

# Bridging gaps: Assistive technology empowering working adults with disabilities for sustainable development

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# Abstract

Worldwide, an estimated 1.3 billion people of the global population experience significant disabilities. The recent UN Flagship Report on Disability and Sustainable Development Goals emphasizes that the entire achievement of the UN Agenda 2030 requires the active involvement of all individuals, including those with disabilities. The current study explored how Assistive Technology (AT) integration in workplaces contributes to achieving SDG 4 for working adults seeking continuous professional development and the challenges and opportunities in implementing AT in workplaces to support SDG 10. Data were collected from two countries (Malaysia and Canada) using semi-structured interviews. Braun and Clarke's six steps were used to analyze data. Based on the responses, two primary and eleven sub-themes were generated. AT plays a crucial role in developing essential skills in the workplace. It is a transformative resource supporting ongoing professional growth for working adults with disabilities. There are many obstacles to successfully adopting and using AT, including organizational, cultural, technical, and financial ones. Developing partnerships among employers, policymakers, and developers of AT is vital for the sustainable use of these resources.

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# **1. Introduction**

Worldwide, an estimated 1.3 billion people, or 16% of the global population, experience significant disabilities, and this number is expected to grow due to the rise in noncommunicable diseases and increased life expectancy [1]. As defined by the 1975 UN Declaration, a disabled person cannot fully participate in life due to physical or mental limitations [2]. According to the Malaysian Persons with Disabilities Act 2008, PWDs are people with long-term impairments that prevent them from participating in society [3]. PWD face numerous challenges, including restricted access to services, limited opportunities for equitable treatment, and various forms of discrimination [4]. These barriers hinder their full participation in society and impede progress toward global development goals. Many adults' access to work will tighten in the coming years, and those most vulnerable could be left behind [5].

The United Nations' Sustainable Development Goals (SDGs) provide a roadmap for addressing global challenges by promoting social inclusion and sustainability. SDGs emphasize inclusion as a fundamental principle, mainly through SDG 4 (Quality Education) and SDG 10 (Reduced Inequalities); these goals highlight the importance of ensuring equitable access to education and employment for marginalized groups, including PWD [6]. The recent UN Flagship Report on Disability and SDGs emphasizes that the full achievement of the UN Agenda 2030 requires the active involvement of all individuals, including those with disabilities. It is widely recognized that SDGs cannot be achieved without prioritizing learning and education, which is the heart of SDG 4. The goal of SDG 4 is to ensure inclusive and equitable quality [7]. Additionally, SDG 10 (Reduced Inequalities) highlights the importance of fostering inclusive environments that support PWD in accessing education and achieving equal opportunities in the workforce.

A specific focus on adult workers is critical in the SDGs, especially SDG 4 and SDG 10. Adults with disabilities face unique challenges compared to younger populations, particularly when it comes to accessing continuous professional development and training opportunities. For many adult workers, learning does not stop after formal education; lifelong learning and skills development are essential to remain competitive in today's dynamic labor markets. In line with SDG 4's commitment to lifelong learning, there is a need to ensure that disabled adults have equal access to professional development opportunities, allowing them to improve their qualifications and adapt to new employment opportunities as industries evolve [4].

Fulfilling these needs calls for the integration of technology. Technology is intertwined with society in a two-way exchange that impacts our lives. The world is presently experiencing a wave of change impacting every aspect of life, with digital technologies and tech-savvy shifts setting the trend [8]. The technological revolution has influenced every aspect of human life, from social to political to economic to cultural. Assistive Technology (AT) is seen as a key enabler of participation for individuals with disabilities. AT provides tools that help bridge the gap between disabled workers and the workplace by offering solutions to mobility, sensory, and communication challenges [9].

It improves access to employment and contributes to the broader SDG agenda by enhancing educational opportunities through adaptive learning platforms, ensuring lifelong learning for individuals with disabilities [7]. For PWD, this is a unique opportunity when AT comes to the fore; it plays a pivotal role in bridging the gap for individuals with disabilities, empowering them to overcome functional limitations, and enhancing their participation in education and employment. AT is an umbrella term encompassing assistive products and related systems and services; it enables people with functional difficulties to navigate daily tasks easily [10].

An example of an AT device is a simple cane used to assist the user in walking [9]. A robotic exoskeleton is a cuttingedge example of advanced technology [11]. It is still challenging to make these technologies accessible, mainly due to low awareness and divergent priorities [12]. At present, more than 2.5 billion people worldwide rely on one or more assistive products to maintain their independence, which is expected to grow to 3.5 billion people by 2050 [13].

In spite of the fact that AT has demonstrated a positive effect on promoting greater autonomy for individuals with disabilities, there are still many barriers limiting its widespread accessibility and effectiveness. According to MacNeil et al. [14] Intelligent Assistive Technologies (IATs) are not universally accessible, practical, usable, or cost-effective; there is no doubt that rehabilitation professionals' expertise can be leveraged to improve access to and the effectiveness of IATs by leveraging their expertise. It is vital for marginalized individuals to access AT, and that inadequate policies, resources, and infrastructure are in place, Austin and Holloway [15]. Boucher [16] presented a comprehensive overview of AT in Europe, stressing how regulatory frameworks are needed and a change in society's attitude towards individuals with disabilities. Furthermore, AT has also been shown to improve the quality of life for people with dementia and reduce the burden of caregivers [17, 18]. The disadvantage of the use of these technologies is that low- and middle-income countries often do not have access to them. Ethics also apply when implementing such technologies, such as privacy intrusions and limitations on freedom [19].

The importance of AT in promoting the SDGs of the UN is also noteworthy. AT is playing a critical role in the promotion of these goals. Even though accessibility and inclusion are not explicitly mentioned in every SDG, there is no doubt that the inclusion and access of working adults to these goals are crucial [20]. AT reduces inequalities, facilitates access to education (SDG 4), and improves health and well-being (SDG 3) in Southeast Asian countries [21]. In order to achieve SDG 3 (Health and wellbeing), AT technology can reduce inequality in several ways, including through innovations such as robotic prosthetics and brain-computer interfaces [22].

Workforce participation and economic development are enhanced when workers with disabilities have access to assistive products (SDG 8). Furthermore, the literature stresses the importance of widespread availability and use of AT if the SDGs are to be achieved equitably [23]. At the same time, AT Passport can be used as a resource to support individuals in accessing the necessary training and equipment [24].

A study by the United Nations Economic and Social Commission for Asia and the Pacific in 2003 and the Department of Social Welfare in 2006 estimated that there are more than 650 million disabled people globally, with about 400 million in the Asia-Pacific region [25]. As disabled people in Malaysia are voluntarily registered, it is hard to estimate their number accurately [26]. According to the Social Welfare Department, 283,000 disabled people were registered by November 2010 [27]. The Khoo et al. [28] study estimates that approximately 8% of Malaysian workers have disabilities. Malaysia has a total population of 637,537 PWDs [29]. Given that PWDs face significant barriers to employment, while the Persons with Disabilities Act (PWD Act 2008) offers a legislative framework to promote disabled individuals' rights, there is a lack of specific policies or incentives to encourage the widespread adoption of AT in the workplace [30-32].

At the same time, although AT offers many benefits, access to these tools remains limited, especially in low- and middleincome countries such as Malaysia [33-35]. Globally, over 2.5 billion people need one or more assistive products, and this is projected to rise to 3.5 billion by 2050, yet only 1 in 10 people can access the AT they require [13]. As a result, a substantial gap exists in the literature regarding implementing AT in Malaysian workplaces, particularly its impact on increasing participation among disabled adults in the workforce. While most existing literature is centered on high-income countries, where AT is more readily available [32, 36]. It has been the goal of the government of Canada to improve employment equity for individuals with disabilities through various policies and legislation [37], and the Canadian government has developed several multi-sectoral strategies for ensuring AT accessibility, including the 2030 Agenda [38]. In Ontario, for instance, employers with disabilities are rewarded with tax deductions when they hire and modify their workplaces to meet their needs [39]. As a result of these initiatives, employers can obtain specialized equipment, as well as offer specialized training, to accommodate the diverse needs of individuals with disabilities [40]. In spite of these facts, access to AT is still hindered by some barriers, such as mainly cost [41]. On the other hand, in low- and middle-income countries, such as Malaysia, there are continued challenges in integrating AT into the workplace due to high costs, limited awareness, and lack of resources [12]. Assistive devices are quite expensive, and in many cases, employers and employees cannot afford them, resulting in a problem in using the devices as a result [4].

The low use of AT can also be attributed to employers not realizing its potential benefits [31, 42]. In addition, AT systems lack trained personnel. This technology cannot be fully utilized without adequate support [43, 44]. The adoption and inclusion of ATs at work must be facilitated through a comprehensive policy framework [27].

A more comprehensive analysis of the challenges and opportunities associated with AT adoption is necessary in light of the gaps mentioned above. In this paper, we examine the role of AT in helping working adults with disabilities achieve SDG 4 and 10 pertaining to workplace accessibility for PWDs in order to achieve the SDGs. Using the Malaysian and Canadian contexts as examples, this paper explores the barriers to the adoption of assistive technologies in the workplace and offers policy interventions that can facilitate greater inclusion of individuals with disabilities in the workplace. Research Questions:

- 1- In what ways can the integration of AT in workplaces contribute to achieving SDG 4 for working adults seeking continuous professional development?
- 2- What are the challenges and opportunities in implementing AT in workplaces to support SDG10 for working adults?

# 2. Research Methodology

# 2.1. Research Design

This study aimed to explore how AT contributes to achieving SDGs for working adults with disabilities through an interpretive research philosophy. Interpretivist philosophy focuses on "subjective perspective" and is "more concerned with in-depth variables and factors related to a context" [45]. Truth and knowledge are subjective, along with cultural and historical context, based on people's experiences [46]. In addition, qualitative research is most suitable when the phenomenon is relatively new and less known (according to the interpretivism philosophy) [47]. Because these phenomena are relatively understudied, and we wanted to get perspectives from individuals in different organizational cultures and contexts, a qualitative research methodology based on interpretive philosophy was selected.

# 2.2. Participants of the Study

Based on research design, we gathered data from professionals working and employing individuals with disabilities, with these PWDs and who knew workplace accommodations and AT policies.

- Representatives from companies/universities
- HR officials
- Head of Departments
- Individuals who have/had experience with PWDS

# 2.3. Sampling Strategy

Snowball sampling may simply be defined as a technique for finding research subjects. One subject gives the researcher the name of another, who in turn provides the name of a third, and so on [48]. Snowball Sampling was used for this research study. The "snowball" sampling is a research technique through survey and data registration which is usually used in sociology, psychology, or management studies and is recommended when the population cannot be strictly delimited or detailed, the characteristics of the sample are rare, a good research method when the study is on behaviors, perceptions, customs, The characteristic of this type of sampling is that it is not used to estimate the characteristics of the general population but to estimate the characteristics of a network of "hidden" populations (rare, difficult to identify). Six participants from Malaysia and eight from Canada participated in the study. Their details are given in Table 1.

Table 1.    Participants Information.					
Pseudonym	Gender	Country	Designation/ Position/Role	Experience (Years)	Involvement in the AT initiative
M1	Male	Malaysia	HR Official	12	Involved in various initiatives to support individuals with disabilities in academic and professional settings for over a decade.
M2	Female	Malaysia	HR Manager	8	Incorporating disability policies into large corporations, identifying needs, providing training, and ensuring an inclusive work environment.
M3	Female	Malaysia	HR Official	11	Providing support and integrating AT into the workplace for employees with disabilities in the healthcare industry.
M4	Female	Malaysia	Leadership roles (operations, strategic planning, and partnerships)	14	AT experience in the tourism industry in terms of making services more inclusive for PWD.
M5	Male	Malaysia	Senior management engineering industry	15	Engaging in large-scale infrastructure projects and implementing AT to improve accessibility for employees with disabilities.
M6	Male	Malaysia	Accessibility Coordinator	10	Lead initiatives to implement accessible software, training programs, and devices like screen readers and speech-to-text systems for individuals with disabilities.
C1	Male	Canada	Researcher	5	Developing algorithms for translating text into sign language, starting with Japanese texts, involving AT and its potential to bridge communication gaps.
C2	Female	Canada	Data Scientist	8	Developing algorithms for translating text into sign language, starting with Japanese texts, involving AT and its potential to bridge communication gaps.
C3	Female	Canada	Psychologist	11	Developed AT for hearing impairments or mobility challenges in a behavioral therapy center to enable them to perform similar tasks to their peers.
C4	Female	Canada	Researcher	5	Work at a large energy company implementing AT for autism spectrum disorders.
C5	Male	Canada	Organizational management roles	10	Worked in the field of AT and its impact on individuals with disabilities, such as people who are visually impaired or who have mobility challenges.
C6	Male	Canada	software engineer	10	Develops software processes, collaborates with teams, and ensures that all colleagues can contribute effectively, regardless of physical or cognitive disabilities.
C7	Male	Canada	Banker	10	Collaboration with colleagues who benefit from such tools using AT and who have observed the way these technologies are incorporated into the workplace systems to support their tasks and to enhance their productivity, while enhancing their work efficiency.
C8	Female	Canada	Health Care Professional	8	Support patients with mobility challenges by providing an advanced motorized wheelchair that assisted in training how to use it more effectively, which significantly improved their ability to navigate the workplace independently.

#### 2.3. Data Collection Tool and Technique

Interviews were conducted semi-structured, allowing more room for exploration [49]. We developed an interview guide to explore participants' perspectives on the research objectives. A total of eleven main interview questions were asked, as well as three background questions. It was sent to three experts with research questions to verify its validity. In addition to WhatsApp, Zoom was used to conduct interviews. We confirmed the interview time and date with the participants and obtained their permission. Following the research protocol, the interviews were recorded. Each interviewee provided informed consent. UNITAR's ethics committee approved the study's ethical protocols (UNITAR/FEH/REC/2024/11/01).

#### 2.4. Data Analysis Technique

Braun and Clarke's [50] 6-phase coding framework guide for thematic analysis was used as the methodological foundation for this study. The 6 phases are:

- 1. Familiarization with data.
- 2. Generation of codes.
- 3. Combining codes into themes.
- 4. Reviewing themes.
- 5. Determine the significance of themes.
- 6. Reporting of findings.

Each interview was reviewed by two authors. By selecting about 20% of the cases from the total sample, it was possible to determine the inter-rater reliability. Based on the independent coding of these cases, we were able to achieve a high contract score of 90%, which is indicative of a strong agreement with an alpha of 0.85 according to [51]. The high level of inter-rater reliability noted above indicates that there was strong consistency and impartiality in the inclusion judgments [52]. Inter-rater reliability is considered one of the significant steps in qualitative data analysis. It reduces bias and improves the trustworthiness of analyzed data.

# **3. Results**

The findings were organized into two key areas: the role of integrating AT in workplaces in advancing SDG 4 by supporting continuous professional development for working adults and the challenges and opportunities associated with implementing AT to support working adults in alignment with SDG 10.

#### 3.1. The Role of AT in Advancing SDG 4: Supporting Continuous Professional Development for Working Adults

The use of AT can be considered a crucial part of the development of essential workplace skills. For working adults with disabilities, it plays a transformative role in providing ongoing professional development. Using AT can help improve productivity and well-being by addressing challenges related to communication, mobility, and accessibility. Additionally, it fosters an inclusive environment consistent with the goals of SDG 4, which advocates for lifelong learning and equitable quality education for all. In this context, the following participant emphasized its significance based on their experience.

*M1:* AT is essential for enabling working adults with disabilities to participate fully in professional environments, ensuring they have equal opportunities for career development, skill acquisition, and meaningful engagement in their roles.

C1: It's AT critical for working adults as it fosters independence, boosts productivity, and ensures equitable participation in professional settings.

# 3.2. Learning Opportunities and Empowerment

Through AT, we can close gaps in access to education and professional development. As AT removes barriers to learning and training, it empowers individuals, promotes their autonomy, and eases their career advancements. As a result, everyone has the chance to succeed and make meaningful contributions at work, which is especially important for fostering inclusive workplaces. According to respondents, AT opens doors for individuals to access educational opportunities, allowing them to succeed in their careers.

M3: "Including software like Job Access with Speech (JAWS) for employees with visual impairments, Dragon NaturallySpeaking for employees with motor disabilities, and captioning tools for individuals with hearing impairments and ergonomic workstations, all these tools have made it possible for employees to participate in learning modules and access information in ways that accommodate their needs."

C3 emphasized that by using closed captioning in webinars, employees with hearing impairments can attend training sessions, creating equitable access to learning opportunities.

# 3.3. Training and Skill Development

Employers can create customized solutions to train and develop their employees with disabilities with the help of AT. As part of the organization's efforts to foster an inclusive environment, it allows employees to participate fully in mandatory and optional training programs. Employers can acquire more relevant skills using tools like mind-mapping software, screen readers, and speech-to-text applications. Technology facilitates learning structured tasks, including understanding complex information, communicating with others, and joining collaborative platforms. In addition to sharing valuable insights based on their experiences, participants pointed out that these tools are extremely valuable.

M1: The use of mind mapping tools, like MindMeister and XMind, screen readers, and speech-to-text software has enabled employees to participate in mandatory and voluntary training sessions in a more accessible and interactive manner, providing employees with greater access to skills development opportunities.

*M4:* As an example of how AT will assist employees with low vision in accessing previously inaccessible training sessions, using a screen magnifier will allow the employee to see what is being presented on the screen.

C6: In my current position, I am working at a company where accessible tools, such as screen magnifiers and closed captioning, are available to ensure that employees with disabilities can attend online meetings to be able to take part actively in training programs and to upskill effectively during training sessions.

#### 3.4. Skill Acquisition and Development

AT facilitates the development of skills and training for individuals with disabilities. As a result, employees can take part in mandatory and optional training programs without being affected by the fact that they can't fully participate. Various tools can support employees' understanding and interaction with their training materials, improving their skills and adaptability to a changing work environment. For example, these technologies make deciphering complex information easier, participating in collaborative platforms, and completing structured learning activities efficient. The importance of these tools was highlighted by participants who shared valuable insights drawn from their experiences.

M3: One success story involves an employee with dyslexia ... After providing them with a text-to-speech tool, their ability to manage work tasks improved significantly, resulting in increased productivity and confidence.

C6: Digital training platforms with features like adjustable font sizes or keyboard navigation enable individuals to learn at their own pace, accommodating different needs.

*M* 2: "Online learning platforms with text-to-speech features or mobile apps that facilitate skill development allow employees to learn at their own pace, in their own space, and in a way that works best for them. This is especially important for employees with disabilities, as they may require more time or different learning methods to keep up with new technologies or industry trends".

# 3.5. Inclusivity and Accessibility

A supportive and equitable work environment requires accessibility and inclusivity. To meet the needs of diverse employees and ensure that no employee is left behind, assistive technology (AT) is crucial. The use of voice-controlled devices, screen readers, and adaptive learning platforms can enhance productivity for individuals with disabilities. Moreover, AT promotes inclusive cultures by removing barriers to communication and participation, enabling employees to work more effectively. Diversity fosters innovation and enhances perspectives when an organization emphasizes inclusivity. All employees can succeed when AT is incorporated into daily workflows, individualized support is provided, and accessibility awareness is raised. A key role played by AT in promoting accessibility and inclusivity was emphasized by respondents.

M5: "AT has certainly played a significant role in fostering a more inclusive learning environment. A key example of how AT has enabled an employee to participate in training programs is the case of an engineer with severe mobility issues. They could attend an online training course on structural engineering software thanks to Dragon NaturallySpeaking, which allowed them to control their computer and interact with training modules. Without this tool, participation would have been impossible in our internal training programs, we use Microsoft Teams with live captioning enabled, which benefits employees with hearing impairments. This ensures they can participate in training webinars alongside their colleagues, rather than being left behind".

C2: Using our tool, a university provided deaf students with lecture materials in sign language. As a result, they could participate in advanced courses and earn professional certifications at a higher level.

C7: "As a part of my work, I've observed the bank's commitment to providing training materials and resources that are accessible to everyone. To assist employees with visual, mobility, and learning disabilities, we've introduced programmers, screen readers, and ergonomic equipment. Using these tools, employees can access learning platforms and training materials to support their professional development."

#### 3.6. Supportive Measures and Customization

Supportive measures are important for ensuring that AT is used effectively in the workplace. The AT acceptance and use program includes awareness campaigns, training sessions, and technical support systems. Put another way, it is not enough for an organization to just have AT tools. The ecosystem should also enable long-term success and the use of AT. Support teams, follow-up consultations, and training modules tailored to each individual's role are some of these resources. These steps can bridge the gap between availability and effective usage and ensure users feel confident and competent. Respondents emphasized the importance of supportive measures:

M2: "To ensure that everyone, regardless of ability, has the tools to succeed, we regularly review and update our accessibility policies. A significant portion of our work also involves advocating for inclusion in the workplace, raising awareness about the significance of this not just for legal compliance, but as a core value that benefits both employees and the organization."

C3: "Hands-on workshops often accompany this type of training, the provision of individual coaching, and peer support. As a result of the diverse population of Vancouver, many workplaces provide multilingual training as part of their diversity initiatives."

C8: In order to ensure that the technology meets employees' needs and enhances their work experience, we conduct regular feedback surveys, monitor performance improvement, and conduct usability tests. In addition, our workplace offers adjustable-height desks and supportive seating options, which make working adults with disabilities more comfortable and efficient.

AT tools can be modified to meet individual needs, preferences, and difficulties through "customization." By matching employee duties and talents, AT solutions maximize usability and efficiency. A customized instrument allows employees to ensure maximum functionality, which improves their comfort and productivity at work by ensuring maximum functionality and enhancing their productivity. A major component of employee empowerment is giving them more control over their educational and career development experiences.

Customization also enhances worker empowerment by providing more control over their technology. A seamless integration into everyday life is possible with adaptive interfaces, mobility aids, and sensory aids. Organizers can demonstrate their commitment to meeting the diverse needs of their employees by focusing on customization. Based on anonymous participant experiences, here are some insights:

*M1:* "We also use platforms that offer customized learning experiences such as captioned webinars, screen readers, and voice-to-text transcription tools to support professional development programs and lifelong learning. These tools allow our employees to engage with training materials effectively, regardless of their disabilities.

M3: "One notable example is the use of screen magnification and text-to-speech software for an employee with a visual impairment, allowing them to complete an online certification program that would have otherwise been inaccessible to them."

# 3.7. Challenges and Opportunities in Workplace AT: Promoting SDG 10 through Accessibility, Usability, and Equity The study's second research question considers workplace challenges and opportunities.

#### 3.8. Inclusivity and Accessibility

The importance of AT in fostering inclusivity and accessibility for all in the workplace cannot be overstated. Taking steps to eliminate workplace barriers that restrict PWDs' full participation is the first step toward inclusion. Using AT, we can bridge the gap between mobility, communication, and information. Additionally, AT seeks to reduce inequalities and promote economic inclusion. The participants described their thinking evolution as follows:

*M1:* "In order to ensure that all employees have access to learning environments, AT is crucial. It facilitates communication, allows individuals with disabilities to participate in educational opportunities equally with their peers, and removes barriers to information access. Employees with disabilities benefit from AT, as it supports them in contributing to discussions, completing assignments, and participating in professional development."

#### 3.9. Awareness, Support, and Feedback

AT can be more effective in the workplace by increasing awareness, providing support, and providing feedback to those who use it. While AT can potentially reduce workplace inequalities, many organizations don't know its benefits. Due to a lack of awareness, AT is often overlooked as a means of fostering inclusivity.

There is a need for targeted campaigns and training so that employers can use AT more effectively in the workplace. In addition, for AT to be implemented successfully, companies and employees require comprehensive training programs and easy access to documentation. Supporting employees with disabilities both technically and emotionally can boost their confidence. As a result of such feedback loops, users share their experiences and challenges with ATs, allowing future technology to become more practical and useful. Participants emphasized the value of awareness, support, and feedback by sharing insightful observations from their experiences.

M3: "We are committed to continuously exploring new assistive technologies and best practices to support our employees with disabilities further. Similarly, we are also actively involved in promoting awareness of the benefits of AT in the workplace, ensuring that all employees have access to the tools they require to reach their professional goals in an inclusive work environment."

*C1:* The University provides workshops and training sessions through dedicated accessibility offices. These programs help both students and staff familiarize themselves with available technologies.

*M1:* "Effectiveness and usability are assessed through employee feedback, surveys, and one-on-one interviews. We also monitor assistive tool usage rates and performance indicators such as training completion rates and employee engagement in professional development programs; conduct usability tests to ensure that the technology is intuitive and user-friendly and evaluate the need for adjustments or adding new tools periodically".

M5: "Users provide valuable feedback on ATs regarding day-to-day use and productivity impact. In addition, we use these tools to track whether employees can meet their targets with these tools, focusing on metrics such as task completion time and error rates to monitor their progress."

#### 3.10. Collaboration and Solution Development

AT can only be effective and sustainable if collaboration and solutions are created. The process involves bringing together stakeholders, including businesses, workers, legislators, AT developers, and advocates. Collaboratively identifying workplace issues can lead to customized solutions. Collaboration ensures AT is accessible, contextually relevant, flexible, and accountable.

Solution development involves identifying and eliminating obstacles to the uptake of AT in work settings. Legislation, tax rebates, other financial incentives, and inclusive organizational structures are common tactics. Training in AT usage can promote an inclusive workplace culture, aside from addressing prejudices and misunderstandings. When organizations combine collaboration with workable solutions to enable employees with disabilities to flourish in their positions, they can ensure that AT tools are created and successfully incorporated into workplace procedures. The following is an account of the participants' experiences in this regard.

M2: One-size-fits-all solutions don't always work, and customization of AT for different disabilities can be timeconsuming and expensive.

C7: Our bank provides training and support to employees through IT support teams, Accessibility specialists, Partnerships with external organizations

#### 3.11. Solutions for Accessibility and Integration

Ultimately, the author believes a diversified strategy is needed to succeed with AT integration and accessibility. For AT to integrate seamlessly into everyday activities, organizational and technical obstacles must be addressed. Training programs, strong technical support, and user-friendly designs are crucial in giving staff members the skills and confidence to use AT efficiently. An organization's policies must also include clear instructions for maintaining and using AT.

It is important to match certain workplace duties and procedures with AT technologies to maximize the use of these technologies. Consequently, it is crucial to meet employees' specific needs while ensuring that the technology is scalable across the organization. It is important to include digital solutions such as communication platforms and adaptable software in implementing accessibility for workers with disabilities.

*M5*: Voice-controlled devices have significantly improved the ability of our team members with mobility impairments to participate in meetings and complete tasks efficiently.

*C1:* One success story involves a student with a mobility impairment who, using adaptive software and accessible course materials, completed their degree and entered the workforce with enhanced skills.

# 3.12. Barriers and Challenges

In order to successfully adopt and use AT, several obstacles must be overcome, including organizational, cultural, technical, and financial issues. Prices remain a major barrier since many businesses, especially in low- and middle-income countries, cannot set aside adequate funds to purchase, install, and maintain AT solutions. Employees with disabilities lack financial incentives and support systems. AT integration is also complicated. There are often compatibility issues, as well as the need for extensive customization, which causes deployments to be delayed and expenses to increase. Inefficient technical support can lead to a decline in confidence in the capabilities of organizations. In addition to this, there is a lack of knowledge about the issue that further aggravates the situation.

Despite its revolutionary impact on workplace inclusion, AT offers many potential benefits to employers. Because of this, these technologies are underutilized, and people are skeptical of investing in them. In addition, without adequate training, employees may be unable to use AT effectively, thus resulting in less-than-ideal results. Among the other obstacles are cultural shame and opposition to change. Discriminatory attitudes toward PWD can prevent employees from using AT to its full potential. Additionally, resistance to adopting new technology limits AT's potential to increase workplace equity and productivity, whether out of ignorance or fear.

*M4:* "The cost of acquiring AT is a significant barrier for many organizations. Subsidies or financial incentives could alleviate this issue.

*C4: One area of difficulty involves identifying the most suitable tools to address the diverse needs of individuals.* 

M1: AT can be expensive for small or medium-sized organizations. While many affordable options are available, highend tools can still present a financial barrier.

C7 mentioned some of the main challenges in their organization, including identifying the specific needs of employees with disabilities, acquiring and maintaining appropriate AT, providing adequate training and support to employees, ensuring compatibility with existing IT infrastructure.

M2: Ensuring that assistive technologies are compatible with existing workplace systems and software can be difficult, especially when IT infrastructure is constantly updated.

### 4. Discussion

#### 4.1. The Transformative Potential of AT

AT is an effective means of empowering working adults with disabilities through its enhancement of their agency, autonomy, and productivity. With the help of tools like screen readers, voice-controlled devices, and text-to-speech applications, individuals can overcome functional limitations, enhancing their independence and allowing them to participate actively in professional settings [12]. By addressing barriers in communication, mobility, and access to resources, AT enables companies to grow inclusively and increase productivity.

Further, AT supports lifelong learning, contributing directly to SDG4. A wide variety of accessibility solutions and adaptive learning platforms are available through AT. By taking advantage of these opportunities, individuals with disabilities can improve their qualifications and remain competitive in the job market [7]. Thus, enhancing professional development strategies with AT is important for advancing global development initiatives

# 4.2. Bridging Gaps: Accessibility and Equity

In the essence of SDG10, governments are expected to work towards the most marginalized and those left behind the most [22]. By tackling workplace disparities, AT directly contributes to SDG 10's objective of minimizing inequality. Access to AT allows individuals with disabilities to gain full participation in the workforce by dismantling obstacles related to mobility, communication, and efficiency in task performance [53]. To close these gaps, it is necessary to implement effective and practical strategies, such as government subsidies or funding opportunities, open-source solutions or scalable technologies, and targeted awareness campaigns. In the same vein, [54] highlighted the important role of low-cost and open-

source solutions in embedding accessibility for disabled people and likewise [55] emphasized the importance of promoting accessible environments through cooperative efforts. Additionally, the formation of partnerships between employers, policymakers, and AT developers could not be underestimated in maintaining the effectiveness of initiatives.

Implementing AT can be a considerable setback for small and medium enterprises (SME) because of the high costs involved. Financial incentives and partnerships with NGOs or government grants can alleviate this problem. According to Halvorsrud et al. [56] beyond cost, other barriers hinder the implementation and development of AI, and these barriers are intricate. [54]. Advocate targeted measures to overcome these barriers, such as financial incentives, awareness campaigns, and robust training programs. Gonzalez et al. [4] illustrate that high costs often restrict access to AT tools. In addition to these barriers, incorporating new technologies into different organizations is challenging due to technical obstacles like software compatibility, network and hardware configuration. In light of these challenges, Manship et al. [44] illustrated that awareness campaigns can foster a culture of inclusion. Collaborative training programs can help employees learn how to use AT effectively in their workflows. For these initiatives to succeed, continuous and strategic support for AT is required to ensure accessibility and impact in various workplace contexts [57].

The integration of ATs has accelerated in Malaysia and Canada, providing more opportunities for PWD to be included and productive. Adopting AT is challenging for Malaysian employers and employees due to high costs, limited infrastructure, and low awareness. Additionally, to address these challenges, several initiatives have been implemented by the government, such as financial support programs and community-driven campaigns to raise awareness [58]. Increasing institutional resources and support for AT implementation in Canadian workplaces is also crucial. Through the Accessible Canada Act and other government programs, fostering inclusive work environments is a major focus [59]. The high cost of advanced AT devices is also challenging [60]. To fully realize AT's potential, targeted efforts must be made to overcome context-specific barriers.

The adoption and integration of AT in the workplace must be coordinated by key stakeholders. PWD success depends on employers' inclusive workplace practices. Investment in AT and customized training programs will be necessary for employees to take full advantage of these technologies. In studies by Gonzalez et al. [4] and Marinaci et al. [31], workplace accommodation enhances employee productivity. This research shows that inclusive practices empower individuals and improve organizational efficiency.

In addition to these workplace-level practices, policymakers must play a key role in facilitating AT adoption. Providing subsidies and tax breaks to low- and middle-income countries can significantly lower financial barriers. When the public and private sectors collaborate, AT tools can be made more accessible and usable. A study by Manship et al. [44] shows that supportive regulations can spread AT adoption.

Moreover, knowledge-sharing platforms and international cooperation can accelerate progress in regions with limited resources. Particularly in countries with limited resources. Researchers play an important role in addressing empirical gaps. In order to assess the benefits of AT adoption, comprehensive research is necessary. Marinaci et al. [31] emphasize the importance of region-specific studies for policymaking, identifying best practices and scaling solutions that promote workplace inclusivity requires empirical evidence.

AT contributes to the SDGs beyond workplace inclusion. AT enhances the productivity and involvement of PWD by promoting economic growth SDG 8, education SDG 4, health SDG 3, and reducing inequality SDG 10. The SDGs are fast approaching, but many nations still haven't met the targets set by the UN [56]. The lack of funding, political commitment, and awareness have hindered progress [61]. As Tebbutt et al. [23] pointed out, AT adoption must be equitable to achieve sustainability, inclusion, and scalable solutions. In order for AT to fulfill its potential in furthering global development objectives, it is imperative to strengthen frameworks for SDG implementation and encourage multi-stakeholder collaboration.

# 5. Conclusion

This study explored how integrating AT in workplaces contributes to achieving SDG 4 for working adults seeking continuous professional development and the challenges and opportunities in implementing AT in workplaces to support SDG 10. The respondents who were well engaged in the implementation of AT pointed out many positive influences, e.g., AT is an effective means of empowering working adults with disabilities through its enhancement of their agency, autonomy, and productivity by addressing barriers in communication, mobility, and access to resources. AT enables companies to grow inclusively and increase productivity. By tackling workplace disparities, AT directly contributes to SDG 10's objective of minimizing inequality. Access to AT allows individuals with disabilities to gain full participation in the workforce by dismantling obstacles related to mobility, communication, and efficiency in task performance. To create inclusive workplaces that empower individuals and drive socioeconomic development in the future, governments, businesses, and communities must make a sustained commitment to innovation and research.

# 6. Recommendations

Four key areas must be emphasized: SMEs should be encouraged to adopt AT through tax incentives, subsidies, and awareness campaigns highlighting their benefits. Employers, policymakers, and AT developers can collaborate to increase employee empowerment. International cooperation is essential for overcoming barriers for low-income countries, including those related to the SDGs. Policy and practice must be informed by ongoing research to identify the challenges specific to each region.

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