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Perspectives and Practices of Digital Accessibility: A Survey of User Experience Professionals in Nordic Countries

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ABSTRACT

User experience (UX) professionals are key actors in promoting inclusion in the digital society. They are responsible for ensuring that web pages and digital services are in line with regulatory frameworks and that digital accessibility for all is incorporated into their designs. Still, there are few dedicated professionals that specialize only in accessibility. In this paper, we explore how UX professionals in Nordic countries view and practice digital accessibility. We collected data from 167 UX professionals in Denmark, Finland, Norway, and Sweden using an online survey. Our results show that, generally, the UX professionals consider digital accessibility to be important and their organizations include accessibility in their projects. However, they spend limited work time on accessibility issues and have limited knowledge about accessibility guidelines and standards. Their main challenges in creating accessible systems are related to time constraints, lack of training, and cost.

CCS CONCEPTS

• **Human-centered computing** → Accessibility.

KEYWORDS

Digital Accessibility, Web Accessibility, Accessibility Evaluation, User Experience, UX, User Experience Professionals, Human-Computer Interaction

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1 INTRODUCTION

There has been an increasing demand for the public to access and interact with digital information and services in recent years. Digital accessibility aims to provide equal access to all kinds of digital systems and services to as many people as possible, including those with disabilities [28]. Digital systems and services include websites, mobile applications, programs, software, electronic platforms and e-documents. Digital accessibility addresses diverse disability types such as auditory, cognitive, neurological, physical, speech, and visual as well as aging, which are associated with the impossibility or reduction in the ability to properly use digital systems and services [35]. The World Health Organization (WHO) estimates that more than a billion people, representing about 15% of the world's population, "have some form of disability" [36]. It is also recognized that, people with disabilities should have equal access to all kinds of information and communication technologies and services, on an equal basis with others [30].

Digital accessibility is a legal obligation for organizations in many countries [34]. The Web Accessibility Initiative (WAI) provides accessibility guidelines, technical specifications, and educational materials to promote the design of accessible systems for everyone in the digital society [33]. Also, international standards [e.g., 16, 17] covering a wide range of accessibility recommendations have been introduced for years. All Nordic countries have implemented regulatory frameworks for digital accessibility. Finland has enacted the laws for government websites earliest (i.e., in 2003), followed by Denmark for the public sector (in 2007), Sweden for both public and private sectors (in 2008), and Norway for both public and private sectors (in 2013) [34]. However, accessibility continues to be neglected in the development process, leading to the existence of a large number of digital systems with inaccessible features over the years [1, 19]. Studies show that several digital systems (e.g., websites, mobile apps) violate accessibility guidelines and standards [e.g., 11, 14, 21, 37] which result in the exclusion of many people, especially those with disabilities, from digital society.

Studies show that perceived digital accessibility is significantly correlated with user experience (UX) attributes indicating that digital accessibility and UX overlap to some extent [1]. Furthermore, usability and accessibility share measures and methodologies such as user-centered design approach which is seen as a suitable method

for ensuring accessibility [38]. Moreover, aesthetic features [22] and visual design [27] which enhance user experience were found to be significantly related with accessibility. Thus, UX professionals are key actors in promoting inclusion and empowerment in the digital society by designing systems and services that fulfill the requirements of all potential users. Although it is the responsibility of the entire product team, UX professionals in particular are responsible for ensuring that web pages and services are in line with regulatory frameworks and that digital accessibility for all is incorporated into their designs.

However, despite the increasing interest in research on UX professionals' views and practices regarding usability and UX in the Nordic region in recent years [e.g., 6, 7, 26], there is limited research on how these professionals view and practice digital accessibility. Furthermore, there are few dedicated UX professionals that specialize only in accessibility. Our aim is, therefore, to understand the current status of UX professionals' accessibility practices, expertise, awareness and organizational motivation, and potential hurdles toward the implementation of accessibility practices in the development process.

2 RELATED WORK

Previous studies surveying professionals' views and practices on digital accessibility showed that, generally, practitioners involved in the development process have positive attitudes toward implementing accessibility practices in their projects [9, 25] and view accessibility as an ethical issue [19]. Most of the studies conducted so far focused on web developers or development communities including web developers, software engineers, project managers, and analysts [2, 3, 19, 23]. Other studies focused on a wider population, namely by addressing a wide range of professionals with an interest in web accessibility including roles such as HCI and UX, design, computer science, business, and software engineering specialists [15, 38]. These professionals generally believe that accessibility covers everyone in society and should be applied along with a user-centered design process [38]. However, the landscape of digital systems and services paint a different picture for people with disabilities. There are still gaps between the legal requirements in terms of ensuring digital accessibility for all and the reality [1, 14, 37]. The reasons of these gaps may be multiple. Professionals may adopt or not the digital accessibility guidelines and regulations, and they may have different levels of awareness, understanding and interpretation of these requirements. Furthermore, differences can exist in the way different professional roles can apply these requirements in practice with the support of the existing tools and expertise.

Regarding the law enforcement, it was observed that poor enforcement leads to the reluctance of some professionals and organizations to take accessibility into account in their projects [15, 19]. Professionals generally do not consider accessibility practices in their workplaces in countries where digital accessibility is not a legal obligation [2, 3, 15, 23]. Government websites, however, meet more accessibility requirements than commercial websites in countries worldwide [39], due to the fact that primarily digital public services are legally required to be developed in accordance with accessibility standards and guidelines. Strengthening digital accessibility through enacting laws is, therefore, an important initial step for countries to promote accessibility and have it permeated into the development practices [20]. Furthermore, the enactment of accessibility laws and policies helps the development of both individual and organizational awareness and adherence to accessibility standards and guidelines [20].

A further challenge is related to increase the awareness and knowledge about digital accessibility of professionals involved in the development process. Studies show that the limited knowledge and awareness, and the lack of training of professionals lead to difficulties in the development of accessible systems [2, 3, 5, 9, 10, 13, 15, 19, 23]. Education and training are essential for professionals to acquire necessary theoretical and practical knowledge and to value the accessibility domain [9, 13, 19]. However, digital accessibility is neglected or insufficiently addressed in formal education [9]. Most relevant courses are elective and lack coverage of accessibility; thus, important topics such as universal design, accessibility guidelines, standards, assistive technologies, implementation, evaluation, and legislation remain uncovered [4]. This indicates that the exposure of professionals to digital accessibility needs to be organized in a more formal, systematic and extensive way in the HCI and ICT curriculum [12, 13, 32].

Furthermore, it was found that most professionals have limited experience in developing digital systems for people with disabilities [2, 3, 15]. The professionals reported that the accessibility practices are not given priority in their workplace [3, 23]. The following were reported to be the main organizational challenges of creating an accessible system or service: accessibility was not required for the organization [2, 15], there was a lack of support from top management [15, 19], there were budget and time restrictions [2, 9, 15, 19, 29], work overload hindered the work on accessibility [2], accessibility was not required by the target group/customer [2, 15], and reaching out to people with disabilities was not included among the organization's objectives [23]. When considering digital accessibility in any organization, raising awareness and knowledge on all organizational levels is, therefore, crucial to be able to provide inclusive solutions [31].

Taken together, these studies support the notion that several factors impede the adoption of accessibility practices in the development process. However, it still remains unclear to what extent these factors shape UX professionals' experiences to implement digital accessibility practices in the projects they are involved. Our aim is, therefore, to focus on the UX community in the Nordic countries, where accessibility laws and policies have been introduced for many years. To this end, we explore how UX professionals view and practice digital accessibility and what are the potential hurdles toward the implementation of accessibility practices in the development process.

3 METHODS

This research consists of an exploratory survey that tries to answer the research question: *How UX professionals view and practice digital accessibility?* In particular, we are interested in answering the following questions: *What is the current status of UX professionals' accessibility practices, expertise, awareness and organizational*

motivation? and *What are the potential hurdles toward the implementation of accessibility practices in the development process?* To answer these questions, a survey was designed and administered online over a period of three months during November 2019 - February 2020. Data were collected from the UX professionals working in four Nordic countries; Denmark, Finland, Norway, and Sweden. The survey was in English and distributed through local UX email lists, associations, communities, social media, and personal contacts of researchers in each country. The data analysis was conducted as a descriptive statistical analysis performed using Microsoft Excel and SPSS 25.0.

3.1 Sample

The survey participants were professionals who would identify themselves as UX professionals working in Denmark, Finland, Norway, and Sweden. To be able to answer the questionnaire, the participants should have had an interest in digital accessibility. We received a total of 167 complete responses. The distribution by country was as follows: 34 (20.4%) participants were from Denmark, 51 (30.5%) from Finland, 54 (32.3%) from Norway, and 28 (16.8%) from Sweden.

3.2 Questionnaire

There were 36 questions in the survey including various accessibility aspects, ranging from technical to organizational issues. The questionnaire consisted of an introductory part explaining the goals of the study, followed by four sections:

First section consisted of questions that aimed to collect characteristics of the participants' organizations such as business sector, geographic range, type, size, maturity level, software development approaches and number of UX professionals.

Second section contained questions to determine the participants' understanding, level of knowledge about digital accessibility, guidelines and standards, assistive technologies, and how people with disabilities use digital systems.

Third section consisted of questions to identify common digital accessibility practices of the participants, techniques and activities they used, disability types they considered, challenges of creating an accessible system, and individual- and organizational-level reasons and motivations for considering or not considering digital accessibility into their projects.

Fourth section contained questions to collect demographic information of the participants such as age, gender, educational level, graduated field, accessibility specific formal education, current position, job title, and work experience.

4 RESULTS

Here we report the findings from the survey. We begin with characteristics of the participants and their organizations. Then we describe our findings related to digital accessibility practices, motivations, and challenges.

4.1 Demographics of the UX Professionals

Of the participants, 73 (43.7%) were male, 91 (54.5%) were female and the remaining 3 (1.8%) did not state their gender. The age distribution of the participants ranged between 25-34 years (n=61, 36.5%), 35-44 years (n=87, 52.1%), 45-54 years (n=16, 9.6%) and above 55 years (n=3, 1.8%).

The average length of the participants' total work experience was 12 years (SD=7.13) with experience in the UX area being 7.7 (SD=5.95) years, and in the digital accessibility area being 3.5 (SD=4.07) years. Most participants worked as a specialist, followed by middle-lower management, entry-level, and top management in the organizational hierarchy in their workplace, respectively (see Table 1). More than half of the participants (n=96, 57.5%) had UX or HCI related job titles such as UX designer, UX lead, UX specialist, UX researcher, UX manager, UX consultant, interaction designer, user interface designer, and service designer. Among the rest, front-end developer, full-stack developer, product manager, web designer, and full-stack designer were the most used job titles.

Concerning the education attainment, 126 participants had a Master's degree, 26 were university graduates, 9 had a Ph.D., and 6 were high school or vocational school graduates. Most participants graduated from computer and information science, followed by arts, media and communications, and electronic, automation and communication engineering, and electronics. Other fields reported by the participants were industrial design, psychology, business and management, economics, educational science, architecture, and philosophy. Twenty-four participants (14.4%) had not received any accessibility specific formal education or training. Of the remaining participants, 122 had received a human-computer interaction course, 91 had undertaken a project, 22 had engaged in thesis or dissertation, 21 had received in-service (vocational) training programs, and 18 had a certificate (Table 1).

UX events (n=102, 61.1%) were most preferred way of keeping up with the evolving digital accessibility field, followed by online discussion forums and websites (n=81, 48.5%), blogs (n=100, 59.9), technology news and magazines (n=62, 37.1%), courses (n=58, 34.7%), scientific articles (n=44, 26.3%), accessibility events (n=38, 22.8%), and books (n=30, 18%). Podcasts was also mentioned under the other option of the question as a method of following the recent developments. A small number of participants (n=14, 8.4%) reported not to keep up evolving the digital accessibility field.

4.2 Characteristics of the UX Professionals' Organizations

Most participants worked in national, large-scale and private organizations (Table 2). Principal work areas were information and communication (n=73, 43.7%), public administration and defense; compulsory social security (n=18, 10.8%), professional, scientific and technical activities (n=17, 10.2%), financial and insurance activities (n=16, 9.6%), education (n=5, 3%), and human health and social work activities (n=4, 2.4%).

A considerable number of the participants had no idea regarding software maturity or quality certification of their organizations. Only 17 participants reported that their organizations had a certification such as ISO, SPICE, PMI, CMMI, and COBIT. Agile/lean methodology was the most popular approach used in organizations, followed by waterfall model and rapid prototyping, respectively. Design thinking, scrum and design sprint methods were also mentioned under the other category of the question. The number of UX professionals employed in the organizations ranged from 1 to

Table 1: Demographics of the participants

Variables	Values	n	%
Job hierarchy	Entry-level	21	12.6
	Specialist	114	68.3
	Middle-lower management	25	15
	Top management	7	4.2
Education level	High school or vocational school	6	3.6
	Bachelor	26	15.6
	Master	126	75.4
	PhD	9	5.4
Graduation field	Computer and information science	105	62.9
	Arts	11	6.6
	Media and communication	9	5.4
	Electronic, automation and comm.	8	4.8
	Industrial design	7	4.2
	Psychology	6	3.6
	Other	21	12.6
Accessibility specific formal education	Human computer interaction course	122	73.1
	In-service (vocational) training	21	12.6
	Theses & dissertation	22	13.2
	Certificates	18	10.8
	Projects	91	54.5
	Other	3	1.8
	No formal education	24	14.4
Keeping up with the accessibility field	Keep up	154	91.6
	Do not keep up	14	8.4

Table 2: Characteristics of the participants' organizations

Variables	Values	n	%
Geographic range	International organization	74	44.3
	National organization	93	55.7
Type	Public sector	45	26.9
	Private company	118	70.7
	Both	4	2.4
Size	Small (under 50 employees)	26	15.6
	Medium (50-250 employees)	25	15
	Large (over 250 employees)	115	68.9
	Do not know	1	0.6
Development approach	Waterfall model	69	41.3
	Agile/lean methodology	158	94.6
	Rapid prototyping	59	35.3
	Other	9	5.4
	Do not know	6	3.6
Maturity or quality certification	Yes	17	10.2
	No	40	24
	Do not know	110	65.9

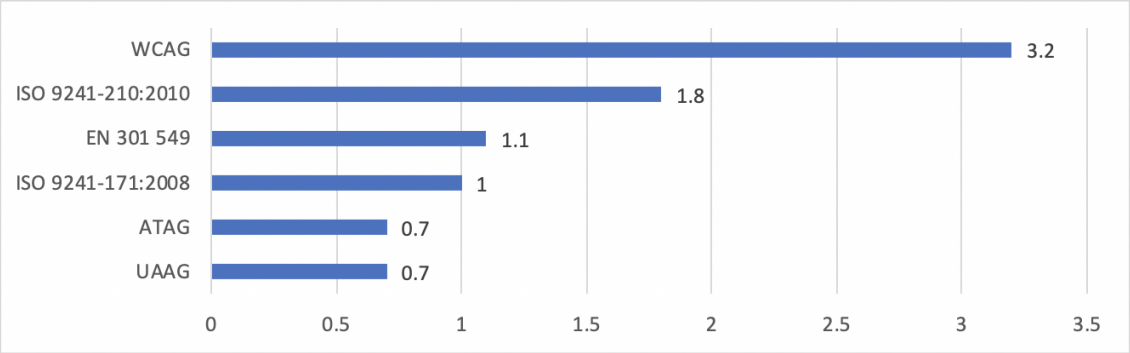

Figure 1: Level of knowledge regarding guidelines and standards on digital accessibility (average)

"more than 200" depending on the size of the organization. However, the average number of UX professionals in the most recent project was 2.4.

4.3 Individual Motivations, Expertise and Responsibilities Regarding Digital Accessibility

Respondents rated their motivations in digital accessibility on a 4-point scale. Being inclusive and designing better products were two main personal interests of the participants (average score of 3.8). Other notable motivations included being ethical (M=3.7), complying with the law (M=3.4), designing for mobile web (M=3.2), and increasing revenues (M=3.0). A small number of participants reported that accessibility helped in search engine optimization (M=2.8), and that they were interested in accessibility because they were forced to do it by their organizations (M=2.2).

Knowledge and expertise were measured using questions where the participants were asked to rate their perceived level of knowledge, their past involvement in accessibility projects, as well as their skills in creating accessible web pages and mobile applications, and their level of knowledge on how people with disabilities use such technologies. Ninety participants (53.9%) rated their perceived level of knowledge of digital accessibility to be intermediate level, followed by advanced (n=43, 25.7%), and basic (n=29, 17.4%). Only five participants (3%) reported being expert in digital accessibility. Regarding experience in accessibility projects, most of the participants (n=125, 74.9%) created web pages or mobile applications for people with disabilities. Among those, 22 (13.2%) reported as always making adequate systems for them. However, 31 participants (18.6%) did not know how to create accessible web pages or mobile applications, although they were aware of how people with disabilities use digital technologies.

The participants also rated their knowledge on accessibility guidelines and standards on a 6-point scale (0: no knowledge; 5: expert level; see Figure 1). A high number of participants had little or no knowledge. Web Content Accessibility Guidelines (WCAG) had the highest average score, followed by ISO 9241-210:2010 Human-centered design for interactive systems, European Standard for Accessible ICT (EN 301 549), and ISO 9241-171:2008 Guidance on Software Accessibility, respectively. User Agent Accessibility Guidelines (UAAG) and Authoring Tool Accessibility Guidelines (ATAG) were reported to have the lowest score (Figure 1).

In contrast to the observed low awareness of accessibility guidelines and standards, many participants (n=107, 64.1%) were aware of and followed the government accessibility regulations in their countries. The number of participants who had heard about them but knew little was 35 (21%). There were 15 (9%) participants who knew about but did not follow the local regulations of their countries. Only seven (4.2%) participants had never heard about them.

Responsibility of different roles and professions about digital accessibility was captured using questions asking the participants' opinion on whose responsibility should it be to make the design of the website or mobile application digitally accessible. A large percent of the participants thought that digital accessibility was responsibility of the professionals who had expertise on interface design such as UX designer (n=138, 82.6%), user interface designer (n=134, 80.2%), interaction designer (n=130, 88.8%), front-end developer (n=126, 75.4%), or web designer (n=114, 68.3%). This was followed by management related titles such as UX lead (n=92, 55.1%) and product manager (n=77, 46.1%). The participants chose back-end developer (n=37, 22.2%) to be one of the least responsible groups for ensuring accessibility. Ten participants reported that all project parties should be responsible for digital accessibility practices in a project.

4.4 Digital Accessibility Practices

To understand the digital accessibility practices in companies, we inquired the amount of working time that the participants spend on digital accessibility. Furthermore, we queried what kind of accessibility work the participants were engaged in such as user tests, evaluation methods, type of disabilities addressed in their work, and familiarity with assistive technology. The participants reported their estimates in percentage regarding the time they typically spent on working on digital accessibility in a project (Figure 2). Most of the participants (n = 93, 55.7%) spend less than 10% of their working time on digital accessibility practices, while 29 (17.4%) spend between 10%-20%. Ten participants (7%) spend about half of their work time (between 30-60%) in a project on digital accessibility. Furthermore, only four participants (2.4%) reported working on

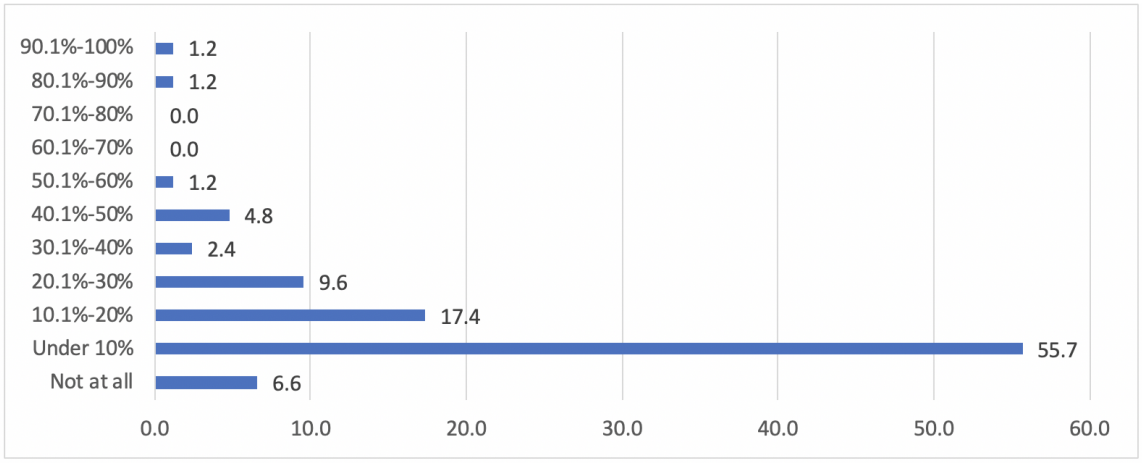

Figure 2: Time estimates in percentage of total working time in a project spent on accessibility issues (percentage)

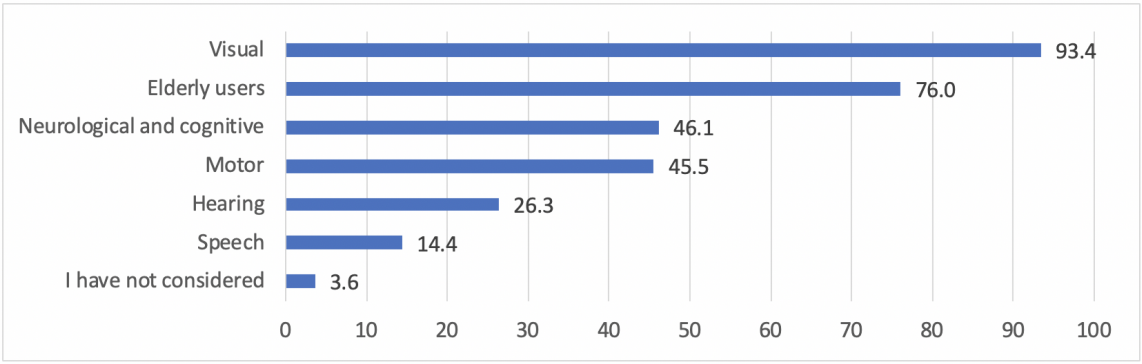

Figure 3: Disability types considered by the participants (percentage)

digital accessibility between 80-100% of their working time. These can be considered highly specialized professionals in accessibility. Eleven participants (6.6%) reported typically not spending any time in a project on digital accessibility. This category can be considered as representing UX professionals interested in accessibility but without having hands-on experience about it.

Fifty-nine participants (35.3%) performed accessibility tests with people with disabilities. The same participants (n=59) were asked the approximate number of people with disabilities they worked with. The average number of people who participated in the test process was 3.4 with the minimum number being 1 and the maximum number being 15. Visual impairment (n=156, 93.4%) was the most considered disability type. It is important to note that many participants were concerned about digital accessibility for elderly users (n=127, 76%). Other disability types addressed were neurological and cognitive impairment (learning disabilities, convulsive disorders, autism etc.) (n=77), motor impairment (n=76), hearing impairment (n=44) and speech impairment (n=24). Only six participants reported not considering any disability types in their entire work experience at the time when the data were collected (Figure 3).

Figure 4 shows the accessibility evaluation methods employed in participants' projects. Accordingly, HTML validation (n=97) was the most popular method, followed by manual guideline review (n=94), inspections with assistive technologies (n=90), CSS validation (n=89), and automatic evaluation tools (n=79). Evaluation methods that require a user to test digital accessibility of a system, such as test with users with disabilities (n=72) and test with users with special needs such as elderly people (n=70), were selected less. A small number of participants (n=12) reported not having performed accessibility evaluation in their projects.

It is also interesting to highlight that many participants (n=104, 62.3%) were not familiar with automatic accessibility evaluation tools. Almost all participants had no experience in using evaluation tools such as DaSilva, ASES, Taw, Hera, Bobby, Axe, SiteImprove. The most popular tools were Wave (n=31, 18.6%), AChacker (n=17, 10.2%) and Total Validator (n=8, 4.8%). Six participants used color contrast checkers to evaluate the conformance level of color usage. Regarding assistive technologies, almost all participants (n=155, 92.8%) were familiar with screen readers, followed by voice navigator (n=97, 58.1%), text-only browser (n=85, 50.9%), alternative

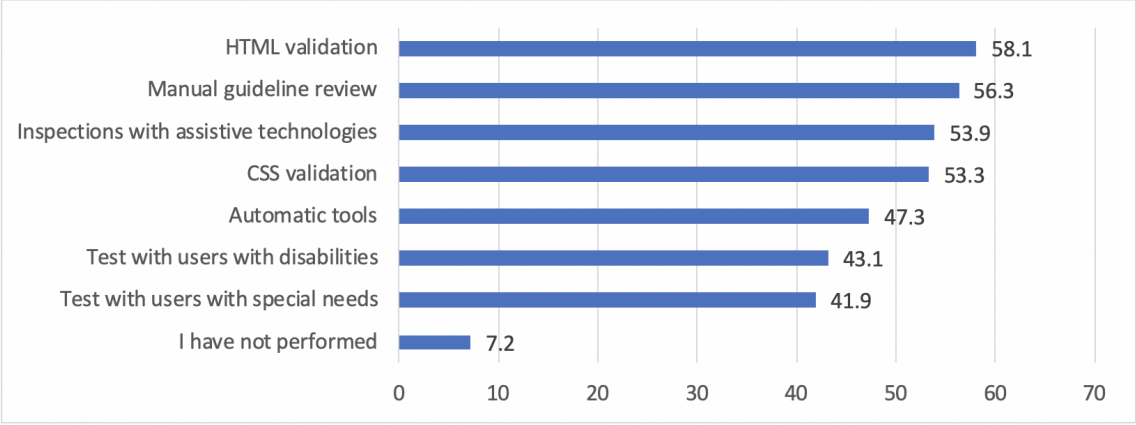

Figure 4: Accessibility evaluation methods that the participants used (percentage)

Table 3: Reasons pointed by the participants for considering accessibility in their projects

Reasons	n	%
It was enforced by the law	70	51.5
Ethical aspects	62	45.6
Project team members' personal motivation	59	43.4
It was required by the customer	47	34.6
Company policies	43	31.6
Organization gains good reputation by following ethical and social responsibility principles	43	31.6
Organization required to follow web development standards which help build accessible products	43	31.6
The target users included people with disabilities and special needs	38	27.9
Organization required to take into account web accessibility in that project	27	19.9
The project focused on reaching more people	8	5.9

keyboard (n=71, 42.5%), alternative mice (n=69, 41.3%), screen amplifier (n=61, 36.5%), and braille printer (n=41, 24.6%). Eye-tracking was mentioned under the other option of the question as an assistive technology by some participants. Only six participants were not familiar with assistive technology.

4.5 Organizational Awareness, Motivations and Familiarity Regarding Digital Accessibility

To capture the organizational awareness of and motivations towards accessibility work, we asked the participants if they considered that accessibility is important in their organization, whether digital accessibility is considered in the company's projects, as well as the reasons why accessibility is considered in the company. Digital accessibility was viewed as an important asset in many organizations. Very important (n=58, 34.7%) and moderately important (n=74, 44.3%) were the most chosen options, followed by slightly important (n=14, 8.4%). The majority of the organizations (n=136, 81.4%) included digital accessibility in their projects. In these organizations, the main reasons for taking into account digital accessibility in the projects they were involved in are as follows (see Table 3): law enforcement, ethical aspects and personal motivations. Focusing on reaching out to more people and organizational requirements had the lowest number of indications, respectively.

The participants were also asked about the extent to which they thought digital accessibility was familiar to people in their organizations. UX professionals (n=87) and designers (n=41) were rated as the most knowledgeable groups. Developers, project managers, and top managers had moderate knowledge on digital accessibility according to a large number of the participants. Some participants reported that marketing and customer support categories were not applicable to their organization since they may not be actively involved in the development processes.

4.6 Challenges in Ensuring Digital Accessibility

To identify the challenges of creating an accessible system, we presented the participants a list of potential challenges to choose from. As can be seen in Figure 5, time constraints (n=100), lack of training (n=99), and cost constraints (n=82) were the most reported challenges. Some participants reported as challenges regarding accessibility the fact of focusing on other users (n=72), the work overload (n=70), not being a requirement for the organization (n=54), and not being a customer requirement (n=53). Language barriers to either accessing digital accessibility materials or understanding them were reported to be the least reasons.

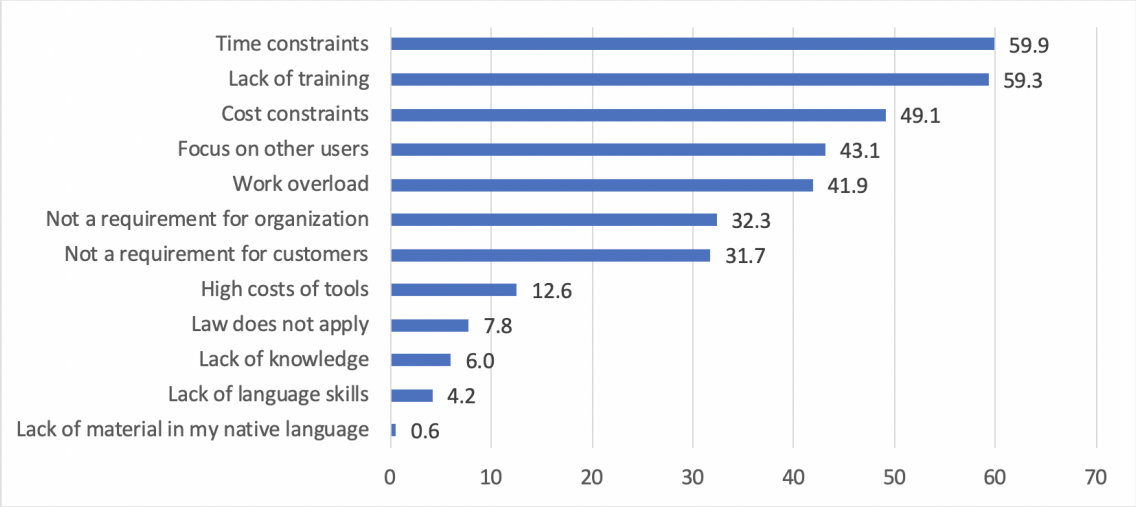

Figure 5: Challenges of creating an accessible system for people with disabilities (percentage)

Furthermore, in organizations where digital accessibility work was not yet implemented, the participants were asked to point out the reasons for not implementing digital accessibility practices in projects they were involved in. The main reason was related to project characteristics. Fifteen participants reported that the target users did not include people with disabilities or special needs, followed by a lack of management support and lack of organizational requirements where digital accessibility practices were not necessary to implement. Lack of time and training were also other main reasons for not considering digital accessibility in their projects.

5 DISCUSSION

This paper analyzed survey data about digital accessibility practices among UX professionals in four Nordic countries: Denmark, Finland, Norway, and Sweden. We aimed to understand *how UX professionals view and practice digital accessibility*. In particular, we examined *what is the current status of UX professionals' accessibility awareness, motivations, expertise and practices?* and *what are the organizational motivations and barriers towards implementing accessibility practices in system/service development process?* Data from 167 professionals showed that in general participants considered accessibility to be important (87.4% of participants reported accessibility as being very, moderately, or slightly important) and their organizations included accessibility in their projects (81.4%). In the following, we discuss the survey findings and derive implications for practice and future research.

5.1 Digital Accessibility Expertise and Responsibilities

The survey participants were generally having significant years of work experience in UX and digital accessibility, thus they represent the core UX professionals in these countries dealing with accessibility issues in their work. A small number of participants (10%) reported that they have not had previous work experience with digital accessibility, but all participants reported at least basic knowledge of accessibility. The participants typically hold a master's degree, graduated computer and information sciences programs, and work in specialist roles such as UX designer, UX lead, UX researcher, interaction designer. Many of the participants also hold management positions at middle or top-level in their organization. Other participants had job titles such as front-end developers, full-stack developers, web-designers.

Regarding the *expertise in digital accessibility*, most participants rated their level of accessibility knowledge to be intermediate, whereas very few reported having expert-level knowledge. We found that the distribution of perceived level of knowledge on digital accessibility was similar to previous studies, for example, in Brazil [2]. In line with the previous research, the participants had low level of knowledge about accessibility guidelines and standards [8] and WCAG was the most well-known guideline [15, 19]. Many participants were not familiar with ATAG or UAAG, and did not have much knowledge about ISO accessibility standards.

Most participants were aware of and followed *government accessibility regulations*. This may indicate that the accessibility policy in Nordic countries is successful in permeating the software and web development practice in these countries and leads to adoption and compliance with the digital accessibility guidelines. An earlier survey conducted in Brazil in 2008 showed that the poor awareness and knowledge of accessibility laws were associated with a lack of accessibility awareness among web developers [10]. A similar pattern was observed in 2018 in Brazil showing that web developers that are aware of legal accessibility requirements take into account accessibility when developing websites [2]. In line with this argument, our study found that one of the main reasons leading organizations to include accessibility in their projects was that it was required by law (in 51.5% of cases). Similar findings are reported also by [10] where 41.8% of participants were motivated by the law to include accessibility in their projects. Since countries have enacted laws regarding digital accessibility several

years ago, legal factors were the main reason that the organizations obliged to. In European Union, the directive on making the websites and mobile apps of public sector bodies more accessible entered into force in December 2016 and accordingly the member states translated this directive in their legislation by 23 December 2018. Accordingly, websites and mobile applications of public services should be made more accessible to people with disabilities starting from 23 September 2019.

The participants reported that professionals having expertise on interface design, usability design, and front-end development should be responsible for digital accessibility practices in a project. Management related titles such as UX lead or product managers were also considered to be responsible for making a system accessible, whereas back-end developers were considered among the least responsible group. The findings of the current study diverge slightly from previous research, for example, in Turkey, where Inal et al. [15] found that management-related titles, interface designers and developers were reported to be responsible for ensuring digital accessibility, respectively. Furthermore, the level of knowledge about digital accessibility in organization was found higher among UX professionals and designers than among managers and developers. In addition, the participants indicated that education and training play a major part in adopting accessibility practices and reported the lack of training as the second most common challenge in creating an accessible system for people with disabilities.

These results point to a generally positive picture of the level of adoption and expertise of digital accessibility among professionals and organizations, however with several aspects that could be improved:

We observed a lack of interest in and awareness of a diverse set of standards regarding accessibility.

The accessibility expertise is rather limited to WCAG standard and national laws and regulations.

The main driver of adopting accessibility practices is that it is *enforced by law*.

The expertise and responsibility are held by rather specialized professionals instead of being shared by the extended team in an organization.

The *lack of training* is perceived as one of the main challenges when working with accessibility issues in concrete projects.

These lead us to conclude that education and awareness on digital accessibility should be more systematic and extensive. Some solutions could be for educators to integrate accessibility more thoroughly in the HCI and ICT curriculum, for managers to provide professionals involved with the design, development, and management of interactive systems training and certification programs, and for professionals to participate in open-community platforms for sharing experiences, methods, and materials regarding concrete actions of implementing and improving accessibility practices in organizations and projects.

5.2 Digital Accessibility Drivers and Practices

The participants in our study spent relatively limited amount of work time on accessibility issues. Most UX professionals used less than 20% of the work time on accessibility. This indicates that UX professionals involved with accessibility issues divide their working time on other projects not involving accessibility or on tasks that do not involve accessibility issues. Examining the drivers of including digital accessibility in projects, we found that besides legislation, the next most popular drivers were ethical principles and personal motivation. These two results indicate that the digital accessibility work is rather practiced unsystematically and practitioners have other responsibilities besides addressing digital accessibility.

On the other hand, approximately one-fourth of the participants either did not work directly with digital accessibility in a project or they were not familiar with the accessibility as a concept. This group represents UX professionals interested in digital accessibility but not yet working on projects related to accessibility. One reason may be a poor integration of user experience practices and accessibility practices in the development. In the literature, it is suggested that the interplay between accessibility and user experience requires to be considered comprehensively to be able to provide a better experience for people with disabilities [1]. Furthermore, accessibility practices should be implemented throughout the development life cycle from the beginning to the end [10]. There have been some initiatives to develop "accessibility UX design guidelines" for designing inclusive products/services [e.g., 18], however more comprehensive and well-established guidelines are in need of integrating accessibility practices in all phases of the UX design/development processes.

Trewin et al. [29] found that designing an accessible system and implementing test tools to evaluate accessibility were difficult to web developers. Furthermore, involvement of people with disabilities in the design and evaluation process is essential to consider their point of view and, thereby ensure digital accessibility for as many target users as possible [24]. In our study, consistent with the literature [e.g., 2, 10, 19], the UX professionals commonly used evaluation methods which did not require a user to test the accessibility of the system or service. They usually employed HTML validation, inspection with assistive technologies or CSS validation. Most UX professionals were not familiar with automatic accessibility evaluation tools. However, about one-third of the participants included in the accessibility evaluation people with disabilities. In line with previous research [e.g., 2], visual impairment was the most considered disability type followed by older users.

Assistive technologies are necessary for people with disabilities to access digital content properly. A system is required to be compatible with assistive technologies in order to make it accessible. Therefore, when creating an accessible system, familiarity of professionals with assistive technologies is critical. Previous research found that some professionals were uncomfortable using assistive technology since it requires proficiency in using [29]. However, in our study, almost all UX professionals were familiar with assistive technologies such as screen readers, voice navigator, text-only browser and alternative keyboard.

5.3 Organizational Motivation and Challenges

Most of organizations represented in the study considered digital accessibility in their projects, unlike in previously reported research [e.g., 10, 15]. Digital accessibility practices were considered to be an important asset for these organizations. From the organizational

perspective, law enforcement and ethical aspects were the main reasons for taking into account digital accessibility.

We found that the most reported challenges in creating an accessible system were related to time constraints, lack of training, and cost constraints. These findings are in line with the previous studies [e.g., 15, 19, 29]. However, unlike previous research [e.g., 2], none of the participants reported language barriers to either accessing digital accessibility materials or understanding them to be a challenge to create an accessible system. The top challenges highlighted by our survey indicate a lack of management support for accessibility work because budget, work allocation, and training are the responsibilities of managers. In the same time, some of the reasons reported for not taking into account accessibility issues in projects were related to lack of management support, lack of time and training. Furthermore, management and developer roles were perceived as being less aware of digital accessibility when compared to UX and designer roles. Thus, these results point out that top management and UX managers should integrate accessibility practices in the development process systematically.

6 CONCLUSION

This study explored the current status of UX professionals' accessibility practices, expertise, awareness, challenges and organizational motivations. The main driver of adopting accessibility practice was government laws and policies. Organizations generally included accessibility practices in the development process. However, the professionals reported spending limited time on accessibility issues and had limited knowledge about accessibility guidelines and standards. The main challenges in creating an accessible system were reported to be time constraints, lack of training and cost constraints. These lead us to conclude that education, awareness and management of digital accessibility should be more systematic and extensive. An inclusive approach in UX design/development processes can enrich the diversity of capabilities to reach user groups with disabilities or special needs. We hope our research benefits the UX ecosystem by increasing the understanding of the current accessibility practices of UX professionals and the challenges they face in their workplaces. Future research should pay more attention to the cross-cultural factors faced by the countries, to determine the effects of these factors on the adoption of digital accessibility into the development process. Future research should also investigate how the development organizations perceive accessibility as part of their business practices and organizational values, as well as how the accessibility work is integrated into their development processes and responsibilities.

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