

Digital technologies for promoting the inclusion of workers with disabilities: A brief investigation

Luisa Varriale^{1*}, Paola Briganti², Tiziana Volpe³ and Giovanni Minucci⁴

¹University of Naples “Parthenope”, Department of Economics, Law, Cybersecurity, and Sports Sciences, Nola (NA), Italy

²University of Naples “Parthenope”, Department of Sport Sciences and Wellbeing, Naples, Italy

³CNR-ISMed - Istituto di Studi sul Mediterraneo, Naples, Italy

⁴Società Cooperativa “il Tulipano”, Naples, Italy

Abstract. This paper investigates the role and function of digital technologies within firms, widely believed to make them much more sustainable and promote the social inclusion of people with disability (PWD) at the workplace, especially those with cognitive disability or autism spectrum disorder (ASD). In the last thirty years, and more recently due to the COVID-19 pandemic, technological change related to digital transformation, hence the adoption and diffusion of digital technologies, has impacted every field and sector in private and professional life, both positively and negatively. Undoubtedly, our ways of working and quality of life have been improved by digital technologies which are able to overcome geographical, physical, and social barriers. Yet there are negative effects in some domains and for certain categories of people, like those with disabilities or special needs. Within the well-known phenomenon of digital divide, people may be totally excluded due to their limited digital skills or lack of access to technological tools. After a brief review of the literature on the topic, adopting a multiple case study method, we investigate several firms operating in different economic sectors in one specific country, namely Italy, where there is a significant presence of PWD, mostly with ASD, who face challenges in being recruited and working within organizations. Our qualitative research, investigating the role and function of digital technologies in supporting and promoting the inclusion of PWD at workplace, provides some stimulating insights for future studies.

1 Introduction

Over the last thirty years, especially in the last two years due to the COVID-19 pandemic, rapid technological change, characterized by computing power, algorithms, and digital technologies, has significantly changed our lifestyles and working practices [1]. Unlike the previous technological revolutions which “were mainly due to advances in general purpose technologies, namely steam power, electricity, computerization, the current fourth industrial revolution involves a shift of paradigms [2] in all disciplines, economies and industries since it challenges what it means to be human and consequently raises important political and

* Corresponding author: luisa.varriale@uniparthenope.it

ethical issues” [1: p. 1]. For instance, algorithms of artificial intelligence (AI) “are trained” to consider big data from the past and embody stereotypes and values of their designers and coders [3]. Thus, algorithms should give the chance to overcome stereotypes and support human biases especially regarding the most vulnerable individuals, like people with disability (PWD). Moral and human values need to be integrated into technologies [4]. Indeed, when operating and living in a scenario where there are increasing income inequalities between workers [5], “the disconnection between the technological and social progress is not sustainable anymore” [1]. In this direction the main goal is to create new models and narratives for inclusive prosperity [2]. Unfortunately, technological change and hence digital transformation, intended as the adoption and diffusion of digital technology, whether hardware (PC or mobile devices) or software (web applications, social networking spaces, chat sites, etc.), and especially emerging technology like augmented reality, virtual reality, and AI, also have negative effects in some domains and on certain categories of people, like those with disabilities (PWD) or special needs. Indeed, there exists the well-known phenomenon of digital divide which entails the total exclusion of people from the world for some reasons, such as their limited or absent digital skills, or the lack of technological tools or because they have specific forms of disabilities.

Starting from these short considerations, this paper aims to answer one specific research question: whether and in what way can digital technologies favor inclusion and reduce inequalities at the workplace for people with disabilities or special needs? To answer this research question, we focus on the field of neurodiversity which concerns the combination of strengths and difficulties associated with neurological differences between individuals. Such differences include conditions such as dyslexia, dyspraxia, attention deficit hyperactivity disorder (ADHD), and autistic spectrum disorder (ASD). In this exploratory study, we consider above all workers with ASD, since autism is currently a focus for most employment programs which favor neurodiversity. Autism represents a neurological psychiatric life-long condition, resulting in differences in perception and cognition of individuals who have difficulty socializing and interacting with the world.

Through a multiple case study, we briefly investigate the application of digital technologies within firms for supporting and promoting the inclusion of PWDs at the workplace, especially those with ASD. Indeed, this exploratory study, using a qualitative approach, aims to depict the Italian context vis-à-vis how firms seek to avoid the negative implications of digital technologies, developing and adopting innovative technological solutions to close the digital divide and promote the inclusion of workers with disabilities, following the existing regulatory system at national and European level in the perspective of sustainable development at the workplace. Our analysis concerns the way firms strive to be much more technologically advanced in adopting digital technologies (accessible website; learning and training applications; assistive technology; etc.) to promote the social and economic inclusion of their workers with disabilities. Following the strand of previous studies [6, 7, 8, 9], this paper aims to contribute to service science research by providing an integrated treatment of service science and technology studies and disability studies, where the first two research areas support the latter to tackle the existing challenges going beyond the dominant approaches, such as the medical and social models, adopting a very open perspective related to sustainability. We follow the key concept of service science, that is creating the right mix of knowledge, including computer science, engineering, management, and social science, also paying attention to the disability phenomenon at the workplace. Under the key concept of service science, where service systems can be studied to create a basis for systematic service innovation, in this study we also try to combine “organization and human understanding with business and technological understanding to categorize and explain the many types of service systems that exist as well as how service systems interact

and evolve to co-create value” [7: p. 18), specifically considering workers with disabilities and special needs.

Starting from a brief review of contributions to the topic in research and industry, we investigate several firms in different economic sectors. In analyzing one specific country where the presence of PWD, mostly with ASD, represents a considerable challenge in terms of recruitment and working within organizations, our qualitative study yields both insights and stimulating avenues for future research.

2 The role of technological assistance systems for the inclusion of workers with disabilities within organizations: Theoretical and international legal foundations

During the last few years, the fourth industrial revolution introduced the concept of new technological assistance systems for the inclusion of PWD at work [10]. Technological tools, machines, and devices are now conceived as ‘partners’ that improve and support hard skills, knowledge, and competences of those working in organizations. Industry 4.0 scenarios adopt the anthropocentric approach, and have built productive processes around an operator, who receives support from assistance systems or machines, which enhance humans’ physical, sensorial, and cognitive capabilities: the new workers cooperate with machines and robots [11, 12].

Machines and robots have ushered in a great process of inclusion for PWD and aging operators, transforming their work into comfortable and efficient tasks, and facilitating collaborative interaction with new generations: workers with special needs can be supported by technological systems in an adaptive, intelligent, and dynamic way. Context-aware supporting systems have been successfully introduced into smartphones and cars, and in several cases into working contexts. PWD and elderly people need context-sensitive support in production facilities to control work results, not only trusting in their personal expertise and skills [13].

2.1 Assistance systems for workers with disabilities

During the last century, people with disabilities were seen as an exception to the widespread rule of having to earn one’s living by working: this phase of exclusion was followed by the establishment of sheltered work, where structure for their lives and occupation in a segregated setting were offered to those with disabilities through “administrative segregation”. The constructs of normalization and social inclusion view the individual and their special needs as part of human diversity: the question becomes what is needed to match the person with disability and the work environment, based on new integrative labor market norms accommodating their diversity [14, 15].

Mark and colleagues [16] set out the eight different types of future workers which include operators with disabilities, with the presence of assistance systems that enhance the working environment and the functionalities of such systems for the well-being of physical-neurodiverse workers, in terms of increasing quality control capability, worker capacity, search times, and integration. Specifically, the authors identified the type of interactions for workers with physical and cognitive disability, such as super-strength, collaborative, smart, social, healthy, virtual, analytical, and augmented operator; these different types of operators can confer several benefits, such as physical and cognitive support, speed and productivity, safety and integration for workers, and reduced mental stress and comfort.

Furthermore, Mark and colleagues [16] introduced the concept of subdividing users of assistance systems into different groups in the organizations 4.0. One such user group is

represented by workers with disabilities, who are specifically divided into physically impaired and mentally (cognitively) impaired workers. The main assistance systems, including tools and digital technologies, able to support workers with physical and cognitive disabilities are as follows: tablets, laptops, smart watches, software systems, smart gloves, laser support, worktables, desk lighting, mixed and augmented reality, touchscreen, collaborative robots, shoulder exoskeleton, balance, and manipulator, and so forth. Other scholars [11] identified three different categories of assistance systems: sensorial, physical, and cognitive assistance systems. Sensorial assistance systems support PWD at the workplace through warning lights mounted on top of doors or technical machines to show the manufacturing plant's status, and aid workers with hearing problems to recognize dangerous areas early enough to react appropriately. A combination with audible signals can also warn the visually impaired. Pictographs are used to replace written information, especially about dangers, when this information must be communicated quickly when the law prescribes those operators be informed for their safety. They must increase risk awareness, capture attention, and their meaning must be easily understood from a distance to support awareness of those with reading difficulties and provide additional safety. At the same time, Braille was invented to communicate with visually impaired people [17]†.

Moreover, physical supporting systems are available to increase the mobility and force of the user, limited to body parts, such as upper extremities and hands or the whole body [18, 19, 20, 21]‡. New devices can assist workers who lost the use of their finger, hand, or arm. Hand impairments can be counterbalanced using a robotic glove made with a rubberlike and flexible material that can be moved with a small motor. In addition, wheelchairs have been developed to overcome the stair climbing problem, and collaborative robots can be used to compensate physical disabilities of workers, allowing working together with the operator within a shared workspace, integrated in a standard manual workstation as an additional and individual aid to give lifting support or to hold parts while the operator is executing work: with a collaborative robot the operator can receive an individually ergonomic working environment. Finally, cognitive assistance systems [22, 23, 24, 25], such as thermography to check the quality of work, provide useful information to the operator by considering the level of education and special needs of PWD, since they can reduce the cognitive workload of operators, as they do not have to memorize the specific assembly instructions for every change in the product line. While for operators with cognitive disabilities continuous support is useful, for other workers an additional form of information is necessary only during the learning phase. Furthermore, PWD become faster and make fewer errors while executing tasks.

2.2 International legal background

From an international legal perspective, looking at the numbers of PWD in employment and the situation of those who are not, the need and opportunity for equality measures is significant. The last EU-wide census showed that only 45 percent of PWD were in employment. As a reaction, the EU's Disability Strategy 2010–2020 set employment as one of its priority areas with the goal of increasing the level of participation, in regard to inclusive employment and how it can be facilitated by technology, stating the Convention on the Rights of Persons with Disabilities (CRPD): the developed policy guides the legal development of

† <https://smallbusiness.chron.com/pictographs-used-workplace-38856.html>

‡ <https://www.sciencenewsforstudents.org/article/new-devices-coming-assist-disabled>; <https://www.bosch-presse.de/pressportal/de/en/bosch-showcases-contact-free-collaborative-robots-for-the-flexible-factory-61248.html>.

the region in terms of the rights of those with disabilities, whose progress is monitored by the United Nations (UN) via periodic reviews.

Three articles of the CRPD are of particular importance: Article 5 on equality, Article 9 on accessibility, and Article 27 on employment. The CRPD Committee clarifies in its General Comment on Article 5 that equality—to be understood as substantive equality, as described in Section 1 of this article, even though the General Comment introduces the terminology of ‘inclusive equality’—is to be understood as both a right and a principle that guides the interpretation of the entire Convention. The goal of equality is described as having four contents of “(a) a fair redistributive dimension to address socioeconomic disadvantages; (b) a recognition dimension to combat stigma, stereotyping, prejudice and violence and to recognize the dignity of human beings and their intersectionality; (c) a participative dimension to reaffirm the social nature of people as members of social groups and the full recognition of humanity through inclusion in society; and (d) an accommodating dimension to make space for difference as a matter of human dignity” (par. 11). Accessibility in this context is then understood as “a precondition and a means to achieve de facto equality for all persons with disabilities” (par. 40). It can therefore be seen as part of the tools to achieve the overall goals of equality of opportunities and the recognition of full human dignity of persons with disabilities. Article 9 on accessibility must be understood, as outlined by the CRPD Committee, in its entirety as applying to both private and public actors, regarding the physical environment, transportation, information and communication technologies (ICT), and any services offered to the public. The principle of universal design specifically describes the obligation to ensure that two approaches are complied with the design stage of a product: (1) User-Aware Design: pushing the boundaries of ‘mainstream’ products, services, and environments to include as many people as possible; (2) Customizable Design: minimizing the difficulties of adaptation to users. Already existing products and services must be adapted gradually, depending on the country’s resources, to ensure they can be accessed by persons with disabilities on an equal basis with others. This approach is therefore to be understood as an ex-ante group approach, making everything as accessible as possible from the outset, without anyone having to request it or having to show a need for it.

Although the universal design standards have been considered, there is the risk that the existing barriers persist, and thus there will be the need to make changes with some complementarities for reasonable accommodation. Reasonable accommodation has been defined as the “necessary and appropriate modification and adjustments not imposing a disproportionate or undue burden, where needed in a particular case, to ensure to persons with disabilities the enjoyment or exercise on an equal basis with others of all human rights and fundamental freedoms” (Article 2). This is the specific duty for individuals to accessibility. Thus, the employer must consider the effectiveness of the measure in the specific individual case, while considering the burden it imposes on their specific business, such as the financial costs or disruptions of the work arrangements which have to be measured against the overall benefits of the arrangement, such as broadening the customer base because of the improved overall accessibility. The exact accommodation arrangements must be decided in consultation with the employee in question. Finally, Article 27 of the CRPD sets out the duties of the state parties regarding the right to employment. It clarifies that the right to equal, freely chosen employment opportunities covers every aspect of employment, starting from the recruitment process, covering labor rights, career advancement, and training amongst other things. It reaffirms the duty to provide reasonable accommodation and clarifies that the state parties’ duty goes beyond a mere anti-discrimination approach and explicitly allows for affirmative action (Article 27).

At the European Union level two acts are of especial importance: The Council Directive 2000/78/EC of 27 November 2000 establishing a general framework for equal treatment in employment and occupation and the Directive (EU) 2019/882 of the European Parliament

and of the Council of 17 April 2019 on the accessibility requirements for products and services.

“The Framework Directive forbids both direct and indirect discrimination, meaning that not only is it forbidden to give less favorable treatment because of the disability itself (direct discrimination) but also to use a seemingly neutral criterion which negatively affects persons with disabilities disproportionately” [16: p. 17]. It also implements the duty to provide reasonable accommodation into EU law. The Accessibility Act finally entered into force in 2019 after years of drafting and negotiations. It sets out compulsory accessibility requirements for producers, which are also mandatory for member states to abide by in procurement processes. Its focus is however primarily on technology, such as self-service machines or e-commerce to name just two examples. Other important fields, such as the built environment, are not regulated by the act, which is considered one of its main shortcomings, as it can therefore not promote full accessibility of public services. The act focuses on making products of general use accessible; it does not focus on assistive technology specifically for persons with disabilities. Member states have until 2022 to implement the directive in their national law, otherwise it will be directly applicable. As part of the EU’s Disability Strategy, it aims to target the fragmentation of the market for assistive technology and their high costs for consumers. However, it also clarifies that in this field its role is to support and supplement national efforts, in other words a subsidiary competency. Italy has ratified the CRPD and received its first Concluding Observations in 2016. Its anti-discrimination law is mainly based on the EU’s equality directives, which were almost directly transformed into national law and not fully harmonized with the wider legal system. The prohibition of discrimination in the workplace on the grounds of disability can be found in Legislative Decree 216/2003. The other law of particular interest in the context of inclusive employment for persons with disabilities is Law 68/1999 on the right to work of persons with disabilities. It sets out several specific measures to promote employment but does not apply to every person with a disability, but only specific groups as listed in the act itself, for instance requiring a specific percentage of disability for certain impairments.

Italy has a quota system, introduced by Law 68/1999, of 7% for enterprises with more than 50 employees and one employee with a disability for enterprises with more than 15 but less than 50 employees. It has been reported that this quota is generally complied with and that specific exemptions must be granted for enterprises which cannot comply with the quota for legitimate reasons. This quota system does not change the situation of smaller enterprises however, which account for about 95 percent of the Italian economy.

Act 68/1999 offers some incentives for employers, such as tax reductions and subsidies if they employ persons with disabilities. Job seekers with disabilities can be added to a specific job placement list and have an assessment of their abilities done and get some training offered. This approach led to an increase in registrations at job centers and employment of persons with disabilities. Funding for additional costs of employing persons with disabilities is mostly available on a regional basis, coming from the Regional Fund for the Employment of Persons with Disability, which was set up in accordance with Article 14 of Act 68/1999. It covers, amongst other things the costs of some cases of reasonable accommodation. Regional Laws can also regulate a claim to assistive technology at the workplace. The Southern Tyrolian Law on Participation and Inclusion of Persons with Disabilities for instance sets out that the region subsidizes the extra costs of purchasing necessary work equipment for employees with disabilities.

Reasonable accommodation in general is a topic of ongoing debate in Italy. The CRPD Committee noted in its Concluding Observations “The Committee is concerned that national legislation lacks a definition of reasonable accommodation and does not include an explicit recognition that the denial of reasonable accommodation constitutes disability-based discrimination”. This statement is more relevant as case law has shown that employers rarely

agree to bear the costs of reasonable accommodation. The existing regulation of the duty to provide reasonable accommodation states furthermore that “public employers shall apply this provision without any additional burden and with the human, financial and technical resources already available”, thereby omitting the word ‘undue’, which apparently lowers the threshold of what constitutes too high a burden for the employer to be expected to bear.

2.3 Analysis on neurodiversity of workforce, digital transformation, and inclusion: The case of workers with ASD

Walkowiak [1] analyzes the productive complementarities between digital transformation, the skills of autistic workers and neurodiversity management. Based on a qualitative approach and interviews with leaders or experts of neurodiversity initiatives, the theoretical framework provided analyzes the link between the neurodiversity of the workforce and digital transformation at the individual, organizational and industry level, identifying several ways in which digital transformation may provide a favorable context for workers with ASD: creating new opportunities, valuing their performative abilities, cognitive differences and creativity, removing stereotypes and biases during recruitment and improving the management of psycho-social risks. Neurodiversity management also contributes to digital transformation by making good the digital skills shortfall, shaping algorithms of artificial intelligence, and providing a competitive advantage for innovation. Moreover, neurodiversity management provides an effective model of inclusion that can mitigate the development of inequalities associated with digital transformation.

Starting from a review of the literature on the difficulties faced by individuals with ASD juxtaposed with evidence-based social psychology and management theories, Patton [26] showed that individuals with ASD represent a growing segment of the population but face major obstacles at the workplace. Even for ASD individuals with the mildest form/highest-functioning type, unemployment is about 80 percent, and many of those who work are underemployed. This occurs even though such individuals are highly intelligent and capable of excellent work. Further, Patton (2019) illustrates a model of the unique challenges that workers with ASD face in the modern workplace based on stigmas and discrimination surrounding mental health, attribution theory and the disconnect between behaviors common to neurodiverse individuals and some of the most researched theories in the field of organizational behavior, encouraging more empirical research focusing specifically on ASD workers.

Krzeminska and Hawse [27], besides stressing that people with autism have the highest rates of unemployment among any group of people with and without ‘disabilities’, identify their skills as essential to meeting current and future workforce needs, particularly in STEM areas. Traditionally defined as a disability, the strengths and limitations of autism are now recognized as valuable differences and increasingly harnessed by employers in the workplace: their case study showed that employment for people with autism is empowered by a movement that was started by a small Danish social innovator in 2004 and is now spreading globally in large for-profit companies. This case concluded with the various HR practices of these organizations, which are moving from affirmative action programs to regular front-door modes of employment and other models in between, an interesting area to be addressed in future.

Molloy and colleagues [28] define Generation A by people with ASD, expected to join the workforce in greater numbers in the next decade, understanding employment and its success factors. This study aims to highlight the important gap between traditional and inclusive HR practices while exploring the current inclusive practices adopted by neurodiversity champion companies, through interviews conducted with six Irish

organizations to identify the success factors behind their approach to neurodiversity and autism.

Furthermore, in their volume Bruyère and Colella [29] illustrate an extensive overview of practices for building a truly inclusive work environment, focusing on the following topics and HR aspects: Shaping organizational climates to develop and leverage workforce neurodiversity starting from neurotypical norms; recruitment strategies for creating a neurodiverse workplace where people with ASD represent an enormous pool of untapped talent; methods and specific tools, also digital technologies, for screening, interviewing, and selection for neurodiverse applicants to avoid typical and implicit biases encountered by applicants with ASD; disclosure dilemma about neurodiversity at the workplace, such as formally or informally disclose information; the effectiveness of traditional leadership theories in a neurodiverse context; the role and function of colleagues in experiencing employees with autism at the workplace; workplace accommodation for a neurodiverse workforce; performance management and career development for employees with ASD; the support of mental health and general well-being of employees with ASD or neurodivergence; other internal organizational resources for neurodiverse workforces; hiring programs and legal and regulatory environment for workers with ASD. In recent decades, the business world has paid growing interest to “inclusive hiring”: software and technical solutions have been developed and implemented by several enterprises, such as Microsoft, Ford, Hewlett Packard Enterprises, and IBM, for specific neurodiverse human resources talent programs [30].

Few studies about technologies and workers with neurodiversity, specifically workers with ASD, outline the main benefits of adopting digital technologies, such as robotics, virtual reality and QR code for making the work environment much more inclusive for such employees [31, 32, 33, 34, 35]. For instance, according to Tomczak [34], assistive technology (AT) can be a useful means of creating a better work environment, making the digitized workplace more friendly for people with ASD: technology can tackle the typical issues encountered in the communication process where interpersonal communication between employees is replaced by electronic (non-direct) forms of communication, such as online communicators or chatbots. Likewise, opportunities to create optimal inclusive conditions for people with ASD through digital technologies have been found to improve both performance and well-being, underlining the need to redesign the work environment using digital solutions, especially technology-based accommodation overcoming the workplace challenges faced by employees with ASD [36]. For instance, using virtual reality, through a 3D visor, employees with ASD can simulate situations to be tackled in the future with psychological support. Thus, any uncontrolled reactions are taught in advance [35, 36]. Likewise, in work environments such as laboratories or food organizations/restaurants, small QR code holders containing precise and clear operating instructions can be distributed. On 'reading' such QR codes with an app, employees with ASD can be guided step by step through the various tasks like a personal assistant [35, 36].

There is still too little attention paid by scholars and operators to the topic in question, specifically the role and function of digital technologies to support and promote social inclusion of workers with ASD. The link between sustainability (social and economic in terms of total inclusion at the workplace), digital technologies and workers with disabilities, mostly workers with ASD, needs to be explored and reinforced, especially given the significant increase worldwide of PWDs.

3 Methodology

This exploratory study adopts a multiple case study as the research method. Starting from a review of the main contributions of the literature and in industry and adopting a qualitative

methodology, this study provides an in-depth analysis of the technological solutions and initiatives introduced and used by firms to include their workers with disabilities, specifically those with ASD. The research aim was mainly to investigate the firm's position and the degree of innovativeness vis-à-vis the adoption of digital technologies and the social sustainability of firms, given their measures and actions for promoting social and work inclusion of PWD, primarily workers with ASD.

Therefore, this empirical analysis provides an overview of the sample Italian firms, exploring behavioural models and initiatives introduced from both the perspective of digital technologies and that of sustainability, outlining the degree of technological innovativeness with impact on their social sustainability in terms of work inclusion of PWD. According to previous research, our multiple case study approach aims to achieve descriptive purposes [37, 38]. Indeed, it intends to describe the current state of the degree of technological innovativeness linked to social sustainability of the Italian firms investigated. According to the literature, a qualitative study, due to its being a case study, cannot validate theoretical hypotheses or move towards a "grounded theory" [39]. The sample is made up of 29 case studies corresponding to Italian small/medium/large firms in several geographic areas and different economic sectors. The firms meet the following criteria set for our investigation: 1. at least one employee with ASD, or with Asperger's syndrome, works in the firm; the companies analyzed must be headquartered in Italy. We conducted an in-depth investigation of all the documentation available of the firms selected; specifically primary and secondary data were considered. We analyzed the firms through the following data sources: company websites, archival data, sustainability reporting, financial statements, press and magazines, and reports related to the specific firms or their industry. Information and data about the digital technologies introduced and implemented by the firms, including the accessibility of their websites, were collected, and processed, focusing on issues related to digital technologies and social sustainability with primary emphasis on workers with ASD and also Asperger's syndrome. Furthermore, the specific information acquired and included in the work for investigating the selected companies was identified on their official website pages, in the databases of the Chambers of Commerce, as well as other information sources (newspapers, online magazines, social networks).

We went through all the mentioned sources of our investigation, carefully reading them also using specific key words, separately and combining them, that is "technology", "ASD", "Asperger", "disability", "tools", "inclusion", "workers with disability", "workers with autism", "workers with ASD".

The overall technological digital solutions, programs and actions promoted and identified and investigated as introduced by the firms analyzed can outline their overall degree of technological innovativeness and the related social sustainability orientation. We also compared the different firms to complete the analysis to identify the key organizational and managerial implications that characterize the main differences with a specific focus on their approach and position regarding technological innovativeness and social sustainability.

4 Results and discussion

The 29 companies investigated with headquarters in Italy are mostly located in Northern Italy. No companies operating in Southern Italy were found.

A very significant experience is Auticon, an international IT consultancy company, which exclusively employs adults on the autistic spectrum who are high functioning, i.e., who have a good cognitive level, as IT consultants. The company identifies itself as a social enterprise. Established in 2013 in Germany, it has opened dozens of offices in various countries worldwide, including Italy. The team of expert consultants - all autistic - does not work

remotely, but directly with the companies that require Auticon services. These are large companies, such as Eni, Unipol, Enel, Poste Italiane and many others.

In the analysis conducted, seven companies operate in the hotel and restaurant sector, their employees work in various positions assuming different roles and tasks, such as waiters, assistant chefs, dishwashers, and porters. The Locanda dei Girasoli Restaurant – Pizzeria, since 1999 has combined the love of quality cuisine with the social and work inclusion of young people with Down syndrome, Williams syndrome and other cognitive disabilities. The company, which has on its staff 14 employees with disability, boasts a positive balance sheet and proposes a new and replicable production model, inspired by basic principles such as mutuality, solidarity, respect for the person and democracy.

In the province of Milan is the PizzAut pizzeria, where 20 young people between 17 and 24 years old, all with ASD, work as cooks, pizza makers and waiters. Some workers are hired on permanent contracts, others on part-time contracts. The workers were selected according to their inclinations by a pool of experts made up of psychologists and educators. The environment is designed to allow workers with ASD; the ceilings have been soundproofed to avoid excessive noise, and there is furniture without doors. The place is all well-lit, with restful lights. There are unbreakable polypropylene glasses and jugs to avoid noise. The owners hope that this place can become a franchise.

Of greatest significance is that 12 companies (50%), which have hired people with ASD, are companies operating in the consultancy and technology sector. Alberto Balestrazzi, chief executive officer of the Auticon company said: “People on the autistic spectrum and with Asperger's syndrome are very good at IT jobs. Because of their mindset they pay close attention to detail, and then reconstruct the whole, and this is very important when we analyse the data. For example, they are very good at spotting mistakes. In short, in complex realities they have something extra”. The analysis shows that the jobs most in demand are Sales force, Junior Consultant, Junior Software Tester. In a period in which business data analysis, test automation and complex software development projects are becoming increasingly important as digitalization progresses, it is important for companies to have employees who have good cognitive skills. It has been shown that people on the autism spectrum pay attention to detail and have a systematic approach to work, displaying logical reasoning, pattern recognition, error detection and constant concentration even in the most repetitive tasks. Another company, H-farm, which was set up with the aim of promoting the development of digital projects that make the lives of people and companies easier, has launched an online training method, which enables the participation of autistic students throughout Italy who will become qualified professionals. The company at the Venice lagoon has a campus, a unique place for sharing and collaboration for students, professionals, entrepreneurs, and innovation enthusiasts.

To deal with the hypersensory nature of autistic individuals, it is essential that companies minimize the stimuli in the environment that hosts them. It is important to use warm lights, pastel colors on the walls, few objects on the desks and volume of the computers “off”. Open spaces are not recommended but it is much better to have locations away from lifts and toilets. Otherwise, workers with ASD need regularity and familiarity at the workplace more than their colleagues because they do not like continuous changes. Indeed, although workers with ASD share the same work environment with other people, it is necessary to have the same number of people and always the same faces [32, 35].

It is worth noting that eight of the companies use the Danish company Specialisterne to select their employees, founded in Denmark in 2004, with offices all over the world. The company supplies neurodivergent workers, particularly in the digital, IT and administrative fields, such as software testing, software programming and data management. It also prepares companies for the inclusion of neurodiversity through dissemination and training, and with consultancy projects in Diversity & Inclusion. The only company in our study that works in

the assembly and packaging sector is L'Officina, founded in 2015 in Codogno, in the province of Lodi. The company, with about 15 "special" employees, does not provide internal educators but each person brings his/her own 'support network' to the workshop. In the company the workers greatly appreciate the assemblies, where each worker can explain their opinion, express doubts, and ask questions. Often some concepts explained by employees with ASD have been better understood by everyone, even by those without disorders. Among the companies with neurodivergent workers we also found Chicco Cotto, 90% of whose workers are on the autistic spectrum. The company manages coffee and snack vending machines; the company started with a very small number of workers but currently has about 40 shops throughout Italy. The peculiarity of the company is that the workers begin the training course from elementary school to high school. In this way, the problem of early school leaving of children in difficulty is prevented, and a qualification is recognized for the training path carried out by the children.

Table 1: Overview of the Italian firms investigated.

	Company	Geographic area location	Size	Economic sector
1	Ristorante Gusto P	Northern Italy	Small	Catering
2	Locanda dei Girasoli	Northern Italy	Small	Catering
3	Locanda alla Mano	Northern Italy	Small	Catering
4	21 Grammi	Northern Italy	Small	Catering
5	NTT DATA	Northern and Central Italy	Large	Advice
6	ENI	Northern and Central Italy	Large	Energy
7	L'OREAL	Northern Italy	Large	Cosmetic
8	AVIO COMMERCIALE	Northern Italy	Large	Metalworker
9	CISCO	Northern Italy	Large	Consultancy
10	EVERIS ITALIA	Northern and Central Italy	Large	Consultancy
11	H-FARM	Northern Italy	Large	Consultancy
12	Avanade	Northern Italy	Large	Technologies and Consultancy
13	IBM	Centre Italy	Large	Technologies and Consultancy
14	AVANADE	Centre Italy	Large	Technologies and Consultancy
15	INTESA SAN PAOLO	Northern Italy	Large	Financial
16	INDUSTRY	Northern Italy	Large	Electronics
17	HOTEL	Northern Italy	Medium	Hotel
18	INOCERT	Northern Italy	Large	Service providers
19	AUTICON	Northern Italy	Large	Service providers
20	SAP	Northern Italy	Large	Technologies and Consultancy
21	IL TORTELLANTE	Northern Italy	Small	Catering
22	PIZZAUT	Northern Italy	Small	Catering
23	L'OFFICINA	Northern Italy	Small	Manufacturing
24	CONSORZIO SIR	Northern Italy	Small	Communication
25	CHICCO COTTO	Northern Italy	Small	Distribution
26	FLEX	Northern Italy	Large	Technologies and Consultancy
27	SALES FORCE	Northern Italy	Large	Technologies and Consultancy
28	ARAKNE	Centre Italy	Small	Technologies and Consultancy
29	CARRARA S.P.A.	Northern Italy	Medium	Waste recycling

Our analysis, which gives a short summary of the Italian firms investigated vis-à-vis the two topics, technological innovativeness, and social sustainability, interpreting them through an integrated reading lens, allows us to clarify the degree of innovativeness related to technology of the firms in question through the use and adoption of digital technologies in a social sustainability perspective (see Table 1 for a summary):

1. Most of the firms have their own website and use it primarily to provide some basic services and express their policies and measures to promote inclusion by making their environment physically and virtually accessible and usable. In practice, they set out to transpose and apply the current legislation on the protection of weak categories or guarantees for fragile or challenged categories, especially regarding people with ASD.
2. Those firms with a greater inclination to adopt digital technologies, such as NTT DATA, ENI, L'OREAL, CISCO, and IBM, are mostly concentrated in Northern and Central Italy, and consist of large firms, showing that their size and geographical location also help to be much more innovative in their management and that their position toward developing and adopting technological solutions is correlated to their increasing attention to social inclusion at the workplace for PWD, especially employees with ASD;
3. Most long-established firms stand out in promoting and adopting technological solutions for being much more sustainable by paying attention to vulnerable worker categories.
4. In IT companies that use software with block diagrams, with clear and repetitive procedures, workers with ASD and Asperger syndrome on average yield better results than neurotypicals; the most suitable tasks for them are testing and reporting services, data analysis, platform migration and RPA management.

In summary, the 29 companies selected through the specific criteria defined do not present relevant experiences in developing and adopting digital technologies for making their workplace for employees with ASD or Asperger syndrome much more comfortable and inclusive. There were no major findings concerning the advantage to adopt digital technologies, such as robotics, virtual reality and QR code, to make the work environment much more inclusive for such employees [31, 32, 33, 34, 35]. These limited results show that companies, despite having specific hiring programs for workers with ASD or Asperger syndrome and in general those with disabilities or special needs, do not tend to redesign their work environment by improving it through advanced technological solutions or simple basic technologies for such worker categories, from AI, VR, AR, robotics, and QR codes to applications, accessible intranet, comfortable lighting, and so forth. In the Italian context analysed we find that there are still limitations about initiatives and solutions supported by technology for creating a more inclusive workplace, especially for workers with cognitive disability or social troubles like those with ASD or Asperger syndrome. It is also clear that, in respect of the category of employees in question, firms still focus mostly on hiring programs, partly to comply with legal and regulatory systems, yet do not really promote inclusive work environments by using technological solutions.

5 Concluding remarks

This exploratory study, adopting the double perspective of technological innovativeness and social sustainability, analysed the Italian context by referring to several firms of different sizes and from different economic sectors. Starting from the research aim of this exploratory study, that is to investigate the role, function, and importance of adopting digital technologies for supporting workers with disabilities, especially workers with ASD, the final findings do not enable us to give a useful and significant answer to our research question. Indeed, we observe that the firms in question still show a limited tendency to develop and adopt technological solutions and share them appropriately to make their work environment much more inclusive for people with ASD. There is clearly the need to promote internally at firms, involving all staff, regardless of position, a significant process of organizational change, especially by reducing resistance to technological change in the direction of social sustainability. Indeed, both technological innovation and social sustainability require the

activation of a deep-rooted process within firms in which each organizational position/level and all employees with and without disability need to be involved.

Starting from the limitations of this study and previous studies on the topic [31, 32, 33, 34, 35], especially for its exploratory nature and the scant primary findings, in the future we aim to conduct specific in-depth and semi-structured interviews with human resource managers and diversity and disability managers, as well as sustainability managers of firms. Starting from the current sample, our objective would be to collect specific information and data to identify the technological tools adopted to promote the recruitment and inclusion of workers with disability, especially those with ASD. Indeed, useful information and data can only be obtained through interviews with managers and technical staff and directly with employees with and without ASD within the organizations concerned.

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