

Chapter 2

Role of Technology in Addressing Challenges Faced by People with Disabilities

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Chapter 2

Role of Technology in Addressing Challenges Faced by People with Disabilities

1. Technology-Enabled Working Environments

There are 472 million people with disabilities of working age in the Asia-Pacific region; as mentioned, they are two to six times less likely to be employed than their peers without a disability (UNESCAP, 2020). Additionally, people with disabilities are more likely to work in the informal or 'gig' economy, which is often associated with a lack of social protection and rights. The International Labour Organisation (ILO) estimated that in Indonesia, for example, 49.27% of the population without a disability works in the informal economy compared to 64.93% and 75.8% of working people with mild or severe disabilities, respectively (ILO, 2017).

Barriers to work for people with disabilities are myriad – poor self-confidence, lack of previous work experience, non-inclusive interview processes, and inaccessible working environments or transport. Attitudes and prejudices also play a part, with incorrect assumptions made as to the abilities and skills of people with disabilities, as do costs associated with providing reasonable accommodations in the workplace.

Exclusion from the labour market comes at significant cost to the self-esteem and sense of worth of people with disabilities, as well as an economic cost. In 2009, ILO calculated the economic cost of excluding people with disabilities from the labour market for 10 countries in Africa and Asia. In Viet Nam, the price of this exclusion was estimated at 3.0% of 2006 gross domestic product (GDP) and 4.6% of GDP in Thailand (Buckup, 2009).

Box 2. Breaking Down Barriers: Job-Matching Platforms

Kerjabilitas. Kerjabilitas is an Indonesian job platform matching people with disabilities and employers. It provides career support, a fully accessible digital platform, as well as consulting services to improve inclusion within businesses.

CareER, Hong Kong. Walter Tsui, who is visually impaired, is the co-founder and chief executive officer of CareER, a non-profit based in Hong Kong. He founded the non-profit after experiencing first-hand the lack of employment opportunities for highly educated graduates with disabilities. CareER is the first non-profit job-matching platform and peer support community for highly educated people with disabilities and special educational needs. It also engages with and trains corporations and is focussed on changing society's attitude towards people with disabilities and special educational needs.

Sources: Kerjabilitas, <https://kerjabilitas.com> (accessed 4 July 2022); and W. Tsui (2022), interview, 23 May.

The COVID-19 pandemic has had a significant impact on employment in the Asia-Pacific. ILO estimated a loss of 81 million jobs in the region in 2020 (ILO, 2020). Workers in the informal economy felt the brunt of the downturn, as lockdown measures came into force, although informal employment recovery overtook formal employment recovery in Q4 2021 (ILO, 2022). There are no regional data on the impact of the crisis on the employment of people with disabilities, although there is some evidence from other countries that the impact on this demographic may have been greater than on the employment of people without disabilities (Emerson et al., 2021).

The pandemic has brought about a major change in the world of work, with digital technology accelerating the transition to widespread remote and hybrid working environments. Remote, flexible working has long been a wish of people with disabilities, and this development is – on the whole – positive for inclusion, shifting mind-sets globally amongst employers and employees alike. It has served to normalise digital working, removing stigma and judgement that may have been associated with adaptive working in the past. Remote working can also break down accessibility barriers for people with mobility issues, and key digital meeting tools like Zoom, Google Meet, and Microsoft Teams have made strides in becoming more accessible through closed captioning and live transcripts. Working remotely can also facilitate flexible working hours that are better adapted to some disabilities.

There are mounting concerns that these gains for inclusive working will be lost, however, as certain high-profile businesses call their employees back into the office (Ballentine and McNeely, 2022). The Netherlands, on the other hand, is set to be the first country in the world to protect employees' right to work from home (Papachristou, 2022). Moreover, although this cultural shift has helped improve the accessibility of traditional working environments – and has the potential to open up a broader range of working opportunities for people with disabilities – disability rights advocates highlight that there are risks associated with making remote working a solution for accessibility. Firstly, at home, people with disabilities risk working in isolated silos, cut off from human interaction in the workplace. Secondly, offering remote working for the workforce with disabilities could potentially let employers off the hook when it comes to integrating specific accommodations and ensuring that physical working environments are accessible and inclusive.

Employment equity and non-discrimination laws in numerous ASEAN Member States require employers to put in place reasonable accommodations⁹ for people with disabilities, with sanctions for non-enforcement. Nevertheless, 'there are frequent calls for more rigorous implementation and enforcement of employment equity and non-discrimination laws, and for amendments to these laws to allow persons with disabilities to pursue cases of discrimination more easily' (UNESCAP, 2020). Reasonable accommodations promote a truly inclusive working environment; without them, it can be difficult for people with disabilities to succeed in the workplace, as they are not operating on a level playing field. In addition, assistive technology, as well as emerging technologies, has a key role in transforming

⁹ Reasonable accommodations are defined by the CRPD as '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' (UN, 2016).

workplaces from an inclusion standpoint. Gartner, a technological research and consulting firm, predicted that by 2023, the number of people with disabilities who are employed will triple due to AI and emerging technologies that reduce barriers to access (Panetta, 2019).

Indeed, AI-powered tools, if designed well, can help address hiring biases, breaking down prejudices and judgements often faced by people with disabilities in the hiring process (Accenture, 2021). This is a crucial point, as concerns around AI recruitment tools to date have highlighted their potential to exacerbate exclusion (Wall and Schellmann, 2021). Assistive technologies, though, can provide people with disabilities with the tools to thrive in the workplace, such as speech-to-text technology, speech recognition software, screen readers, or apps that block distracting websites specifically for neurodivergent individuals who find concentration a challenge. There are examples of work sharing between robots and people with disabilities as well. Bosch created APAS assistant, a mobile automation device that, in a factory setting, assists with repetitive tasks, allowing a worker with a disability to instead focus on quality control (Kentsch, 2016).

Box 3. Inclusive Office Spaces: Steps and IKEA

Steps, a social enterprise based in Thailand, is working with IKEA to create a blueprint for an inclusive office using IKEA products. The aim is to dispel the myth that workplace accommodations are expensive while demonstrating that they can benefit everyone and be aesthetically pleasing. The project will include an accommodations station with a mix of physical and assistive technology resources that can be trialed in a workspace.

Steps is also working with the Sasin School of Management at Chulalongkorn University to create a digital library that tracks the accommodations consulted, how long they were used for, how a person felt using them, as well their resulting independence. Providing employees with the opportunity to try workplace accommodations empowers them to better understand for themselves and for employers that these result in increased productivity. For neurodivergent employees, this is a step towards more workplace independence and less reliance on job coaches, who are often a barrier for employers (Sundar, 2017).

Source: M. Simpson (2022), Discussion on Social Enterprises in Thailand. [email] (Personal Communication, 26 July 2022).

Box 4. Robotics

After a series of pilot pop-up cafés, Japanese robotics company Ory Laboratories launched its first permanent robot café in Tokyo. Customers are served food and drink by robots. These are avatars, controlled by people with disabilities working remotely, some of whom have significant physical disabilities; the robots can be controlled by eye-tracking software. The workers controlling the robots see the customers through the robots' cameras and can engage the customers in conversation using the robots' microphones and speakers.

Source: Dawn Avatar Robot Café, <https://dawn2021.orylab.com/en/> (accessed 12 July 2022).

Box 5. Mixed Reality Technology to Train People with Disabilities

Ability Works is a social enterprise in Victoria, Australia providing meaningful work to people with disabilities and other marginalised groups. It is currently running a trial programme using Microsoft's HoloLens glasses as a training aid for workers using machines to weld and to cut metal. Neurodivergent individuals often require repetitive training, and the glasses allow the individual to repeat the training as often as needed, using video game technology to facilitate this (Coggan, 2021).

Sources: Abilityworks, <https://www.abilityworks.com.au/> (accessed 27 June 2022); and Microsoft, Microsoft HoloLens 2, <https://www.microsoft.com/en-us/hololens> (accessed 27 June 2022).

There are insufficient data available to analyse whether these technological trends are positively impacting the employment of people with disabilities on a large scale. Valuable 500, a global business collective of 500 chief executive officers and companies committed to disability inclusion and system change, recently surveyed its members, finding that the COVID-19 pandemic had halted or stalled gains in employment and cultural improvements. Although 85% are working to remove top barriers to employment, year on year, they posited that there has been no difference in resolving these barriers for the recruitment of candidates (Valuable 500, 2022).

Technology is providing ready tools for employment inclusion – yet businesses still need to recognise that people with disabilities are a key, untapped, and overlooked source of talent, rather than a quota to fulfil or a box to tick in a generic diversity and inclusion policy.

2. Digital Jobs

Studies have shown that diverse and inclusive businesses outperform their peers in revenue by 28% (Accenture, 2018). Some large technology companies are recognising the talents, valuable skill sets, and different perspectives that people with disabilities can offer. As Accenture pointed out, 'Having employees with disabilities across departments helps ensure

that the products and services that go to market are truly inclusive’ (Accenture, 2018). SAP’s Autism at Work programme is renowned globally for embracing neurodiversity with its focus on hiring people with autism-spectrum disorders. The nature of neurodivergent individuals can be associated with a keen attention to detail; some people with autism-spectrum disorders may have natural aptitudes for careers in ICT in areas such as testing software, programming, and data entry.

With the growing digital economy, opportunities for people with disabilities to work are increasing. For instance, in ‘crowdwork’, workers complete microtasks – also known as human intelligence tasks (HITs) – in return for income. These self-employment opportunities in the digital gig economy – while affording little social protection, guaranteed income, or access to traditional financial services – have the advantage of being flexible in nature, home-based, without specific educational or professional prerequisites, and easier to access than traditional employment opportunities. This type of work remains more accessible to people with disabilities, but individuals do require basic digital literacy. There can also be accessibility issues with user interfaces, allocated time to complete tasks, as well as unclear instructions (Uzor, Jacques, Dudley, Kristensson, 2021).

Box 6. Artificial Intelligence

The Vulcan Coalition’s two co-founders, an artificial intelligence (AI) expert and a disability expert, established the startup in 2020 as a way to bridge the gap between two key needs. In Thailand, of the 852,033 people with disabilities of working age, only 36.87% are in employment, and the AI industry in Thailand needs data labellers – also known as data trainers – who manually curate data to train AI machine learning. Supported by neuroscience research into the neuroplasticity of people with disabilities and their enhanced cognitive abilities – for example, a visually impaired person can process audio inputs twice as quickly as someone with full vision – the Vulcan Coalition identified a perfect match between people with disabilities and careers in data labelling.

Through its Vulcan Academy, people with disabilities (and others) are offered inclusive training and upskilling to gain the necessary digital literacy to be able to work as a data labeller. The Vulcan Coalition then offers people with disabilities work as data labellers, who in turn drive the data sets required to create AI models that can then be commercialised as products and services to clients. Employees receive a monthly salary, which is paid for by Vulcan Coalition’s quota partners. Section 33 of the Persons with Disabilities Quality of Life Promotion Act BE 2550 (2007) in Thailand requires private and public businesses to hire 1 person with a disability for every 100 employees. Should businesses decide not to hire internally, they can pay into the government disability fund or hire social subcontractor services – in this case, offered by Vulcan Coalition. These businesses are referred to as quota partners.

The Vulcan Coalition further incentivises the data labellers by allowing them to share in the revenue from the intellectual property associated with the data that they are

generating. To date, it has almost 600 data labellers – known as ‘Vulcan Heroes’. Currently, 60 quota partners work for them, with increased growth in their sights. The Vulcan Coalition’s ultimate goal, however, is to show businesses what people with disabilities can do, to change perspectives, and to encourage companies to hire people with disabilities directly, creating truly inclusive employment.

Source: T. Jiraphakorn (2022), interview, 22 June.

Box 7. More Careers in Technology

Enablecode is a social enterprise in Viet Nam focussed on launching people with disabilities into careers in technology. Convinced of the creative problem-solving abilities of people with disabilities, the social enterprise wants to change the way people with disabilities are viewed as well as to improve their livelihoods through employment opportunities. Enablecode initially focussed on providing web and mobile app development and digital-marketing services to clients globally, carried out by coders with disabilities. It then realised that it could increase its impact by encouraging large-scale change, specifically by working on the bottlenecks standing in the way of people with disabilities in accessing employment through the gig tech economy, specifically for human intelligence tasks (HITs).

HITs are composed of single, self-contained virtual tasks that a worker submits an answer to and is rewarded for completing. HITs do not require educational qualifications, only a certain level of literacy and common sense. Workers have the flexibility to work from home and on their own time, which can suit people with certain disabilities. Enablecode is now working with Amazon’s Mechanical Turk, the largest HIT platform, to identify what training works to develop the cognitive skills needed to perform HITs. It tracks the training completed and measures impact on productivity and earnings. This feeds into Amazon’s artificial intelligence to adapt training targeted at workers with disabilities or from other disadvantaged groups. This training and upskilling allows workers to complete work at higher levels and therefore earn more.

Source: C. Blackwell (2022), interview, 16 May.

A World Bank consortium, Solutions for Youth Employment, noted that digital work is not just composed of careers in the ICT industry. It also comprises digital jobs across all sectors that can be categorised by their reliance on technology – from ICT-intensive jobs to ICT-dependent jobs and ICT-enhanced jobs – with a need for varying degrees of digital skills (Solutions for Youth Employment, 2021). Thus, the need for digital skills in the world of work is clearly only set to grow, and people with disabilities need to be equipped with the skills to succeed.

Digital literacy, however, remains a key barrier to digital jobs. Vocational training, adapted to the evolving labour market, can equip people with disabilities with the necessary digital skills to access these job opportunities. Indeed, Solutions for Youth Employment stated that demand-led training and upskilling programs with appropriate accommodations are critical

for youth with disabilities to enter the digital jobs market, as well as socioemotional skills training (Solutions for Youth Employment, 2021).

The demand-led approach encouraged Steps, a social enterprise in Thailand specialising in vocational training for neurodivergent young people, to create the Steps Business Centre. It recognised a need amongst businesses to outsource back-office work, such as digitisation of documents and data entry.¹⁰ Steps thus provides on-the-job ICT training specifically for youth with disabilities.

Business process-outsourcing services is also the focus of Digital Divide Data, a global social enterprise that was founded in Cambodia in 2001 to bring technology skills and living wage work to underserved communities in Asia. It recruits, trains, and helps improve the earning potential of its employees, 10% of whom are youth with disabilities.¹¹ Its services evolve to keep pace of changes in the industry, ranging from 3D digital archiving to handwriting transcription to Amazon Web Services cloud solutions.

Box 8. Preparing People with Disabilities for Work in the Digital Economy

Philippines-based social enterprise Virtualahan was founded in 2015 by Ryan Gervasa, who lives with a disability. Virtualahan equips people with disabilities, as well as other socially excluded groups, with the skills needed to be competitive online professionals and/or entrepreneurs. Its programme includes digital skills training, employment support, apprenticeships, as well as job and life coaching. The employment success rate of its graduates currently stands at 60% (78% before the pandemic).

Source: Virtualahan, <https://virtualahan.com/> (accessed 4 July 2022).

3. Striving for Disability-Inclusive Education

In opening remarks at the 2020 Nelson Mandela Lecture, António Guterres, United Nations Secretary-General, highlighted the opportunity post-pandemic to build back a more equal and sustainable world, noting that ‘education and digital technology must be two great enablers and equalizers’ (Guterres, 2020). With the increased adoption of digital solutions, educational technology (EdTech)¹² can improve access to education and support learning outcomes for children with disabilities.

Currently, children with disabilities are more likely to be out of school and have significantly worse educational attainment outcomes, lower literacy rates, and lower school completion rates than their peers without disabilities – all of which significantly impact their future

¹⁰ M. Simpson (2022), interview, 17 May

¹¹ Digital Divide Data, <https://www.digitaldividedata.com/about> (accessed 4 July 2022).

¹² The World Bank defines EdTech as ‘the use of hardware, software, digital content, data, and information systems in education [that] supports and enriches teaching and learning and improves education management and delivery’ (World Bank, 2022).

prospects. Moreover, girls with disabilities are disproportionately impacted, making up the majority of children out of school with disabilities (Leonard Cheshire, 2021). This disparity is common across many parts of the world, although concrete data are lacking in the ASEAN region. In Cambodia, 1 in 2 children with disabilities are not in school, compared to 1 in 14 children without disabilities (UNESCO, 2018). In Viet Nam, only 20% of children with disabilities completes primary school compared to 92% without disabilities; this gap continues through secondary and tertiary education.¹³

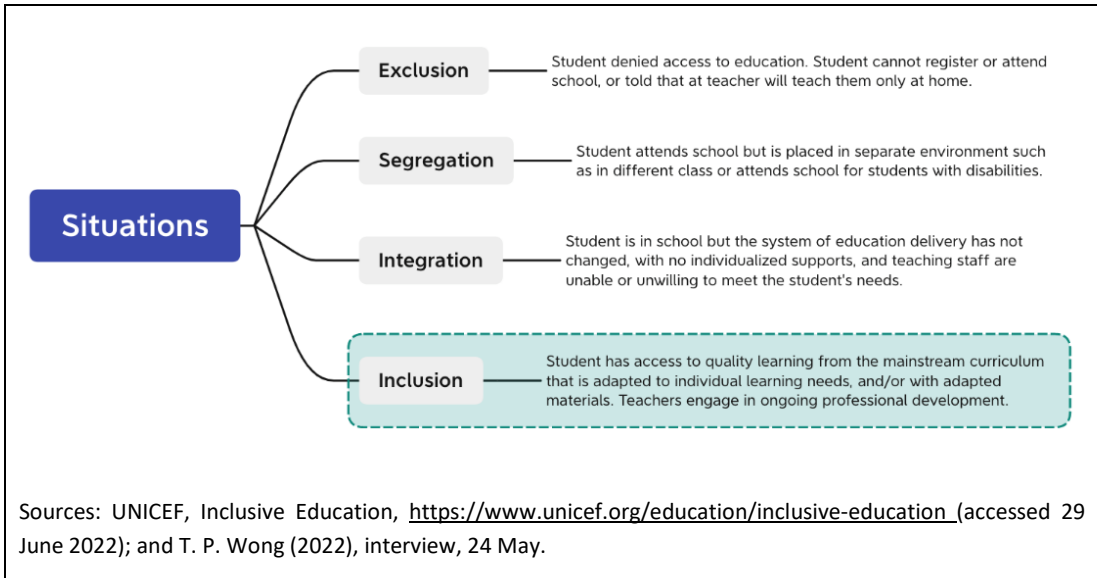
The barriers that children with disabilities face are twofold. Firstly, access to education can often be hampered by specific physical or social barriers – such as lack of accessible transport or social attitudes. Secondly, when in school, the quality of learning can be an issue, particularly in ensuring that the learning is fully adapted to their needs. Many teaching staff lack necessary training or support; children with disabilities and their families may also require extra support, particularly for learning at home. Indeed, it is evident that much progress is required to achieve Sustainable Development Goal 4 of ensuring that all children complete free, equitable, and quality education.

Box 9. Inclusive Education

The United Nations Children’s Fund (UNICEF) defines inclusive education as ‘all children in the same classrooms, in the same schools . . . [comprising] real learning opportunities for groups who have traditionally been excluded [that] value the unique contributions [that] students of all backgrounds bring to the classroom and allow diverse groups to grow side by side, to the benefit of all.’

The illustration below (Singh, 2022) outlines the different situations that learners with disabilities may face in education. According to Tze Peng Wong, associate professor, University of Nottingham, Malaysia, while inclusion is a key priority in Association of Southeast Asian Nations (ASEAN) Member States, the integration model is still the norm. Singapore is an example of a best practice, as more than 80% of children with special education needs learn in an inclusive classroom setting within mainstream schools (Singh, 2022).

¹³ The Disability Data Portal, <https://www.disabilitydataportal.com/> (accessed 12 June 2022).



The COVID-19 pandemic caused widespread disruption to education across the world. As already illustrated, issues with educational provision to people with disabilities existed before the pandemic; there is further evidence to suggest that the COVID-19 crisis has had a particularly disproportionate impact on children with disabilities, exacerbating inequalities in education provision. The pandemic saw school closures worldwide and widespread adoption of remote learning strategies that were both high- and low-tech in nature. Online platforms were used in 91% of countries, with television, radio, and paper-based take-home packages also employed (UNESCO, UNICEF, World Bank, OECD, 2021). The effectiveness of these remote learning strategies has yet to be fully analysed, especially in low- to middle-income countries; yet ultimately reaching learners – especially those most vulnerable – remained an issue (UNESCO, UNICEF, World Bank, OECD, 2021). The pre-existing digital divide was also clear, highlighting inequalities of access to digital connectivity, particularly in low- and middle-income countries and rural areas. UNESCO highlighted this crucial challenge for the most vulnerable students: ‘50% of learners (826 million students) around the world do not have a household computer, 43% (706 million) do not have internet access at home, and 56 million were unable to use mobile phones to access information due to limited coverage by mobile networks’ (UNESCO Institute for Statistics, 2020).

In the ASEAN region, internet access at home varies, with high rates of the population having access to the internet at home in Malaysia (91.7%), Singapore (98.4%), Thailand (84.2%), Indonesia (78.2%), and Viet Nam (76.4%). Much lower rates are evident in countries such as Cambodia (21.3%), the Philippines (17.7%), and the Lao People’s Democratic Republic (1.7%).¹⁴

During the pandemic, students with disabilities faced additional barriers such as lack of additional support for learning, lack of access to assistive devices or materials, as well as the

¹⁴ Statista, Share of Population with Internet Access at Home in the Asia-Pacific Region in 2020, by Country or Territory, <https://www.statista.com/statistics/1293198/apac-population-with-internet-access-at-home-by-country/> (accessed 21 June 2022).

requirement to learn independently (UNESCO Bangkok, 2020). A small-scale study in Malaysia challenged the accessibility of online teaching during this period, highlighting the need for new models for inclusive support as well as impact on teachers' well-being (Jothinathan, Lim, Wong, 2022).

There is concern about a widening learning gap for children with disabilities as a result of the educational disruption during the pandemic – as well as the long-term impact. There is, however, some anecdotal evidence that the switch to remote learning may have positively impacted some learners with mobility issues for whom access to physical schools or traditional learning programmes is more difficult (Inclusive Education Initiative, 2021).

Much can be learned from recent experiences during the pandemic. Policymakers should examine how to design distance learning in a more disability-inclusive way in the event of future need, how to bridge the widening gap for students with disabilities, as well as how to address the digital divide for people with disabilities and upskilling teachers in ICT and inclusive education.

Indeed, technology's real potential is to facilitate inclusive education. The World Bank noted that EdTech is not a panacea in itself and that 'much more attention must be directed on how technology will enhance teaching and learning in a blended learning environment reaching students, both in school and at home.'¹⁵ Six global key challenges, impacting access to and use of ICT in inclusive education have been identified:

- (i) **People.** Supporting children with disabilities to access and to make the most of EdTech is complicated by teachers, parents/guardians, and other educational support figures lacking sufficient expertise in ICT and inclusive education.
- (ii) **Products.** Affordability is an issue, as most EdTech devices and software are too expensive for schools or families. Further, products are not always truly inclusive of children with complex needs, appropriate to the context, or aligned with national curricula.
- (iii) **Pedagogy.** There is a lack of understanding of pedagogical approaches and assessment practices to assess educational needs and effectiveness. No mechanisms are in place to monitor progress and to ensure adaptations, including technology that is positively impacting learning.
- (iv) **Policy.** Inclusive education and ICT policies are often separate or poorly integrated, creating difficulties in coordinating actions across government bodies or between different actors.
- (v) **Place.** Accessing the necessary equipment that students with disabilities need is a struggle for inclusive and mainstream schools, and teachers often lack inclusive-education training.
- (vi) **Provision.** Funding for ICT-inclusive education initiatives is often project-based and fails to focus on all necessary components for successful implementation, such as adequate technological infrastructure, training, and maintenance for correct use of

¹⁵ World Bank, Digital Technologies in Education, <https://www.worldbank.org/en/topic/edutech> (accessed 10 July 2022).

devices. This impacts the sustainability of projects. Procurement is also vital (Inclusive Education Initiative, 2021).

On a basic level, essential assistive technology can open up the world of learning for children with disabilities, addressing their isolation, facilitating accessibility, and providing a level playing field on which to pursue their education. While research is limited, there is some evidence of the positive impact of assistance technology on educational outcomes (Bell and Foiret, 2020). Use of innovative technology to further enhance learning may have potential – such as robots for children with an autism-spectrum disorder (DiPietro, Kelemen, Liang, Sik-Lanyi, 2019) – but the costs are often prohibitive. Smart phones, however, can prove cost-effective, as highlighted by the example of deaf or hard-of-hearing children in Pakistan using SMS and social media to access lesson information and communicate with their peers (Zahra et al., 2018). EdTech Hub, a global research partnership focussed on providing evidence on technology in education, posited that investing in apps for phones has additional benefits for learners with disabilities when the investment is sustainable. It stated that the same technology can be used to support daily living activities at home and to increase opportunities for independent living (Lynch, Singhal, Francis, 2021).

Nevertheless, the lack of evidence of what technology solutions work for improving learning outcomes is a key issue for policymakers, highlighted by EdTech Hub, whose review of EdTech for learners in lower- and middle-income countries shows that ‘there is little understanding of how, when, and what type of technology should be introduced into the learning process to respond to the needs of children with disabilities’ (Lynch, Singhal, Francis, 2021). Existing research in ASEAN is promising for the potential of technology to positively impact learning, but it is based on small cohorts, such as lip-reading computer-assisted instruction tested on deaf learners in Thailand (Nittaya, Wetchasit, Silanon, 2018), a lip-reading app in Indonesia to help the hard-of-hearing learn Bahasa (Muljono et al. (2019), or a software programme to teach Malaysian sign language to pre-schoolers.

Teacher training is consistently cited as crucial. A recent report on inclusive education in ASEAN emphasised the need to increase teacher training on inclusion and supporting children with disabilities (Singh, 2022). In addition to teachers not having the right tools to ensure inclusive classrooms, they need to be supported their own digital literacy, how to actively use technology to enhance learning as well as how to support learners on the use of assistive technologies. EdTech Hub noted that there is evidence of the significant lack of training available to teachers to incorporate technology in professional development programmes (Lynch, Singhal, Francis, 2021). Until teachers are confident and empowered when it comes to technology, its potential to facilitate more inclusive learning for students with disabilities will be hampered.

Box 10. Equipping Teachers with 21st Century Skills

Founded in Singapore in 2019, Akadasia is a mission-driven education technology business focussed on upskilling and empowering teachers. Its key markets are the Philippines, Indonesia, India, and Viet Nam. Its platform is available in 5 different languages; it is currently supporting more than 200,000 teachers in 35 different countries. The founder, Neelesh Bhatia, originally planned to build a learning management platform for the Asian market but pivoted during the COVID-19 pandemic as teachers struggled with the skills needed for teaching in the 21st century.

The platform is focussed on three main services for teachers:

- (i) **collabED.** A LinkedIn-type community for teachers where they can share ideas, network, and collaborate with other teachers.
- (ii) **skilledED.** Contains a wide range of professional development content and training for teachers.
- (iii) **designED.** An opportunity for teachers to apply what they have learned to the classroom, with feedback on their lesson plans.

Recognising that many teachers do not have the financial means to pay for the platform and educational institutions do not often have the budgets – or, on occasion, the will – to dedicate financial resources to teacher training, Akadasia developed a fourth service. **certifiED** allows educational institutions to design and to generate their own diploma or certificates and to issue these on the blockchain. Schools pay for this service via a 3-year membership, and their teachers can utilise the other three services for free.

Akadasia has yet to develop any dedicated content to help teachers support students with disabilities or teachers with disabilities themselves, but it sees this as a potential area for development. It is currently exploring an Amazon Web Services tool, which converts text to speech.

Source: N. Bhatia (2022), interview, 30 June.

Affordability and infrastructure issues mean that EdTech is the preserve of more affluent consumers – private schools and wealthy and middle-class families. Many schools in the region do not have the budget for EdTech solutions; they often only use learning management systems, like Google Classroom. Moreover, many of the EdTech solutions available in the region focus on 21st century skills or language skills. While 22 out of 108 suppliers of EdTech solutions indicated that their solutions are inclusive, this pertains to accessibility for disadvantaged users generally rather than to universal solutions to include or to target people with disabilities (Better Purpose, 2020).

The challenges facing the use of technology or ICT to facilitate inclusive education are clear. While technology cannot necessarily solve some structural barriers children with disabilities face in accessing quality education, it may be able to support learning and to cater to

learners' specific needs when in the classroom. Its potential as a leveller and enabler for students with disabilities needs to be further explored.

4. Tech for Good

Assistive technology can transform the lives of people living with disabilities. Assistive products range from low-tech, such as glasses, wheelchairs, and hearing aids, to high-tech eye-tracking software enabling web navigation. This assistive technology helps people with disabilities live, learn, and work more functionally and independently. Such technology has the possibility of changing people's interactions with the world around them, whether through Smart Cities integrating inclusive design or technology reducing the exclusion of people with disabilities.

Inequality of access to assistive technology remains a major issue. The World Health Organization estimated that only 1 in 10 people have access to assistive products/technology and that 2 billion people will need at least one assistive product by 2030 (WHO, 2018). Affordability is a key factor, alongside a wide range of other barriers including awareness, inadequate products, workforce capacity gaps, procurement and delivery challenges, lack of funding, and stigma (WHO and UNICEF, 2022). While low-tech assistive products are often the most needed in countries across the world, technological innovations have improved accessibility and continue to hold promise in further expanding accessibility and inclusion. Lack of investment remains an issue, such as investment in developing affordable assistive technology for people in low-income countries or venture capital for inclusive tech start-ups (Lockwood, 2021).

Box 11. Venture Capital for Assistive Technology

Based in Hong Kong, the Disability Impact Fund was created to enable access at scale to assistive technology for people in Sub-Saharan Africa, India, and South-East Asia. The founders identified a gap in the market for affordable, accessible assistive technology in low- and middle-income countries. Thus, they invest in mission-driven businesses delivering new technologies and innovations in assistive technology – they focus both on product development and distribution models. To date, the fund has invested in development of a hearing aid that costs \$1 and is specifically developed for low-income countries as well as prosthetics that cut out elaborate provisioning and distribution.

Source: R. Belcher (2022), interview, 26 May.

Box 12. Non-Visual Desktop Access

For many with visual impairments, screen-reading software is key to accessibility. However, in the past, the cost was often prohibitive, limiting access to everyday online activities as well as inclusion and opportunities. To address this issue, two fully blind men, Michael Curran and James Teh, developed a free, open-source screen reader and founded a non-profit, NV Access, to help develop it. Its open-source nature allows developers and translators to contribute to its continual development and improvement. To date, it has been translated into more than 55 languages and is used in over 175 countries, winning a number of awards.

Source: NV Access, <https://www.nvaccess.org> (accessed 26 June 2022).

Box 13. Cambodia Academy of Digital Technology, Institute of Digital Research and Innovation

A first of its kind in Cambodia, the Institute of Digital Research and Innovation is focussed on promoting digital development and the digital economy. It has a team dedicated to natural language processing, a branch of artificial intelligence that works to give computers the ability to understand text and the spoken word like humans (IBM Cloud Education, 2020). The team is working on addressing the gaps in natural language processing for Khmer. To date, they have worked on voice-to-voice translation from Khmer into 31 languages via the application VoiceTra, real-time spontaneous speech recognition, machine translation, and a Khmer text-to-speech system.

While this research and development are not specifically focussed on disability, the benefits play into the idea of universal design. The institute currently has a visiting professor from Myanmar who is working on the translation of Cambodian sign language and braille into text and/or speech. His work in Myanmar includes building a corpus of Myanmar Sign Language (MSL) videos for machine learning, signwriting (i.e. a system for writing sign language created by dancer Valerie Sutton in 1974), annotation for MSL, and machine translation between MSL and Burmese as well as Myanmar braille and Burmese.

Source: IDRI team (2022), interview, 1 June.

When considering how technology can be an enabler for people with disabilities, universal design is fundamental. The principle behind universal design is that environments, building, products, and services should be designed to meet the needs of everyone, regardless of their

sex, age, or abilities and without adaptation.¹⁶ Functionalities available through mobile phones, such as speech-to-text technology, can benefit a wide range of people; this inclusive experience should be integral to design. Professor Catherine Holloway, academic director, Global Disability Innovation Hub, stated, 'The distinction between assistive and mainstream technology is eroding, with accessible products such as Microsoft's Seeing AI app, which helps blind and partially sighted people identify text and objects, or Amazon's audiobook platform Audible becoming mainstream' (Lago, 2021). Ensuring that people with disabilities are involved in the design process is crucial; otherwise, there is risk of creating disability-related products that are described by one disability advocate as a 'disability dongle: a well-intended elegant, yet useless, solution to a problem we never knew we had' (Smith, 2019).

Universal design in the built environment is recognised as indispensable to guarantee accessibility and usability for all. Inclusive environments and infrastructure, such as transport, can facilitate access to education, employment, health care, and culture and improve the quality of life and equality of access for all. Furthermore, the positive economic impact of accessible tourism is a key consideration, and this demand is likely to continue as the population with accessibility needs increases.¹⁷ The European Union runs a yearly Access City Award celebrating a city's efforts to become more accessible, and technology often forms a cornerstone to this accessibility.

Indeed, technology-enabled and data-driven cities, referred to as Smart Cities, are high on agendas worldwide. ASEAN established the ASEAN Smart Cities Network in 2018 to adopt an inclusive approach to Smart City development, although no reference to disability is made.¹⁸ There is a risk that smart urban development can increase barriers to access for people with disabilities if inclusion is not accounted for – particularly the risk of a marked digital divide between connected citizens and the digitally illiterate and marginalised (Kolotouchkina, Barroso, Sánchez, 2022).

Nevertheless, as inclusive cities are still not a reality in many places, technology can help fill the gap. The app TuneMap in Indonesia, for example, is a citizen-powered mobile application that helps visually impaired people navigate Bandung by giving them up-to-date information about accessibility challenges and allowing visually impaired people to request help when needed. It also organises 'Map My Day' events to raise awareness about disability and city accessibility.¹⁹

¹⁶ NDA, What Is Universal Design, <https://universaldesign.ie/what-is-universal-design/> (accessed 14 July 2022).

¹⁷ A found that accessible tourism represented the equivalent of about 3% of total GDP of the EU27 in 2012 (GFK, University of Surrey, Neuman Consulting, Pro A Solutions, 2007).

¹⁸ ASEAN, ASEAN Smart Cities Network, <https://asean.org/our-communities/asean-smart-cities-network/> (accessed 19 July 2022).

¹⁹ Tunemap, <https://tunemap.org> (accessed 1 August 2022).

Box 14. Smart Cities

An initiative from Singapore’s Land Transport Authority, Green Man+ comprises inclusive pedestrian crossings designed to give people with disabilities and older persons more time to cross the road. Using their senior citizen or disability concession cards, users can tap a reader above the standard push button to extend the crossing time.

Source: Government of Singapore, Land Transport Authority, Green Man +, https://www.lta.gov.sg/content/ltagov/en/getting_around/driving_in_singapore/intelligent_transport_systems/green_man.html (accessed 29 June 2022).

Box 15. Inclusive Design

Founded by Ken Chua, (these)abilities is a design and technology company that aims to ‘disable disabilities’ by working with corporations, governments, and nongovernmental organisations to design and to build high- and low-tech inclusive products, services, and environments. (these)abilities worked with Grab, the ride-hailing company, to make their app and experience more accessible to deaf and visually impaired users. It has also designed a lower-cost, made-in-Asia, customisable keyguard for users with cerebral palsy, muscular dystrophy, or Parkinson’s disease, facilitating their use of computers by avoiding upper-limb strain and striking unwanted keys due to tremors or involuntary movements.

Source: K. Chua (2022), interview, 19 May.

Technology also has a role to play in rendering other key services more inclusive, such as financial services. Bain and Company estimated in 2019 that more than 70% of the South-East Asian adult population is either underbanked or unbanked, with digital financial services a key driver to overcoming financial inclusion challenges (Bain and Company, 2019). While specific data on the rate of financial exclusion of people with disabilities in ASEAN are not available, it is evident that people with disabilities experience physical and virtual accessibility issues. Crowd-sourced data, mostly from developed countries, indicated that 28% of banks and 12% of ATMs are not accessible by people in wheelchairs (UNDESA, 2018).

Beyond arguments for equity and inclusion, people with disabilities represent an underserved and untapped market for financial services. The International Finance Corporation set out the business rationale:

An estimated 1.85 billion persons with disabilities have a combined USD 1.9 trillion in annual disposable income...constitut[ing] the largest “minority” segment of the world’s consumer population and an emerging market larger than China. Banks with more disability-inclusive product and service offerings are also more likely to attract customers from the friends and families of persons

with disabilities, who represent 3.4 billion potential consumers and hold a further USD 11 trillion in annual disposable income worldwide (IFC, 2022).

Financial services in the region are far behind in terms of accessibility compared to those in European or North American markets. Kasikornbank in Thailand stands out as having developed a mobile application to facilitate online financial transactions for visually impaired and older people without the need to look at their smartphone screens (Chatterjee, 2022). Nevertheless, examples of inclusive fintech innovations remain rare in the region.

It is clear that perceptions of people with disabilities urgently need to evolve. Inclusion is not just about ensuring basic human rights – an inclusive economy and society with inclusive products and services can be beneficial to all. Deafness was the inspiration behind some major technological evolutions – notably the telephone, SMS texting, and the internet (Sound Advice, 2010). How much more innovation can be achieved by applying universal design and tapping into the innovative, creative nature of people with disabilities?