MAPPING ICT ACCESS AND DISABILITY IN THE WORKPLACE: AN EMPIRICAL STUDY IN ITALY

ABSTRACT

BACKGROUND: It is well known that the Information and Communication Technologies (ICT) are important to assist people with disability in the workplace. **OBJECTIVE:** In this context, this paper sheds light on the state of ICT accessibility for Italian employees with disabilities in private sector companies by mapping and critically analyzing the assistive role of ICT. **METHODS:** To do this, empirical evidence was drawn from a multi-methods research with middle and top managers from 97 medium and large Italian companies. Quantitative data was collected using a survey was directed at personnel identified as Human Resource (HR) and Information System (IS) managers, followed by a qualitative study with selected firms whose aim was to understand the inner workings of assistive technology and the decision making process related to assistive technology acquisition and use. **RESULTS:** The main results show the role and the integration level of people with disabilities, and the presence and effectiveness of specific assistive technologies. **DISCUSSION:** Ways to improve the inclusion of people with disability in the workplace, as well as the use of assistive technologies are discussed.

Keywords: Inclusion, Information and Communication Technologies, Employment.

1   INTRODUCTION

Inclusive access to ICT is widely recognized as an important driving force behind development, be it at a personal [1,2] or societal level [3–6]. The issue is so relevant in the contemporary society that a whole stream of academic literature devoted to the digital divide phenomenon has arisen since the late 1990s, following the explosive expansion of the Internet [7,8]. However, most of the studies and proposals for bridging the digital divide consider mainly cultural, economic or societal barriers for ICT access, while the issue of personal impediments for using ICT is usually only marginally addressed, if at all.

Furthermore, research on assistive technologies for widening ICT access to individuals with disabilities tend to focus either on the role of the government on policy making for and direct provision of inclusive ICT [9,10] or on specific technical solutions for rehabilitation and assistive ICT, either from a purely technological [11,12] or design perspectives [13,14]. With the exception of few notable works such as Baker [15] and Mendelsohn et al. [16] and studies limited in scope [17–19], very little attention has been given to the critical assessment of assistive technologies in the workplace. In fact, the scantiness of systematic studies dealing with wide-scale provision of assistive ICT for employers with special needs within the private sector can be understood as a reflection of the overall lack of opportunities for people with disabilities in everyday life [20]. This situation is even more paradoxical when one considers the recent advances in legislation towards inclusion of people with cognitive and physical disabilities in the workforce all over the developed world [16,21–24]. It seems obvious that this situation cannot be ameliorated if the identified gap in scholarly studies is not addressed.

Thus, a wide and systematic understanding on how companies are trying to tackle the issue of assistive technologies provision for employees with special needs is of surmountable importance towards, on one hand, devising policy for improving accessibility to ICT and thus increase social equality and, on the other hand, enhancing working conditions of individuals

with disabilities by offering ICT that actually meet their needs. Although such effort has been considered previously [16], research up to now does not include any empirical data, being focused mostly, on the one hand, on legal aspects surrounding the issue and, on the other hand, on highlighting the importance of adequate data collection to support measurement and assessment of assistive technology adoption and use in the workplace. The latter aspect is also implicitly brought to attention by the use of national survey data and employment rates to formulate policy making and assess policy impact regarding work inclusion of individuals with disabilities [25].

Understandably, empirical-driven macro-level analysis must take into consideration a number of contingency and environment variables that depend on specific industries and countries. As far as the authors were able to verify, no empirical study of this kind has ever been conducted with the proper academic rigor that is needed to orient government policy-making and support decision making within companies. In this context, the aim of this paper is to shed light on the state of ICT accessibility for employees with disabilities in private sector companies by mapping and critically analyzing the assistive role of ICT in Italian companies.

This paper is structured as follows. First, the research problem and objective are stated in section 1, while methodological procedures employed in this research follow in section 2. Next, section 3 shows the main results of this research, which are then discussed in section 4. Finally, implications for researchers and managers and considerations about research limitations are presented in section 5.

2 METHOD

Given the strong novelty aspect of the research problem at hand and the absence of similar studies, the research approach is basically exploratory. In order to understand the role of assistive technologies in Italian firms, empirical evidence was drawn from a multi-methods

research with middle and top managers from 97 medium and large Italian companies. Quantitative data was collected using a survey was directed at personnel identified as Human Resource (HR) and Information System (IS) managers. Data was collected during three months using two online questionnaires. A first instrument, aimed at HR managers, investigated the role and the integration level of people with disabilities within the company, while the second questionnaire, aimed at IS managers, and investigated the presence and effectiveness of assistive technologies (e.g., high resolution displays and screen magnifying software) and accessibility tests. Typical questions for the HR manager instrument include 'How many people with disabilities are currently employed by your company?' and 'From the following list, please indicate the approximate number of employees that have each type of disability', while a typical question of questionnaire aimed at IS managers is 'From the following list, please indicate which types of assistive technology is available in your company'. The questionnaires were reviewed by experts for refinement. Moreover, a pre-test was conducted in a sample of five companies. Although the questionnaires were designed to be self-completed by a single respondent in relatively short time, it was reported that respondents often consulted colleagues in order to provide up-to-date responses. Researchers were made available for support, either by phone or personally.

The sample was drawn from a cross-industry database created and owned by a high-standard and EQUIS accredited European School of Management. Only Italian companies with more than 250 employees were included in the sample. This selection criterion was employed in order to maximize the number of respondent companies with at least one employee with disability. The first step in the data collection phase was to contact by phone, e-mail or personally the whole sample of 505 firms in order to explain the motivations for the research and ask for their support. Following this step, 147 firms authorized the survey and provided the necessary contact information for HR and IS managers. Altogether, 111 firms provided complete responses. However, the analysis was restricted to 97 pairs of

questionnaires, as companies that provided only one response (either the IS or the HR manager) were discarded.

The survey was complemented by a qualitative study with selected firms whose aim was to understand the inner workings of and the decision making process within those companies regarding integration of people with disabilities and the presence of assistive technologies. A total of eight case studies were conducted: three in the finances sector (a regional bank, a national bank and a multinational bank), three in the ICT sector (a multinational technology and services provider, two multinational telecommunications providers), and two in the public administration (a regional transportation services company and a national insurance company). The main criteria for inclusion in the sample were the relevance, uniqueness, impact and visibility of assistive technology initiatives (indirectly measured a priori from secondary sources). Usual case study data collection instruments were employed: primary data was collected in face-to-face or telephone semi-structured interviews with top management (HR and IS managers) and secondary data included internal documents and news, reports and white published [26,27]. Data analysis for the qualitative and quantitative studies was conducted in parallel, with combined cross-case analysis of detailed deep case study write-ups, which included coding analysis of the transcripts of all interviews and secondary data [26,28], and descriptive statistical analysis of survey results.

3　RESULTS

In this section, the main results of the research are presented.

3.1　THE ROLE AND THE INTEGRATION LEVEL OF PEOPLE WITH DISABILITIES

The survey with HR managers indicated that, on average, 4% of the investigated firms' employees have some kind of disability. The higher prevalence is that of physical disability (90%), followed by hearing impairment (6%), visual impairment (2%), and intellectual/cognitive disability (2%).

Generally, employees with disabilities can be found in all business areas within the studied companies. The most common role is that of operational support (80%), including activities such as management, strategic planning, control and finances, IS, and HR support. Additional roles where employees with disabilities operate include customer care (65%), logistics & operations (53%), and sales & marketing (30%). Most of the time, employees with disabilities are restricted to the lower hierarchical levels. In fact, clerk or office worker is the most common job description (94% of the companies surveyed), while in only 5% of the studied companies they occupy managerial roles.

3.2   PRESENCE AND EFFECTIVENESS OF ASSISTIVE TECHNOLOGIES

Most of the managers that answered the survey declared that all or almost all employees with disabilities have full access to the firm's information systems at a level equivalent to non-impaired employees (68% and 20% of the respondents, respectively). Slightly over 4% of the respondents claimed that only few employees with disabilities can fully access information systems, while 9% declared that there is no such access at all.

Interviews with key personnel confirmed that assistive technology tends to be made available to all employees with disabilities. The main explanation for this fact, mentioned or inferred in the majority of the case studies, is related to the requirements by Italian law. In only one case study it was reported that not all employees with disabilities were equally equipped with assistive technologies, and this was explained by an on-going implementation of braille displays and auditory feedback aids in call centers. Overall, both qualitative and quantitative evidence seems to indicate a high penetration of assistive technologies in Italian companies.

However, upon further investigation, this picture does not seem so solid as initially. When the answers of IS and HR managers are analyzed separately, for instance, it is possible to infer different levels of understanding regarding adoption of assistive technologies. In general, HR managers tend to be more optimistic: 76% affirmed that all employees with

disabilities fully access the firm's information systems, while among IS managers this evaluation is shared by 56% of the respondents. Similarly, IS managers declared that 12% of the employees with disabilities have no access to information systems at all, thrice the number of HR managers that asserted that view. Thus, the survey seems to suggest that IS managers' perception of assistive technology penetration is significantly lower than their HR counterparts'. It may be the case that IS managers, having a supposedly higher technical competence to assess technological solutions and increased knowledge about effective usage of technology within the firm, question the efficacy of part of the tools indicated by HR managers as being assistive technology.

This understanding was partially confirmed by the qualitative studies. Among the eight case studies, IS managers and employees that deal directly with assistive technology implementation, operation or maintenance (i.e., operational support technicians, system analysts, data engineers, etc.) mentioned situations where assistive technologies were deemed fully operational by the HR departments even if they consist of prototypes, testing equipment made available by vendors, or equipment under maintenance. This is particularly true in the public administration, as there are stricter controls determined by law requiring minimum levels of assistive technology provision and, usually, the time lag between equipment acquisition and operationalization is larger than in private firms due to excessive bureaucracy. Moreover, the qualitative study suggests that the informational mismatch about effective and nominal assistive technologies is more consistent on larger organizations as, on the one hand, reporting channels multiply and, on the other hand, there are more employees with disabilities given rise to numerous and distinct requirements for assistive technologies.

To investigate assistive technology presence and effectiveness in more detail, four types of technological tools were surveyed: 1) operational support tools, including technological solutions to support day-to-day activities such as internet browsers, transactional information systems and enterprise resource planning systems; 2) work life

support tools, including services and resources aimed at supporting employee interaction with the company such as human resource systems and distance learning tools; 3) communication and social tools, such as instant messaging software, telephone, email and Intranet tools; and 4) collaborative work tools, including document management systems, workflow systems, forums, yellow page listings and project management tools.

According to this categorization, survey results indicate that communication and social tools (87%) and operational support tools (84%) are prevalent among the studied companies, while work life support tools and collaboration work tools are less frequent: 55% and 49% of the firms surveyed have at least one instance of such applications, respectively. IS and HR managers' responses show that when assistive technologies are present, they are deployed in a comprehensive and balanced manner in order to render all four types of technological tools accessible by employees with disabilities: assistive technologies are present in 87% of communication and social tools, 81% of work life support tools, 79% of collaborative work tools and 78% of operational support tools.

The qualitative studies allowed researchers to gain further insight on this. A large number of interviewees confirmed that companies prefer to invest in a broad number of assistive technologies, covering all facets of an employees' interaction with the company, than to invest heavily in only one aspect such as communications or operational tools. The main reason for this, according to the interviews, is to provide a basic level of integration for employees with disabilities. In retrospective, according to an interviewee, this strategy usually means to spend less per single solution, which can then result in less effective assistive technologies but broader coverage of basic necessities. It is not possible to generalize this mechanism to all firms based on the few case studies conducted, though. Moreover, evidence from the case studies suggests that usually companies invest first in assistive technology for operational support tools, followed by communication and social tools.

The quantitative study also investigated which specific assistive technologies are present in the studied firms. In the survey, respondents were confronted with a comprehensive list of assistive technologies and asked to indicate which ones were actually used within the company. The objective of this investigation is twofold: to map which specific assistive technological solutions are being currently used by Italian companies and to cross-check if managers were being accurate in their assessment of assistive technology presence. In this particular stage, IS and HR managers reported that assistive technologies for personal computers were present in 25% of the firms, while the penetration of assistive technologies for mobile phones is almost absent (only 3%).

Among the assistive technologies for computers, 22% are aimed at visual impairment, 12% at physical disabilities, 8% for hearing impairment and 3% for intellectual and cognitive disabilities. Examples of assistive technologies for visual impairment include high resolution displays, screen magnifying software, screen reader software, braille displays and auditory feedback aids. Assistive technologies for physical disabilities reported in the survey include special input devices, voice recognition software and ergonomic accessories such as wrist and arm rests. In the survey, the only example of assistive technology for hearing impairment related to personal computer is the use of subtitles in multimedia files, but Telecommunications Devices for the Deaf (TDD) were reported in almost 10% of the firms. Finally, reported assistive technologies for intellectual and cognitive disabilities include special keyboards, touch screens, voice recognition software, joysticks and trackballs. Regarding the low incidence of assistive technologies for hearing impairment and physical disabilities, interviewees asserted that in most of the cases there is no need for such aids as employees' disabilities are normally not severe enough to prevent the use of personal computers.

A second issue investigated by the survey is the level of effectiveness of the assistive technologies. In particular, the intention was to gauge if assistive technologies available were

able to cope with the actual needs of employees with disabilities. The high rate of managers that could not confidently answer this question (27%) is further evidence that assistive technology is not a main concern for IS and HR managers even in companies that declaredly invest in these aids. Among firms that employ assistive technologies, only 14% conduct interventions aimed at improving the effectiveness of such technologies given their employees' specific disabilities, while 59% use them without any adaptations or improvements. It must be noted that, among the latter, almost 24% declared that periodic assessments are conducted to verify if current assistive technologies effectively fulfill their employees' needs. Overall, it was observed that 8.7% of the studied companies procured improvements or adaptations in communication and social tools, while 7.6% invested in interventions on operational tools, 6.6% in work life support tools and only 4.4% improved collaborative work tools.

Considering the four types of technological tools surveyed (operational support, work life support, communication and social, and collaborative work), Table 1 shows a comparison between the overall adoption level, the penetration of assistive technologies in these categories and the presence of improvement or adaptation in assistive technologies in order to increase its effectiveness.

It is strikingly evident both the low incidence of assistive technology improvement and the gap between assistive technology penetration and the presence of improvements and adaptations in assistive technology. From what was gathered in the interviews, it was inferred that some companies tend to hire people with disabilities that do not compromise their ability to use unmodified technology tools and/or assign employees with disabilities to functions that do not require them to interact with technology tools. This two pronged approach can be understood as an ex ante "problem dissolution" strategy. On the other hand, it was observed that some companies effectively face the problem of having employees with disabilities that

impair their work routine but do not provide them with adequate assistive technology, in what can be labeled a true "digital divide" within companies.

By jointly analyzing the quantitative results regarding assistive technology penetration and improvement levels with qualitative results from the interviews with managers, four main approaches to the problem of assistive technology by the studied companies can be identified. In most of the cases (58%), companies have a high level of declared technology accessibility but the effective support to employees with disabilities is rather low, characterized by either assigning employees to tasks and functions that do not require sustained interaction with unmodified technology or hiring people whose disabilities do not hinder their work at all. This group of companies employs the "problem dissolution" approach discussed before. This was fairly evident in interviews on four out of the eight case studies, as managers explicitly cited that HR departments are instructed to assess candidates' disabilities in the light of the company's overall assistive technology availability.

The second largest group of companies (30%) is full aware of the accessibility problem, as they score high in both declared technology accessibility and assistive technology effectiveness. The companies in this group are among those that provide their employees with improved or adapted assistive technologies or at least conduct periodic assessments of assistive technology effectiveness given their employees' specific disabilities.

In 9% of the studied companies, it was observed that both declared technology accessibility level and assistive technology effectiveness is low. These companies are aware of the issues regarding employee accessibility but have not made enough effort to address it. Among the reasons cited by managers of these companies, the most common theme is the lack of affordable assistive technology and top-level budgetary constraints for investments in assistive technology. In only 3% of the studied companies it was observed a low level of declared technology accessibility coupled with high assistive technology effectiveness. These

few companies are indeed either early adopters of assistive technology or firms that have people with disabilities among their main customers.

4   DISCUSSION

This paper shows the state of ICT accessibility for employees with disabilities in private sector companies in Italy. It is known that among people with severe disabilities who hold jobs, a significant number performs their tasks using ICT [29]. These equipment can offer a wide range of accessibility and customization options, including the ability to interface with assistive technology devices that allow the worker to perform almost any task [29] and escape isolation [20]. Moreover, ICT-based accessibility technologies have the potential to decrease unemployment and underemployment among people with disabilities [30].

However, the results presented in this study suggest that employees with disabilities are restricted to the lower hierarchical levels. This situation can be explained in part by the technical barriers to the inclusion of people with disabilities [31], such as intimidation by new technologies (including ICT), gaps in technology development, and restrictions arising from low economic and educational levels. Intimidation can be explained by the number of technical problems encountered when trying to accomplish work, causing the individual with disability to stop trying using the technology and, in some cases, even to develop a fear of technology [31]. The gaps in technology development relate to the mismatch between the rate of development of new technology and the (much slower) rate of development of advances in interfaces for people with disabilities to use these technologies [31], as the limited accessibility of Internet websites attest [20]. Finally, the educational level barrier is linked to the high levels of complexity that some assistive technologies display [31]. The reasoning is that employees with lower education backgrounds may not be able to cope with this increased complexity. Moreover, there is a cost-related barrier that applies both to employees with disabilities and to their employers [32] that difficult access to and use of ICT-based assistive

technologies [20]. The results reported in this study, that is, that people with disabilities are usually confined to lower hierarchical levels (and, consequently, lower wages) suggest that educational level and cost-related barriers are especially relevant in the Italian context.

It is already well established in literature how these barriers can be reduced or removed through the effective use of assistive technology [30,33]. ICT is frequently seen as a tool that allows people with disabilities to minimize feelings of isolation [20]. ICT-based tools offer a wide range of accessibility and personalization options, including the possibility to interface assistive technology devices that allow workers to conduct virtually any computer-related task [29]. In this study, it was reported the presence of assistive technologies for visual, physical, hearing, cognitive and intellectual disabilities. For visual impaired persons include, high resolution displays, screen magnifying software, screen reader software, braille displays and auditory feedback aids. For physical disabilities include special input devices, voice recognition software and ergonomic accessories such as wrist and arm rests. For hearing impairment, it was observed the use of subtitles in multimedia files and TDD. And assistive technologies for intellectual and cognitive disabilities include special keyboards, touch screens, voice recognition software, joysticks and trackballs. An assistive technological solution that was previously reported in other research [33] but is absent in the companies studied is the use of external removable hard disk drives that allows users with disabilities to easily change work stations. Moreover, previous research has hinted at telework as an assistive technology [19], but this particular technology was not approached in the present study as we focused on assistive technologies physically present in the workplace. A number of advantages have been proposed for telework, such as money and time savings and minimization of social interaction issues. However, employees with disabilities working by themselves without direct contact with other people may become alienated from recreational and social activities that may help them overcome limitations associated with their disabilities

and acquire adaptive skills [34]. The use of technology is also important as a measure to reduce dissatisfaction among employees with disabilities [35].

It is also important to highlight that the positive outcome in terms of diffusion of assistive technology suggested by our study may be the result of stricter Italian regulations. In this sense, this study agrees with Vicente & López [31], who affirm that political action for accessibility promotion must be prioritized. Similarly, to Vrăşmaş & Vrăşmaş [36] there is a latent need for policy making aimed at facilitating and supporting young people with disabilities transitioning from school to work. The same authors propose action research as an effective method to concieve psychological counseling and professional orientation activities to support young people with disabilities. Policies for social action, such as increased Internet accessibility, may also be critical in improving access to information and promoting learning opportunities for people with disabilities [31].

When the answers of IS and HR managers are analyzed separately, it is possible to infer different levels of understanding regarding assistive technology adoption. The differences in the responses by HR and IS managers suggest that different professional backgrounds may have strikingly dissimilar views on accessibility and the role of assistive technologies in the workplace. Previous studies have also dealt with different professionals' contribution to assistive technology use and diffusion. For instance, Bruyère [37] shows how physiotherapists and other health care professional can facilitate inclusion of people with disabilities in the workplace, educate co-workers and evaluate how people with disabilities can improve their interaction with assistive technology. Similarly, Simpson [38] suggests that a physician should be included in teams charged with the task of selecting and implementing assistive technology, while Vicente [31] argues that the inclusion of people with disabilities in research and development projects for new ICT is critical to guarantee that better and more efficient assistive technologies will be available. It is worth noticing that none of the companies studied in the qualitative phase of our research reported consulting health care

professionals or even people with disabilities in activities related to assistive technology identification, acquisition, implementation and use.

5   CONCLUSIONS

This study is the first large scale empirical mapping of ICT use by persons with disabilities. In particular, this study maps the state of ICT accessibility for Italian employees with disabilities in Italian private sector companies with more than 250 employees using a mixed-methods research approach. Although the study is based only on account of HR and IS middle and top managers, the results can be used as a basis for comparison with other contexts. The overall levels of assistive technology diffusion within the Italian private sector were determined. There is evidence that assistive technology is mostly directed towards allowing or facilitating operational and communications activities. Moreover, it has been detected that less than 10% of the firms that employ assistive ICT provide modifications that improve the usability or efficacy of these technological solutions. Finally, it has been detected that HR and IS managers have different perceptions regarding assistive technology diffusion and use, a result that supports the claim for further investigation on the roles of management in assistive technology diffusion. Future studies may improve the exploratory knowledge generated here, with the direct participation of people with disability who work with ICT in different sectors of industry.

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TABLES

Table 1 - Technology adoption, penetration of assistive technologies and presence of improvements/adaptations.

Technology Type	Overall Technology Adoption	Assistive Technology	
		Penetration	Improvement or Adaptation
Operational tools	84%	65.5%	7.6%
Work life support tools	55%	44.6%	6.6%
Communication tools	87%	75.7%	8.7%
Collaborative work tools	49%	38.7%	4.4%

Source: Elaborated by the authors.