don't Know Area
Software development	34.2% (25)	16.4% (12)	13.7% (10)	16.4% (12)	17.8% (13)	2.7% (2)
UI design	8.1% (6)	25.7% (19)	36.5% (27)	14.9% (11)	13.5% (10)	1.3% (1)
UX design	13.5% (10)	25.7% (19)	37.8% (28)	12.2% (9)	9.5% (7)	1.3% (1)
Usability	20.3% (15)	28.4% (21)	28.4% (21)	12.2% (9)	8.1% (6)	2.7% (2)
Accessibility	12.5% (9)	26.4% (19)	32% (23)	16.7% (12)	9.7% (7)	5.4% (4)

Table 4: ICT Manager Training History

	Yes – Within the last 6 months	Yes – Within the last 2 years	Yes – More than 2 years ago	No
UI design	13.5% (10)	14.9% (11)	23% (17)	48.7% (36)
UX design	13.5% (10)	12.2% (9)	31.1% (23)	43.2% (32)
Usability	10.8% (8)	10.8% (8)	25.7% (19)	52.7% (39)
Accessibility	13.5% (10)	10.8% (8)	27% (20)	48.7% (36)

Table 5: ICT Employee Awareness of Assistive Technologies

Which of the following Assistive Technologies are you aware of?			
	I'm aware of this	I've used this	I don't know this
JAWS- Screen Reader	18 (19.8%)	0 (0%)	73 (80.2%)
NVDA Screen Reader	19 (20.9%)	4 (4.4%)	68 (74.7%)
VoiceOver for iOS Screen reader	50 (55%)	14 (15.4%)	27 (29.7%)
Talkback for Android Screen Reader	46 (50.5%)	12 (13.2%)	33 (36.3%)
Dragon	10 (11%)	0 (0%)	81 (89%)
Text to Speech ReadAloud Narrator ChromeVox	49 (53.9%)	9 (9.9%)	33 (36.3%)
VoICE Navigator	34 (37.4%)	4 (4.4%)	53 (58.2%)
Screen amplifier or Magnifier	48 (52.7%)	13 (14.3%)	30 (33%)
Braille aids and printers	37 (40.7%)	7 (7.7%)	47 (51.7%)
Eye tracking	38 (41.8%)	7 (7.7%)	46 (50.5%)
Text Only browser	45 (49.5%)	7 (7.7%)	39 (42.9%)
Alternative input devices	47 (51.6%)	8 (8.8%)	36 (39.6%)
Crutches, wheelchairs, hearing aids, artificial limbs	51 (56%)	2 (2.2%)	38 (41.8%)

Table 6: ICT Manager Awareness of Assistive Technologies

Which of the following Assistive Technologies are you aware of?		
	I'm aware of this	I've used this	I don't know this
JAWS- Screen Reader	17 (23%)	7 (9.5%)	50 (67.6%)
NVDA Screen Reader	19 (25.7%)	4 (5.4%)	51 (69%)
VoiceOver for iOS Screen reader	39 (52.7%)	8 (10.8%)	27 (35.5%)
Talkback for Android Screen Reader	30 (40.5%)	6 (8.1%)	38 (51.3%)
Dragon	12 (16.2%)	1 (1.3%)	61 (82.4%)
Text to Speech ReadAloud Narrator ChromeVox	40 (54%)	12 (16.2%)	22 (29.7%)
VoICE Navigator	22 (29.7%)	9 (12.2%)	43 (58.1%)
Screen amplifier or Magnifier	35 (47.3%)	12 (16.2%)	27 (36.5%)
Braille aids and printers	30 (40.5%)	4 (5.4%)	40 (54%)
Eye tracking	33 (44.6%)	7 (9.5%)	34 (46%)
Text Only browser	30 (40.5%)	9 (12.2%)	35 (47.3%)
Alternative input devices	42 (56.8%)	6 (8.1%)	26 (35.1%)
Crutches, wheelchairs, hearing aids, artificial limbs	42 (56.8%)	1 (1.3%)	31 (41.9%)

Table 6: ICT Manager Awareness of Assistive Technologies

Which of the following Assistive Technologies are you aware of?		
	I'm aware of this	I've used this	I don't know this
JAWS- Screen Reader	17 (23%)	7 (9.5%)	50 (67.6%)
NVDA Screen Reader	19 (25.7%)	4 (5.4%)	51 (69%)
VoiceOver for iOS Screen reader	39 (52.7%)	8 (10.8%)	27 (35.5%)
Talkback for Android Screen Reader	30 (40.5%)	6 (8.1%)	38 (51.3%)
Dragon	12 (16.2%)	1 (1.3%)	61 (82.4%)
Text to Speech ReadAloud Narrator ChromeVox	40 (54%)	12 (16.2%)	22 (29.7%)
VoICE Navigator	22 (29.7%)	9 (12.2%)	43 (58.1%)
Screen amplifier or Magnifier	35 (47.3%)	12 (16.2%)	27 (36.5%)
Braille aids and printers	30 (40.5%)	4 (5.4%)	40 (54%)
Eye tracking	33 (44.6%)	7 (9.5%)	34 (46%)
Text Only browser	30 (40.5%)	9 (12.2%)	35 (47.3%)
Alternative input devices	42 (56.8%)	6 (8.1%)	26 (35.1%)
Crutches, wheelchairs, hearing aids, artificial limbs	42 (56.8%)	1 (1.3%)	31 (41.9%)

When enquiring about different disabilities, assistive technologies and how people with disabilities use the Web, around 60 (66%) of employees said they have interacted with people with disabilities before with either visual, hearing, speech, cognitive, motor impairments or old age. When asked if they knew how people with different disabilities use the Web, taking an average for the disabilities mentioned, 27% of responses indicated that they did not know that people with disabilities could use the Web, 20% admitted that they have heard they could use it but did not know how, and 38% knew how they use the Web but did not know how to cater to their needs. In terms of catering technologies for people with disabilities, 13% indicated they had at some point, whilst only 3% on average affirmed to have always catered technologies for them.

Amongst ICT managers, 40 (54%) stated they had an interaction with people with disabilities before, and on average 27% did not know that people with disabilities could use the Web, and 30% were aware that they could use the Web but did not know how. 28% knew how they use the web but did not know how to cater for technologies for them. Meanwhile, 12% reported to have catered technologies for people with disabilities, whilst only 3% said they always cater technologies for them.

We then asked about assistive technologies (JAWS, NVDA, Voice Over, Talk back, Dragon, Text to speech-Read Aloud Narrator or ChromeVox, VoICE Navigator, Screen amplifier, Braille aids and Printers, Eye Tracking, Text Only browser, alternate i/p device, crutches hearing aids or artificial limbs), as shown in Tables 5 and 6. On average, less than half of the ICT employees (42%) stated they were aware of them and 50% did not know about any of them, while only 7% claimed to have used them. A similar pattern was noticed in the managers' response in which 41% were aware of some of the assistive technologies, 9% claimed to have used them, and 50% did not know about them.

Table 7: ICT Employee Knowledge of Accessibility Standards

	WCAG 2.0/2.1	UAAG 2.0	ATAG 2.0	ARIA	ISO 9241-210	ISO 30071	KDAF
I've never heard of this	64 (70.3%)	66 (72.5%)	76 (83.5%)	71 (78%)	65 (71.4%)	73 (80.2%)	79 (86.8%)
I've seen this done	7 (7.7%)	13 (14.3%)	10 (11%)	6 (6.6%)	10 (11%)	10 (11%)	7 (7.7%)
I've read about this	10 (11%)	7 (7.7%)	1 (1.1%)	7 (7.7%)	12 (13.2%)	8 (8.8%)	4 (4.4%)
I've applied this (self-initiative)	9 (9.9%)	3 (3.3%)	3 (3.3%)	7 (7.7%)	3 (3.3%)	0 (0%)	0 (0%)
I've applied this (as a regulation)	1 (1.1%)	2 (2.2%)	1 (1.1%)	0 (0%)	1 (1.1%)	0 (0%)	1 (1.1%)
I always apply this	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 8: ICT Employee Knowledge of Accessibility Standards

	WCAG 2.0/2.1	UAAG 2.0	ATAG 2.0	ARIA	ISO 9241-210	ISO 30071	KDAF
I've never heard of this	41 (55.4%)	44 (59.5%)	55 (74.3%)	48 (64.9%)	45 (60.8%)	49 (66.2%)	59 (79.7%)
I've seen this done	14 (18.9%)	15 (20.3%)	9 (12.2%)	11 (14.9%)	11 (14.9%)	12 (16.2%)	7 (9.5%)
I've read about this	11 (14.9%)	11 (14.9%)	5 (6.8%)	4 (5.4%)	10 (13.5%)	8 (10.8%)	7 (9.5%)
I've applied this (self-initiative)	1 (1.3%)	1 (1.3%)	1 (1.3%)	5 (6.8%)	3 (4%)	1 (1.3%)	0 (0%)
I've applied this (as a regulation)	5 (6.8%)	2 (2.7%)	2 (2.7%)	5 (6.8%)	5 (6.7%)	3 (4%)	1 (1.3%)
I always apply this	2 (2.7%)	1 (1.3%)	2 (2.7%)	1 (1.3%)	0 (0%)	1 (1.3%)	0 (0%)

For reference Table 7 and 8: Web Content Accessibility Guidelines (WCAG), User Agent Accessibility Guidelines (UAAG), Authoring Tool Accessibility Guidelines (ATAG), Accessible Rich Internet Applications (ARIA), Human Centered Design for Interactive Systems (ISO 9241-210), Code of Practice for Creating Accessible ICT Products and Services (ISO 30071) and Kuwait Digital Accessibility Framework (KDAF).

With regards to the International Digital accessibility standards (WCAG 2.0/2.1,UAAG 2.0, ARIA, ISO 9241-210, ISO 30071, KDAF) in Table 7, on average 77% of employee level participants had never heard about them. On average 10% had seen someone doing it, and only 8% had reported reading about it. A total of 4 (4%) had applied them as their own initiative, and just one person had applied one or more of them because of some regulation from the company/law. No employee reported always applying any of these standards.

ICT managerial level knowledge is slightly better, as shown in Table 8, on average 66% had not heard about the standards, 15% had seen someone applying one or more of them, and 11% have read about them. While only 2% claimed to have applied one or more of them as a self-initiative and 5% had applied one or more of them as a regulation and one person stated to have always applied the standard(s).

Current perceived motivators and barriers in adopting accessible design by ICT employees

When asked about the factors that motivate them to consider accessibility in software development, over 72% of ICT employees mentioned personal motivation/ethics as being the main reason. The second main factor was social responsibility (56%) followed by organisational and customer requirements (32% each), business motives (23%), legal obligations (8%). Approximately 11% were not aware of accessibility and why to consider it.
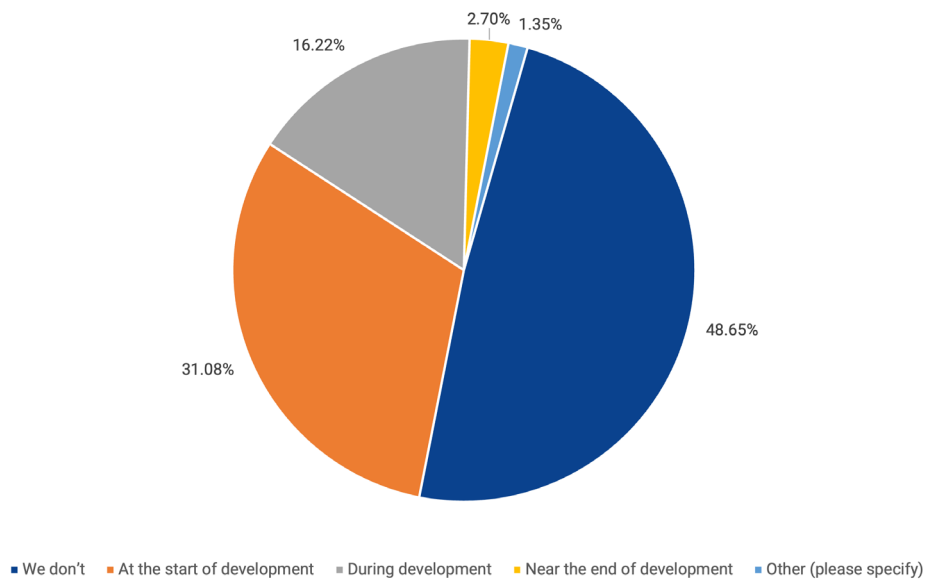
ICT employees were then asked about the challenges they believe affect them when considering accessibility in their work. 68% claimed that lack of awareness of accessibility was the main challenge. This was followed by a lack of skills and knowledge about accessibility (49%), lack of training (49%), and time constraints (41%). The remaining challenges include it not being a customer/organisational priority (34%), trade-off between accessibility and graphic design (32%), lack of support at managerial level (29%), budget limitations (23%), overwhelming content of guidelines to implement (22%), accessibility resources not well documented (20%), accessibility resources not available in Arabic (20%) and no/weak legal obligations (19%). Most of the IT employees and managers (38%) said that some of their technology is accessible and 19% of both said either all were, or most were accessible. 16% of IT employees and 20% of managers claimed that none of their technology was accessible. The remaining (26%, 27%) were unsure.

Current practices in project procurement in government, public and private sectors (ICT managers)

According to ICT manager-level responses, on average 32 (43.2%) company tech projects are acquired using either a request for information (RFI), request for quotation (RFQ) or request for proposals (RFP). A further 21 (28.4%) are developed in-house and the remaining 9 (12%) of projects involve some other form of tendering. 13 (17.6%) of respondents were not aware of their company's procurement methods. A total of 35 (47.3%) of companies have never received or commissioned a project from a Kuwait-based company that included accessibility requirements. A total of 17 (23%) had, and 22 (29.7%) of the professionals were not aware of whether they had. When making final decisions on projects

procured by third parties, 42 (56.75%) managers claimed to have an authoritative opinion. A further 20 (27%) are rarely involved in the decision making and 12 (16.2%) are not involved at all.

Figure 1: When Do You (Manager-Level Professionals) Start to Think About Accessibility in the Product Development Process?

■ We don't   ■ At the start of development   ■ During development   ■ Near the end of development   ■ Other (please specify)

Respondents summarised the following titles as final decision makers for third-party procurement: CEOs/GM, associates, IT director/manager, sales/purchase departments and project managers. Table 9 summarises the current practices of IT procurement with respect to accessibility.

Table 9: IT Procurement Practices

Inquiry	Yes	No	I don't know
Does your company require Web Accessibility in projects in-house/third party?	16 (21.6%)	28 (37.8%)	30 (40.5%)
Do you know how to express the accessibility requirements for a product?	9 (12.2%)	38 (51.3%)	27 (36.5%)
Do you include questions about accessibility in your procurement process?	19 (25.7%)	48 (64.9%)	7 (9.5%)
Does your department conduct accessibility testing?	21 (28.4%)	43 (58.1%)	10 (13.5%)
Does your company have any plans to make their technology products accessible to users with disabilities in the future?	26 (35.1%)	13 (17.6%)	35 (47.3%)

When asked whether they themselves were aware of how to assess if accessibility require-ments have been met in commissioned projects, 9 (12.2%) said they were capable and the remaining 65 (87.8%) either had some idea or not at all. To understand whether the lack of knowledge was compensated by commissioning accessibility testing agencies, 50 (67.6%) said no, 11 (14.9%) said yes, and 13 (17.6%) did not know of such practice happening in their company. The manager-level participants were also asked when they start to think about or test for accessibility in the project life cycle. The results highly correlate and are presented in Figure 1.

To better assess the importance of accessibility in IT projects, participants were asked how much accessibility was discussed through a project with their team colleagues. The majority said they did not 35 (47.3%), meanwhile, 9 (12.2%) said they mentioned it at most once, 26 (35%) said it came up a few times or key points throughout the project and 4 (5.4%) mentioned that it was a topic of discussion at every meeting.

Discussion

This investigation began as an attempt to understand the prevalence of digital accessibility among key tech stakeholders, their level of exposure to assistive technologies, accessibil-ity standards/guidelines, and whether their current practices in design and procurement adopt inclusive design principles or accessibility across the various sectors in the State of Kuwait. Accordingly, we break down the discussion below according to the research inquiries and the tech employee and manager survey findings.

Current mindset surrounding tech and disability and accessibility skills in Kuwait

With respect to ICT employees, we found that more than half had interacted with persons with disabilities, 36% did not have an idea of how they use the Web, less than 40% knew how they used the web and only a handful knew how to cater to their technology needs. Similarly for participating ICT managers, the data revealed a low level of awareness as more than half of managers had interacted with people with disabilities before, but again more than half did not know how they use the web. From this, we can discern that there is a low level of knowledge and or exposure to disability across the ICT professionals' educational and practical life. This is not surprising since computing education in Kuwait minimally covers UX/UI in curricula and does not explicitly include usability or accessi-bility topics in undergraduate or graduate level university courses.[32] ICT and computing skills gaps have been noticed across the MENA region.[33] In addition, small efforts have led

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[32] Zainab AlMeraj et al., 'Evaluating the Accessibility of Higher Education Institution Websites in the State of Kuwait: Empirical Evidence', *Universal Access in the Information Society* 20/1 (2021), pp. 121–38; Michael Crabb et al., 'Developing Accessible Services: Understanding Current Knowledge and Areas for Future Support', in *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems* (Glasgow: CHI'19, 2019); Norun Sanderson, Siri Kessel and Weiqin Chen, 'What Do Faculty Members Know About Universal Design and Digital Accessibility? A Qualitative Study in Computer Science and Engineering Disciplines', *Universal Access in the Information Society* 21 (2022), pp. 351–65.

[33] 'Technological Trends in the MENA Region: The Cases of Digitalization and Information and

to a dialogue of inclusion and adoption across telecommunications companies in Kuwait,[34] but local policy and digital law accommodation for people with disabilities in Kuwait remains very limited.

In our survey, many participants reported to have not received any training in Web accessibility, usability, UI and UX by their employers and instead initiated their own training in them as well as software development. In terms of digital accessibility skills, it was noticed that ICT employees with more working experience were more familiar with WCAG and ARIA, but not aware of any other accessibility or usability related standard; UAAG, ATAG, ISO 9241-210, ISO 30071 or KDAF. The road of awareness is long and is likely to be supported by c-level buy-in of diversity, and equity and inclusion efforts are noticed more in the MENA region during and since the COVID-19 pandemic.[35]

Meanwhile, for ICT managers, data revealed a low level of awareness and competence across all UI and UX, accessibility and usability standards, with nearly three-quarters of management level professionals being not familiar with any of the international standards related to human-centred design or accessibility. This observation is not unusual as many assessments targeting awareness of standards have shown similarly low levels across the MENA region.[36] Looking forward, investment in training, curriculum design and awareness campaigns are needed to advance knowledge in these domains if digital inclusion is to be reached.[37]

It was also noticed that less than 10% knew how to apply the W3C WCAG standard in software projects, and around 20% knew how to assess if accessibility requirements had been met. This further supports the weaknesses in education and awareness identified earlier and suggests that some ICT managers may have confused the term accessibility with something else, perhaps UX or QA since most managers showed poor knowledge and have never received corporate training in UI, UX, usability or accessibility and the few who had done so in their own time. This result supports previous research that proves the need for professional training to overcome knowledge gaps in academia and in tech businesses.[38]

Communications Technology (ICT)' *MENARA Working Papers*. Available at: https://www.researchgate. net/publication/331021327_Technological_Trends_in_the_MENA_Region_The_Cases_of_Digitaliza- tion_and_Information_and_Communications_Technology_ICT (accessed 26 September 2023).

[34] 'Kuwait's Public Authority of the Disabled Showcases Project Achievements with UNDP', *UNDP Kuwait*. Available at: https://www.kw.undp.org/content/kuwait/en/home/presscenter/pressreleases/ kuwait_s-public-authority-of-the-disabled-showcases-project-achi.html (accessed 26 September 2023).

[35] 'Diversity Council MENA to Boost Inclusion in Region', *Arab News*. Available at: https://www.arab- news.com/node/1522196/corporate-news (accessed 26 September 2023).

[36] Antonelli et al., 'A Survey on Accessibility Awareness of Brazilian Web Developers'; Cao and Loiacono, 'The State of the Awareness of Web Accessibility Guidelines of Student Website and App Developers'; Abu Doush and Alhami., 'Evaluating the Accessibility of Computer Laboratories, Libraries, and Websites in Jordanian Universities and Colleges'.

[37] 'United Nation Sustainable Development Goals (SDGs)', *United Nations*. Available at: https://sdgs. un.org/goals (accessed 26 September 2023).

[38] 'Technological Trends in the MENA Region', *MENARA Working Papers*.

Due to the large number of the participants admitting to having never heard about any of the standards related to user experience, these findings raise concern regarding current tech usability and implicate the need to enhance testing to meet the basic prerequisites for accessible Web and increase awareness efforts by local and global expert entities.

Current perceived motivators and barriers in adopting accessible design by IT employees

Having discerned a low level of awareness and knowledge of accessibility, we attempt here to understand the point of view of the tech employees themselves (designers, developers, content creators, quality assurance officers, etc.) as they are the driving force of cutting-edge technology adoption and implementation.

Over 70% of ICT employees mentioned personal motivation and ethics as being the main reason for their drive to adopt accessibility. It is evident across our findings that those aware of accessibility do in fact have a high level of empathy and ethical values that drive them to (potentially) consider accessibility in software design and development. This offers a positive outlook on the challenging road ahead to ensure more accessible technologies are built. This finding corroborates previous work that stresses the importance of understanding needs, having empathy and how putting people in others' shoes can promote better acceptance and adoption of accessibility.[39] In parts of the world where laws and policies are in place at the national or organisational level, motivation results deviate more towards business KPIs and legal obligations which would have much higher ratings than the ones analysed in this work.[40]

The findings suggest that the largest barriers to including accessibility in projects were lack of awareness, lack of accessibility skills and knowledge, lack of training and time constraints. These results corroborate findings from previous research that highlight weaknesses in accessibility knowledge, adoption, and implementation strategies.[41] Our findings prove similar to the outcomes of previous assessments across the MENA region and the world, particularly in the US and Europe, where accessibility was first introduced over two decades ago that demonstrated how much awareness was needed and put laws and policies in place at a national level and within organisations.[42] A growing community

[39] Paula Conn et al., 'Understanding the Motivations of Final-Year Computing Undergraduates for Considering Accessibility', *ACM Transactions on Computing Education* 20/2 (2020); Cosima Rughiniş and Răzvan Rughiniş, '"In My Shoes" Interaction Sandbox for a Quest of Accessible Design: Teaching Sighted Students Accessible Design for Blind People', in *Universal Access in Human-Computer Interaction:. Design Methods and User Experience* (Cham: Springer International Publishing, 2021), pp. 64–74.

[40] Shiri Azenkot et al. 'Understanding Web Accessibility and Its Drivers. In Proceedings of the International Cross-Disciplinary Conference on Web Accessibility', *Association for Computing Machinery* 19 (2012).

[41] Yavuz Inal et al., 'What Do faculty Members Know About Universal Design and Digital Accessibility? A Qualitative Study in Computer Science and Engineering Disciplines', *Universal Access in the Information Society* 21 (2022), pp. 351–65.

[42] Lazar, Goldstein and Taylor, *Ensuring Digital Accessibility Through Process and Policy*; Kelly Mack et al., 'What Do We Mean by "Accessibility Research"? A Literature Survey of Accessibility Papers in CHI and ASSETS from 1994 to 2019', in *Proceedings of the 2021 CHI Conference on Human Factors in Computing*

of researchers continue to focus on gaining insights across the tech scene for countries and organizations who have or have yet to introduce technology-inclusive policies in attempts to enhance the spread and growth of tech accessibility best practices. The MENA region has yet to experience policy reform noticed in the West, and only recently, post-COVID-19 pandemic, have topics such as accessibility and inclusion began to receive media attention. Findings like ours strengthen the case for positive change and impose a need for training and awareness campaigns to ensure more tech is developed with all people in mind.

In retrospect, world nations have been able to measure the impact of education and training across disciplines on the economy and prospective future of the country.[43] However, for inclusive design, user experience and accessibility, instruments of measurement are not common and are harder to quantify. There are a few benchmarking tools available to organisations to assist in this assessment and help keep track of efforts made,[44] but more research is needed to come up with independent assessment tools that can inform the status, irrespective of geographical location and culture. The same applies to the measurement of empathy for advocacy of equal rights for people with disabilities, a main factor listed as important by over half of our participants. This has been noticed in research, in which developers struggle to empathise with accessibility issues and subsequently end up designing interactions specific to a particular demographic, not under universal design.[45]

Current practices in project procurement in government, public and private sectors (IT managers)

From a corporate requirement point of view, 17 (23%) of the managers mention they have been asked to deliver accessible software from clients and 16 (22%) of them confirmed that their company requires accessibility in the products they develop/procure. Interestingly, only 6 (8%) stated that all their software products are accessible. Since some were asked to produce accessible software but many do not actually develop software to be accessible, we can infer that accessibility is not heavily enforced and there are no organisational penalties for excluding it from development. Since 38 (51%) of participating companies develop all their own software is an indication that more in-house developer teams are on the rise. This corroborates positive change in current global technology trends and

Systems (New York, USA: Association for Computing Machinery, 2021); Shari Trewin et al., 'Accessibility Challenges and Tool Features: An IBM Web Developer Perspective', in *Proceedings of the 2010 International Cross Disciplinary Conference on Web Accessibility* (*W4A*) (New York: Association for Computing Machinery, 2010).

[43] Catherine Grant, 'The Contribution of Education to Economic Growth', *K4D*. Available at: https://assets.publishing.service.gov.uk/media/5b9b87f340f0b67896977bae/K4D_HDR_The_Contribution_of_Education_to_Economic_Growth_Final.pdf (accessed 26 September 2023).

[44] 'The Global Initiative for Inclusive ICT', *World Wide Web Consortium* (*W3C*). Available at: https://g3ict.org/ (accessed 26 September 2023).

[45] Cynthia Putnam et al., 'How Do Professionals Wwho Create Computing Technologies Consider Accessibility?', in *Proceedings of the 14th International ACM SIGACCESS Conference on Computers and Accessibility* (New York: Association for Computing Machinery, 2012).

ongoing investments.[46] Across the world, digital accessibility compliance is commonly adopted because of legislation or after litigation cases,[47] and until the agenda for these areas is further developed in Kuwait this pattern will continue and the development scene will be at a disadvantage.

The survey data also points to a weakness in accessibility best practices. For example, 14 (19%) test for accessibility at the beginning of their projects. This is a phase where there is little to test. But only 5 (7%) test for accessibility at the end of the project when it is a crucial time to do so. However, 9 (12.1%) said they knew how to assess if accessibility requirements were met in their projects. These findings suggest that participating managers may have been amplifying their level of accessibility maturity in their answers.

The low level of knowledge, slight adoption of accessibility in the SDLC and inconsistency in the delivery of accessible products further suggests there is no requirement to comply with standards or policies but to foster accessibility in development as and when it is requested. This finding is further supported by the 11 (15%) managers who stated that they have asked for an accessibility audit from an external supplier, whilst only 32 (43%) stated they do their own usability testing of their products, and only 20 (27%) have plans to improve their accessibility practices with almost 50% who aren't sure. This leads us to conclude that as of now there are little to no tangible accessibility skills or industry-adopting accessibility in Kuwait.

One positive outlook is that software development platforms and languages are routinely being embedded with accessibility increasingly part of SEO and metric analytics.[48] This suggests that companies developing software using cutting-edge platforms to some extent create moderately accessible software automatically. What is needed is awareness, and to up-skill knowledge for the initial phases of software development, during UI & UX design, which contributes largely to effective accessible design and development.

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[46] 'Top Priorities for IT: Leadership Vision for 2021', *Gartner*. Available at: https://www.gartner.com/en/publications/cio-top-priorities-leadership-vision-2021 (accessed 28 September 2023).

[47] 'Directive 2016/2102 of the European Parliament and of the Council of 26 October 2016 on the Accessibility of the Websites and Mobile Applications of Public Sector Bodies', *EUR-Lex*; Zsuzsanna B. Palmer and Ralph H. Palmer, 'Legal and Ethical Implications of Website Accessibility', *Business and Professional Communication Quarterly* 81/4 (2018), pp. 399–420.

[48] Justin Grant at al., 'Accountability for the Hidden Codes toward a Better User Experience: Case Study of HR simple Communication Design for Web Accessibility and SEO', in *The 39th ACM International Conference on Design of Communication* (*Virtual Event, USA*) (*SIGDOC '21*) (New York, USA: Association for Computing Machinery, 2021), pp. 347–50.

Conclusion

The purpose of this work is to explore the viewpoints, knowledge, and awareness of Kuwaiti technology workers regarding individuals with disabilities. We discovered that in the educational and professional lives of ICT professionals and employees, there is a low degree of awareness, understanding, and exposure to individuals with disabilities and digital accessibility. The research results in this report can aid future awareness-raising and skill-upgrading initiatives intended to increase knowledge of digital accessibility in Kuwait and the GCC. A more in-depth inquiry to investigate the types of design and development criteria implemented by programmers and product/IT/ICT managers is underway to help better guide future training initiatives and offer a foundation for how to approach awareness and development practices in government, public and private project procurement. The intention is to rerun this benchmark study in a few years to determine whether concrete initiatives to raise awareness in Kuwait have resulted in improvements in knowledge and awareness among ICT demographics. The findings will be applied to policies at the national and organisational levels to further encourage the adoption of accessibility and usability in the public and private sectors.

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