The Role of Technology for the Inclusion of People with Visual Impairments in the Workforce

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Abstract. In this study, we have acquired the experiences of five individuals with visual impairments as job seekers and employees. Our focus has been on technology, but we have also shed light upon topics such as training, technical support, aid schemes, attitudes, and the employer-employee relationship. The interviews with our informants show that being able to use ICT is vital for participation in the workforce. At the same time, technologies introduce a number of technical and related challenges. One of the most important measures to remedy these challenges and achieve a higher degree of digital inclusion in the working life, would be to amend the Norwegian legislation, such that it no longer exempts the labor market from the requirement on universal design of ICT.

Keywords: Digital inclusion · Universal design · Accessibility · IT · ICT · Technology · Assistive tech · Work · Working life · Workforce · Workplace · Facilitation · Impairment · Disability · Low vision · Blind

1 Introduction

For a great share of jobs in today's societies, there is a high demand for technical skills, in particular with regard to information and communication technology (ICT) (Bjønness et al. 2021). This coherence has increased further with the Covid-19 pandemic. At the same time, it is known that the share of people with impairments who are unemployed, but want to work, has changed little in Norway since 2006, which marks the beginning of the statistics (Statistisk sentralbyrå 2020). Several recent studies, described below, have shown that employees with vision impairment are particularly affected by the proliferation of ICT.

In this work, we have focused on people with visual impairments and gathered knowledge about in which circumstances technology acts as an enabler, and when it is a disabler or barrier for their participation in the workforce. Our work is divided into two parts: In the first, we have surveyed recent related research and other work in the intersection of the following fields: work, vision impairment, and technology. The work

has been published as a technical report in Norwegian (Fuglerud, Fyhn, et al. 2021). In the second part, we present five case studies of employees with vision impairment and their experiences with technology throughout their work career. This work has also been published in Norwegian as a technical report (Halbach et al. 2022).

1.1 Abbreviations

- AT: assistive technology
- CRM: customer relationship management
- HR: Human Resources (Department)
- ICT: information and communication technology
- IT: information technology
- NABP: (The) Norwegian Association of the Blind and Partially Sighted
- NAV: (The) Norwegian Labor and Welfare Administration
- NGO: non-governmental organization
- OS: operating system
- UD: universal design

2   Related Work

An overview over related work has been published in Norwegian as a technical report by the authors (Fuglerud et al. 2021). The interviews in the current study are partly based on these findings and were carried out after the completion of the literature review.

The barriers and possibilities of ICT and AT for people with disabilities in the working life is a research area with several different theoretical starting points and perspectives. It spans academic disciplines such as technology, design, working life, rehabilitation, economics, law, human rights, social work and sociology. The overview in (Fuglerud, Fyhn, et al. 2021) covers 56 publications and is mainly related to the labor market in Norway. It includes peer reviewed publications and gray literature, such as surveys, reports, and master theses. The reviewed publications vary with regard to data quality and methodology. Most of the publications are not peer-reviewed. Also, most of the studies are qualitative, and few quantitative studies have been carried out. Nevertheless, the results seem to point in more or less the same direction, which strengthens the overall conclusions. In the following, we highlight some of the most important findings.

In many of the reviewed publications, "vision impairment" is only accounted for as part of the greater topic "human impairment". The literature were thematically categorized and structured according to the following six broader topics: Research, universal design and human impairment, information- and communication technology (ICT) and assistive technology (AT), public administration and training, employer perspective, and society.

One important finding regarding the topic "research" is that while we found a number of publications documenting ICT barriers, there is a lack of peer-reviewed literature that investigates how the ongoing digitalisation within the working life affects inclusion or exclusion of people with disabilities. Moreover, there are research gaps when it comes

to which strategies and measures are most effective for inclusion of people with impairments in the workforce, and especially regarding digital barriers and universal design (Bufdir 2020; Gulliksen et al. 2021; LDO 2015; Proba 2019).

Research on inclusion of people with disabilities in the labor market has documented a wide range of barriers (Chhabra 2021), including technological barriers and lack of universal design of ICT (Fuglerud et al. 2021; Gulliksen et al. 2021; Halbach et al. 2020; Halbach and Tunold 2020; Proba 2020). Universal design (UD) comprises the design of products, applications, and environments in such a way that it is accessible and usable by all people without the need for adaptation or specialization (Miljøverndepartementet 2007). Thus, the goal of UD of ICT is to increase the usability and accessibility of mainstream ICT products and services. The principles of universal design have been solidified in both international and national legislation (European Telecommunications Standards Institute (ETSI) 2021; Kulturdepartementet 2017; United Nations (UN) 2006), but does not yet cover domain specific ICT systems used in working life.

One of the most important findings of the literature study is that many administrative systems and domain-specific software systems, such as economy, CRM or electronic patient record systems are not universally designed. The degree of universal design can impact whether employees with disabilities can use a software system independently (Fuglerud et al. 2021; Halbach et al. 2020; Halbach and Tunold 2020). In particular we find that digital barriers arise due to lack of compatibility with AT. Compatibility with AT is one of the requirements of universal design of ICT (Fuglerud et al. 2014). Also, the development of AT seems to receive less attention than mainstream technology, which results in less-than-optimum quality and delays for people that are dependent on AT.

The lack of regulation with regard to universal design of technology used in working life is likely one important reason why there is little consciousness of universal design and human diversity among developers, testers, and designers of administrative or domain specific software systems. People with impairments are typically not sufficiently involved during the development of such systems (Gulliksen et al. 2021; Walday et al. 2016). While cost-benefit analysis of ICT solutions in general is a well researched field, very few attempts have been made when it comes to analyzing the effects of UD of ICT solutions in the work life (Fuglerud et al. 2015; Halbach and Fuglerud 2016a, b; Proba 2019).

The literature suggests further that both competence and attitudes of public administrations seem to limit exploitation of the possibilities provided by technology with regard to increased work inclusion for people with visual impairments. Moreover, better coordination of efforts is necessary across all the different parts of the administration to give a more holistic service to both employers and employees. The literature states that the training offered by public actors varies widely, and in many instances it is not universally designed, which renders it useless to people with impairments (Fuglerud et al. 2020; Fuglerud et al. 2021; Fuglerud and Solheim 2008; Mordal et al. 2020). For example, it is assumed that students can follow instructions visually.

People with weak digital skills have a lower degree of employment than those with strong digital skills (Bjønness et al. 2021). But good digital skills are not enough if the systems in the workplace do not have good enough accessibility for the employee. 21% of those outside the Norwegian labor force experience a lack of universal design as an

obstacle to becoming better at using digital tools (Bjønness et al. 2021). In one survey, which was conducted among 300 members of the Norwegian Association of Blind and Partially Sighted (NABP), 84% answered that they experienced barriers when using a computer, and 75% answered that they needed help because of this (Halbach et al. 2020).

Important findings with regard to the employer perspective is that the majority have little or no experience with employees with impairments, and that there are attitudinal barriers (Fyhn et al. 2019; Spooner 2017). Studies have shown that job seekers with visual impairments were assessed least positively compared with job seekers with other types of disabilities, minority backgrounds, or various health problems (Chhabra 2020; Fyhn et al. 2019). Another barrier is that technical personnel at the workplace are not sufficiently trained with technical accessibility in mind. Often, this results in a lack of or non-optimum facilitation of the (digital) workplace (Halbach et al. 2020).

The literature regarding society shows that there are potentially huge benefits from the inclusion of a greater share of individuals with impairments in the workforce. Statistics Norway (SSB) estimates that 27% of all unemployed persons with disabilities in Norway wish to join the workforce. Only 43% of Norwegian people with disabilities are employed, compared to 74% in the general population (Bufdir 2015). According to the European Commission's Disability rights strategy (EC 2021) it is essential to implement the UNCRPD principle of mainstreaming the universal design approach for better accessibility and provision of reasonable accommodation for persons with disabilities into the society.

While there are legislation and public support schemes in place to facilitate work life participation for persons with disabilities, the legislation and its enforcement are scattered over multiple laws and public institutions. In many cases this leads to unclear responsibilities, and lack of awareness and knowledge about the rights and possibilities. This calls for a clearer division of responsibilities and perhaps also simplifications.

3   Interviews

The case studies comprise conversations with 11 individuals, hereof five employees with visual impairments, five management staff, and one HR representative. The informants were recruited from professional contacts within the project group. The conversations were conducted as semi-structured in-depth interviews on the phone or as a video meeting. We had prepared two interview guides, one for employees and one for employer representatives, with a series of questions we wanted to get answered, but depending on the dynamic of each conversation we also touched upon related topics. The employees' interviews were carried out prior to the employers' interviews. Speech from the conversations was recorded, transcribed, anonymized and then went through a thematic analysis (Nowell et al. 2017).

The employee population consisted of two females and three males between 30 and 60, all of Norwegian ethnicity. Three employees worked reduced (50–60%) due to various reasons, ranging from "nice with spare time" to following the physician's advice with regard to health, rehabilitation, and physical training. While one employee had highschool as the highest educational degree, the others had up to four years of college or university on their CV. Two of the informants gave their own IT skills a

"medium" and three a "strong" rating. The one low-vision individual made use of various magnification technologies, both of technical and non-technical nature. For the four who were entirely blind, the use of screen readers was common, both on PC and phone. Two of the employers can be classified as public and three as private sector, and there was geographical variation in the population.

3.1 Topics

The analysis of transcripts identified the following topics of interest. Where different informants contribute to the themes, this is specified accordingly.

Personality, Skills, and Educational Training. The employees' self-assessment varied somewhat, but they all had in common that they described themself as being proactive, forward-leaning, independent, and self-securing. The population's mainly good technical skills (self-assessed), and the fact that they all rated themselves as experts for their AT, must be seen in the light of these adjectives as a direct effect. This is exemplified by the story of one informant who was supposed to teach a co-worker a tool she did not know herself yet. She thus first taught herself how to handle the tool properly and then showed her co-worker.

The informants were critical in a number of ways regarding educational training on AT and IT systems in general. There were voices that the training is too hard to get, i.e. taking too much time before the first class is held, that classes are not offered frequently enough, and that five-hour sessions implies too much information. In fact, what is often needed is training/help on demand, and this cannot be provided by training courses. Moreover, much of the training comes in a format which is not universally designed, leaving it useless for low-vision recipients.

Jobseeker Experiences. For some of the informants, the Norwegian Labor and Welfare Administration (NAV) partly played a role during job seeking in terms of giving advice and organizing interim positions. However, they all have in common that they eventually landed their first job on their own. In fact, three of the informants had negative experiences with NAV in regard to job seeking. One was advised to seek jobs she was not qualified for, at workplaces with other low-vision employees. Another was told that the best option would be to apply for social-security income, even though this person was newly educated and eager to work. Yet another received the advice to become a painter/decorator, even though that person could not see colors.

Job Interview and Hiring Process. There was great variation in the individual experiences with job interviews and hiring process, ranging from "alright" and "agile" to meeting prejudices. For some, it was beneficial to ask a third party to join the job interview, not only in terms of getting help in an unknown environment, but also because these helpers could inform the employer about appropriate public support schemes.

The picture regarding applying for these schemes is not clear, though. Some employers said "it is OK after you have done it a couple of times", while others stated that the process is cumbersome and time consuming. Several informants and employers mentioned internal mentoring schemes as an upside for both employee and employer in the

beginning. And even though some employers expressed to have implemented facilitation of the physical workplace, the tone was that employees with impairments need as much or as little time during startup as compared to others.

Superior, Work Environment, and Co-workers. While one superior had experience with an impaired employee, having someone with no or low vision was new for all of them. As a consequence, the superiors had little knowledge about the employees' technical and non-technical needs. The culprit for this situation are partly the employees themselves, as they in certain situations abstain from communicating some of their needs and problems with the management.

The following list of aspects summarizes the traits of a leader as expected by the employee informants: Taking responsibility, being a problem solver, flexible, and clear, having the ability to see others, having good knowledge about a particular human resource, share relevant information, being open regarding challenges, and being assuring. One informant denoted the superior's knowledge about functional impairment and its effects as a "to be or not to be".

The influence of the work environment and co-workers was also emphasized by the employees. The co-workers' knowledge regarding what it means to have an impairment is according to the informants essential for the coordination of tasks and a general understanding of an employee's abilities and disabilities. When it comes to getting help, though, co-workers are mentioned as being third in line, after help by self-help and help by personal assistant or secretary assistant, but before help by a superior.

Neither HR nor customers were mentioned as important factors in this respect.

Assistive Technology, Facilitation, and Inclusion Strategies. The blind informants employed screen readers on PC and phone. The informant with low vision used magnifier applications, both separate and built-in into the OS. Other AT includes braille reader, letter reader, dictaphone, and color reader. The general preference among informants was to have their own devices for proper installation of applications and the right settings.

Some employers had implemented facilitation of the physical workplace, such as braille labels for signs and tactile guiding elements. In one case, however, a more costly investment, to enhance the poor acoustics of an open-space office was not made. This resulted in trouble for the informant to hear their screen reader. The technical customization was often done by the informants themselves and sometimes by Technical Support. The integration of AT with the existing IT systems, often domain-specific software but also generic office solutions, was often said to be problematic or in the worst case impossible. As one informant put it: "There is always something" (talking about technical problems) and applies not only to the initial installation but also to later upgrades. This is exemplified by the story of one informant who said that, after a technical upgrade, she was unable to do her most important task for nine months. IT Support were not able to fix it, and eventually she was assigned other tasks.

Public Supporting Institutions and Schemes. The informants' opinions about public supporting institutions and schemes is dominated by negative sentiments. More than once we heard about "bureaucratic" and "rigid" institutions and cumbersome application processes. The story of a financial aiding scheme, which first was granted, then

withdrawn, then granted again, indicates that a certain amount of randomness is part of the experience. The informants' experiences are, however, not solely black and white. Some commented that their contact person in NAV had been very helpful and proactive, and they were quite satisfied with the help they got.

The interviews revealed a number of various institutions and schemes which are relevant for employers and employees with impairments. As this list is specific to the Norwegian context, it is not repeated here, and the interested reader is referred to the original technical report (Halbach et al. 2022).

It appears that the high number of relevant institutions makes it difficult for people with visual impairments to navigate in the jungle of responsibilities, in particular when it comes to the organization of educational training on AT, complicating information flow and implying many referrals to the right recipient for a request and unnecessary delays. There also is a high number of supporting schemes, and our conversations revealed that some are little known to (and used by) employees and employers alike.

Attitudes and Discrimination. Employees' attitudes are naturally quite varied. When encountering difficulties, some try to hold a low profile: "I think it is embarrassing to be so exposed". Yet others are the opposite and stand up for themselves: "I would not want to work for somebody who does not accept my impairment". This corresponds to the above description of informants as self-confident and forward-leaning individuals. All employers displayed politically correct attitudes and expressed that one has to "see each single human and ask how they could contribute", that it is about seeing "possibilities rather than limitations", and that organizations as part of the society also have an obligation for inclusion. There were, however, subtle statements which revealed different positions. One superior expressed that a lot of facilitation is needed for low vision, and another stated that it is crucial that the employee with an impairment is motivated to do most of the facilitation themselves: "We as an employer do not have the time to deal with all that", referring to technical facilitation, application for public support schemes, and so on. This also signals employers' perception that additional work is expected to be carried out by employees with a disability, possibly at the cost of their productivity.

We also heard a story of discrimination, where one particular employee had experienced to be rejected access to the office due to a co-worker's alleged allergy against fur. However, it is entirely legal for owners of guide dogs in Norway to take them wherever needed.

Covid-19 Pandemic. The effects of the Covid-19 pandemic were mixed. While some did not have any customized equipment at home and therefore got a special permit to attend the office during home office times, others stated that their equipment at home was much better suited to their needs.

Efficiency and Costs. The employers were satisfied or very satisfied with how their employees with low vision solved tasks and stated that their efficiency was satisfactory or highly satisfactory and comparable to their co-workers. As one superior put it: "[The management] is very impressed by the way she works and how efficient she is". Here, one of the employees gave us a possible explanation by mentioning that he often tries to meet higher (perceived) requirements towards himself than the others. He also confirmed

that over-performing and stamina are strategies to compensate for an impairment and to prevent discriminating attitudes. Some of the employees admitted that they needed more time for particular tasks, for instance to acquire new knowledge or manage new tools. This was then compensated for by over-performing in other areas. One informant explained her high working efficiency by the fact that she knew the PC keyboard shortcuts so well.

Other Aspects. Multiple informants reported that being unemployed has affected their mental state in a negative way, which once again illustrates the importance of employment. Technological barriers and other challenges, however, apparently lead to a lot of frustration and may thus counteract the positive effects of being employed.

When it comes to what are good technical solutions for communicating and interaction, the picture is not coherent. Solutions which are presented as good by some are pointed out as poor by others. This may indicate that personal liking and preference play major roles besides universal design.

Civil society organizations like the NABP were seldom mentioned in the interviews. One had received help from this organization to set up their equipment at home, and one had enrolled in a class on how to use a particular screen reader. Both narratives show that an NGO can fill the gaps which are left blank by an employer or the authorities.

3.2 Categories

The findings from the aforementioned topics were structured further and generalized in the below four main categories.

Technology:

- The use of technological means, especially AT, is crucial for the participation of individuals with impairments in today's working life.
- The technology partly eases the work day of impaired employees but also introduces a number of challenges, in particular when IT systems, including domain-specific systems, are combined with individual AT. This may be due to the lack of universally designed solutions, insufficient testing with AT, and low-quality AT.

Inclusion strategies and barriers:

- Each individual's personality, technical competency and skills, as well as personal effort, may be a resource to counteract the challenges experienced with technology.
- The low-vision and blind employees in this study get their job description and tasks customized.
- The (Norwegian) public support schemes "Reading and Secretary Assistant" and "Personal Assistant" may compensate for most of the technological difficulties experienced by the informants in this study.
- The majority of IT support staff has insufficient knowledge about the combination of domain-specific systems and AT.
- A great share of educational training is not universally designed, such that it is not beneficial for individuals with impairments.

Employer and work environment:

- Superiors of impaired employees are in a key position with regard to the organization of tasks, facilitation of the workplace, influence on work environment and attitude, and inclusion in general.
- Few superiors and employees in general have sufficient knowledge about the needs of co-workers with low vision.
- Some employees have experienced discriminating practice and attitudes by their employers due to their visual impairment.
- Typically, employers view the physical facilitation of the workplace as manageable and implement the necessary steps, but simultaneously neglect technical measures.

Public support institutions and schemes:

- Some public support schemes in Norway have a good effect but are not well known and/or used.
- There is potential for improvement when it comes to the coordination of schemes among public support institutions in Norway.
- The informants in this study have had poor experiences with low competency and negative and prejudiced attitudes of public institutions with regard to the assessment of their ability to work.

4   Discussion

The experience by one particular informant about the re-assignment of tasks after technical barriers points at three crucial aspects which are paralleled in the other narratives: 1) Many existing IT systems are not universally designed, with the result that they do not work together with AT. 2) Many technical-support departments lack the proper knowledge regarding AT. 3) The assignment of other tasks is an often used strategy when technical problems are encountered and also illustrates the high dependence of low-vision employees on their AT. We need to add, though, that often it is possible to distribute the workload over several employees according to personal abilities, and in many cases both superiors and employees are satisfied with how the task assignment is solved.

Two more aspects can be derived by the story of another informant regarding the role of AT suppliers in Norway. One particular supplier was unable to set up the AT on her system properly and failed to do so several times, with the consequence that she could not do her work for more than half a year. She suggested strengthening the requirement for the suppliers to successfully install the AT by linking that requirement to financial sanctions. Her personal strategy to cope with the situation was to make extensive use of the secretary assistant, which of course is quite costly. The aspects are thus: 4) There are insufficient requirements towards the suppliers of AT for the successful installation of their software. And 5), public supporting schemes can solve and are often used to solve situations with technical shortcomings.

The results from the thematic analysis of interviews confirms many of the findings from the literature review. In addition, some new aspects complete the picture further,

including: 1) A high level of technical skills can be the consequence of a high number of technical problems an employee with vision impairment typically has to solve. 2) Many vision-impaired employees are given suboptimal job tasks due to technical problems. 3) Physical facilitation typically receives more attention than technical facilitation. 4) Human assistance and adaptation of tasks as a strategy in case of technical problems may stand in the way for the development of more universally designed solutions.

The findings in the literature overview, together with the interview findings, lead to the following list of recommendations.

- Amending the Norwegian legislation, such that it no longer exempts the labor market from the requirement on universal design of ICT, is likely an important measure to achieve a higher degree of digital inclusion in the working life.
- Informational campaigns among organizations' managements and other employees regarding diversity may be effective in increasing knowledge and improving attitudes towards employees with visual impairments.
- Additionally, informational campaigns on assistive technologies and diversity may be effective. The campaigns should be targeted at work and career consultants, as well as caseworkers at the Norwegian Labor and Welfare Administration.
- The Norwegian Labor and Welfare Administration should consider strengthening some of their support schemes (for instance, "Guidance for Work").
- It should be considered to strengthen the programs for reading / writing assistants and personal assistants as backup in case of technology failure and organize them on an hourly basis.
- Digital accessibility and facilitation should get the same attention as physical facilitation and universal design of buildings and environments by the authorities and public and private organizations.

4.1 Limitations

The validity of this work is limited by the following considerations.

The population cannot be said to be representative for employees with low vision due to the low number of participants ($N = 5$) and a recruitment based on convenience sampling. Also, the assessment of education and technical skills shows that the employee informants likely are among the more resourceful ones in the workforce. The limited project budget has further resulted in only one researcher carrying out the thematic analysis. The credibility of the analysis would have been enhanced by additional researchers. Finally, it is stressed that verification of the individual narrative has been outside the scope of this work. As the employees' interviews were prior to the employers' interviews, it has however been possible to verify some of the employee claims by comparing them with what had been said by the employer.

5 Conclusion

In this work, we have studied various aspects related to the role of technology in the working life for employees with visual impairments. Our study shows that this is an interdisciplinary and complex area.

We first surveyed relevant literature on the Norwegian labor market. Although there is a lack of peer-reviewed literature, we found many reports and studies that document profound barriers related to ICT systems used in working life for people with visual impairments. This includes lack of universal design, compatibility with assistive technology, as well as ICT-related training and technical support. Nevertheless, there is little research on the effects of universal design of ICT and other ICT-related measures on the inclusion of people with disabilities in the labor market.

We then conducted a series of in-depth interviews with both employees and employers. We have not found any area of conflicting results, meaning that our findings underline the results from previous research. However, our conversations also revealed a few new insights.

The main message is that a labor market with equal opportunities for all will not be accomplished by tomorrow. Nevertheless, we believe to have increased our understanding of all relevant areas, and we have identified a number of aspects that can be improved. Our recommendations target both developers and suppliers of ICT systems, employers, administrative authorities, as well as law makers. A thorough analysis of the effects of each countermeasure has, however, been outside the scope of this work and remains for future research.

Even though all measures will contribute in some way, we are convinced that amending the Norwegian legislation, such that it no longer exempts the labor market from the requirement on universal design of ICT, may be the most important measure to achieve a higher degree of digital inclusion in the working life for persons with visual impairments. Work participation depends to a large degree on the accessibility of the ICT solutions for employees with visual impairment. As of today, many ICT solutions are not universally designed, resulting in inclusion barriers. This conclusion is likely applicable to other forms of impairment and other countries as well.

We round off by citing one particular informant who formulated: "Incredible what one can accomplish with just a little facilitation"!

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