Mobile technology and inclusion of persons with disabilities

Stephen Thompson
Institute of Development Studies
May 2018

About this report

The K4D Emerging Issues report series highlights research and emerging evidence to policy-makers to help inform policies that are more resilient to the future. K4D staff researchers work with thematic experts and DFID to identify where new or emerging research can inform and influence policy.

This report is based on twelve days of desk-based research.

K4D services are provided by a consortium of leading organisations working in international development, led by the Institute of Development Studies (IDS), with Education Development Trust, Itad, University of Leeds Nuffield Centre for International Health and Development, Liverpool School of Tropical Medicine (LSTM), University of Birmingham International Development Department (IDD) and the University of Manchester Humanitarian and Conflict Response Institute (HCRI).

For any enquiries, please contact helpdesk@k4d.info.

Acknowledgements

Thanks to Tony Roberts who provided advice and guidance on the development of this report and served as an external expert reviewer.

Thanks also to the following experts who voluntarily provided suggestions for relevant literature or other advice to the author to support the preparation of this report. The content of the report does not necessarily reflect the opinions of any of the experts consulted.

- Philippe Bellordre, GSMA
- Jenny Casswell, GSMA
- Sarah Hall, Ashland University
- Hannah Kuper LSHTM
- Islay Mactaggart, LSHTM
- Brigitte Rohwerder, IDS
- Tim Unwin, Royal Holloway
- Mary Wickenden, UCL/IDS

Suggested citation

Thompson S. 2018. *Mobile technology and inclusion of persons with disabilities*. K4D Emerging Issues Report. Brighton, UK: Institute of Development Studies.

Copyright

Contents

1. Introduction

This K4D Emerging Issues report highlights research and emerging evidence that show how mobile-enabled services can help increase inclusion of persons with disabilities. The aim is to provide DFID policy-makers with the information required to inform policies that are more resilient to the future. This report provides a synthesis of the current evidence on how mobile technology and mobile-enabled services can help increase inclusion of persons with disabilities. It was originally planned that this report would also explore how mobile enabled technology might exacerbate existing inequalities. Some evidence was found to focus on the barriers to ICT that marginalised groups encounter, however, no evidence was found to focus on how mobile technology might exacerbate inequalities. As such, the report focuses on the positive impact that mobile technology has been shown to have in increasing the inclusion of persons with disabilities. Research outcomes detailing the potential for mobile enabled technology to exacerbate existing inequalities is recognised from the outset as a major evidence gap requiring further investigation. This report focuses specifically on evidence produced by academic research from low and middle income countries. It also includes information from theoretical or conceptual research, policy papers, institutional literature and where necessary press releases and blogs. Further details of the methodology used for this report can be found in Annex 1. The quality of the body of evidence was high but the size of the body of evidence was low. The geographical and contextual focus of the evidence was found to be varied. The consistency of the body of evidence was not be established, as the papers assessed were based on a variety of different designs or methods and applied in a range of contexts. Further discussion of the strength of the evidence base can be found in Annex 2.

2. Disability and inclusion

It is estimated that over a billion people (or 15% of the global population) have a disability (WHO & World Bank 2011). No single description is adequate to define disability. Factors including the definition of disability, the quality and methods of data collection, rigour of sources and varying disclosure rates influence the prevalence of disability (Thompson 2017). The UN Convention on the Rights of Persons with Disabilities (UNCRPD) was adopted in 2006 and recognises that disability is an evolving concept, and includes those who have long-term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others. Under the UNCRPD's general principals, it is recognised that persons with disability should have full and effective participation and inclusion in society.[1] The Sustainable Development Goals were adopted in 2015 aim to end poverty, protect the planet and ensure prosperity for all as part of a new sustainable development agenda. People with disabilities are referenced under five of the seventeen goals, in relation to education, growth and employment, reducing inequality, safe and inclusive human settlements, and data collection and monitoring.[2] Broad reoccurring themes of the post-2015 agenda include disability inclusion and pledges to leave no one behind.[3]

[1] https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities.html

[2] http://www.un.org/sustainabledevelopment/sustainable-development-goals/

[3] http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E

Disability inclusion leads to realising various benefits including increased earnings and labour productivity, increased tax revenues, improved individual and family well-being, as well as wider societal benefits through a more inclusive and accessible society for all (Rohwerder 2015). In 2015, The UK's Department for International Development's (DFID) Disability Framework set out their vision of a world where no one is left behind, ensuring their work contributes towards a world where everyone, throughout all stages of their lives, have equal opportunities to realise their rights, achieve their potential and live in dignity, free from extreme poverty, exclusion, stigma, discrimination and violence. The framework highlights DFID's commitment to a world where people with disabilities have a voice, choice and control over the decisions that affect them and where persons with disability can participate in and benefit equitably from everyday life, everywhere.[4]

A meta-analysis of the use of social inclusion in qualitative disability studies reported six common themes to frame inclusion of persons with disabilities: being accepted, having relationships, being involved in activities, living accommodations, employment, and support systems (Hall 2009). Social inclusion should aim to facilitate, enrich and enhance capacity at the group and individual level for opportunity, reciprocity and participation (Peace 2001). Social inclusion, social cohesion, social integration and social participation are often used interchangeably (Rimmerman 2013).

3. Technology introduction

This introductory chapter provides an overview of the information and communications technology landscape and its potential for impact on international development. It introduces mobile enabled technology and describes its potential in reducing inequality for persons with disabilities. It provides some key evidence on the global mobile economy, as well as some regional data. A brief introduction to mHealth is provided. The final section of this chapter considers the barriers that marginalised people (including those with disabilities) may face while trying to access to technology.

Information and communications technology

Information and communications technology (ICT) is a term that refers to mainstream technologies such as mobile and fixed-wire telephones, computers, tablets, radio, television and the Internet (Barlott, Adams & Cook 2016). ICTs represent the fastest, broadest and deepest technical change experienced in international development, affecting every sector. The pace of change is continuously accelerating (Heeks 2018). ICT and digital technologies have the potential to help marginalised groups, such as persons with disabilities overcome barriers to communication, interaction, and access to information. Utilising technology to empower persons with disabilities is not a new concept. Assistive and adaptive technologies have been used in the past to promote independence and participation. However, increasingly, as ICT (including mobile devices) develops, new functionalities that facilitate communication and information access for persons with disabilities are emerging. In the past technology for persons with disabilities was expensive and required either specialised standalone software or hardware. Technological advances have reduced the cost and the availability of ICT for persons with disability. For example, features such as text-to-speech and voice recognition, ability to change contrast and

[4] https://www.gov.uk/government/publications/dfid-disability-framework-2015

colour schemes, touch and gesture input, and screen magnification are now readily available. ICT has the potential to enable persons with disabilities to realise independent living, employment, education, and access to government services. The internet and ICT can facilitate the social, economic, and civic participation of persons with disabilities. Multiple ICT formats, channels and services allow persons with different disabilities to access information and communication in the manner in which they can comprehend and prefer. Technological advances have increased the ability to use everyday consumer ICT devices as assistive devices. This, along with the growing role in the delivery of services, is making ICT a key driver of inclusive development. Accessible functionality in mainstream ICT is driving down costs and encouraging innovative uses of ICT for inclusion. For ICT to enable inclusion for persons with disability, efforts must focus on raising the awareness of various stakeholders and building capacity for service provision and barrier free digital environments (Samant Raja 2016).

To assist the wider involvement and fulfilment of people with disabilities in low income societies through the use of ICTs, companies developing new ICTs are encouraged to place accessibility at the heart of their work. Identifying appropriate funding for such initiatives will be essential (Bonnah Nkansah and Unwin 2010). Accessibility in the production, transmission, and rendering ICT technology can be achieved via a mixture of top-down (impose direct obligations on supply side) as well as bottom-up (rights for users/consumers) approaches to promote accessibility in of ICT products and services. Governments can foster ICT innovation and local manufacturing via public-private partnerships. This type of approach would ensure the creation and delivery of ICT accessibility tools and content are both locally and culturally relevant (Samant Raja 2016). Table 1 below, adapted from Samant Raja (2016), details the barriers to inclusion and how ICT has the potential to help:

Table 1: Major barriers to inclusion and how ICT can help

Major barrier to inclusion	How ICT can help
When traditional written or verbal communications are the only forms of communication available, they can be completely inaccessible to persons depending on type of disability.	Individuals can use the form of communication that works for them - voice, text, video - to understand and contribute information in face to face or remote interactions.
Specialized, standalone, assistive technology used to increase, maintain, or improve the functional capabilities of individuals with disabilities can be cost prohibitive for persons with disabilities without external financial supports or subsidies.	How ICT can help: Accessible functionalities in mainstream, off-the-shelf, ICT are rapidly reducing the cost barriers to technology solutions for persons with disabilities, while becoming attractive features for all users irrespective of disability.
Many persons with disabilities will need more than one type of assistive technology solution to enhance their independent living and socioeconomic participation.	The growing number of apps and web-enabled services make it possible to bundle and access multiple assistive features within a single or limited number of devices thus increasing affordability, efficiency, and portability.

For ICT to make a serious contribution to improving the lives of the most marginalised people (including people with disabilities), they must be involved in the conceptualisation, design and implementation of ICT programmes from the start (Unwin 2017). Technological solutions to global health challenges require innovative and participatory approaches to ensure people living in low-income and middle income countries are included in shaping the global health agenda. At present, major donors set the priorities, with little input from stakeholders from low and middle income countries. These hierarchies can be further entrenched if technology is used indiscriminately without considering context. The development of new technologies must be informed by an understanding local context. Effectiveness of technological innovations can increase if local needs and resources are considered during the design phase. An example of this concept in operation is Peek Vision, which uses smartphone technology and incentive-based financing to increase access to eye care in Botswana, India, and Kenya. Peek Vision are facilitating teachers to use locally adapted smartphone apps to screen and identify school children with visual impairment (Mannell et al 2018).

Credit: Peek Vision - @peekteam

As technology has developed, so has the potential for it to benefit health and health systems. Technological advances combined with medical expertise has led to mobile devices to increasingly be used in all healthcare areas including diagnostics, telemedicine, research, reference libraries and interventions. This sector is often called ‘mHealth’. A literature review written by Bastawrous and Armstrong (2013) reported that while smartphones are the main mHealth tool used in high-income countries, basic text-messaging systems of standard mobile phones are useful in low- and middle-income countries. While the availability of mobile phone based applications for healthcare workers and healthcare consumers is well established, the evidence base in terms of what works is weak and requires further research.

The explosive global growth in the availability of mobile phones is increasing opportunities for large scale data collection. In the mobile enabled era, costs of data collection have come down

and data exchange have improved.[5] A lack of data on persons with disabilities and their experiences contributes to the invisibility of persons with disabilities within in official statistics, reducing their inclusion in planning and policy.[6] There is a need to improve the collection, analysis and use of accurate data on disability to inform all development efforts (UN 2014). Mobile technology may present opportunities to achieve this. For example, Aptivate developed a tool which allows visually impaired field workers to collect data using mobile phones. The field workers record how many people there are with disabilities in a particular area and the support they currently have. This data is presented on a web-based reporting dashboard that allows local and overseas program managers to analyse the data, and thus better serve the needs of the community and empower community members.[7] Another example is the Global Trachoma Mapping Project (GTMP), which was the largest infectious disease survey ever undertaken. It was led by Sightsavers and involved the collect and transmit data on 2.6 million people in 29 countries using smartphones.[8] In 2014 a UN Expert Group on Disability Data and Statistics called for further exploration of the potential of collecting data using new technologies, such as data on the Web or using mobile phones. New technologies may facilitate disability-disaggregation within routine data collection (UN 2014).

As mHealth technology develops, so does the potential to improve data collection, education and lead to behaviour change. This may indirectly lead to increased inclusion of persons with disabilities. As such, mHealth is not the main focus of this report but relevant evidence from the mHealth literature is included where relevant.

Mobile economy

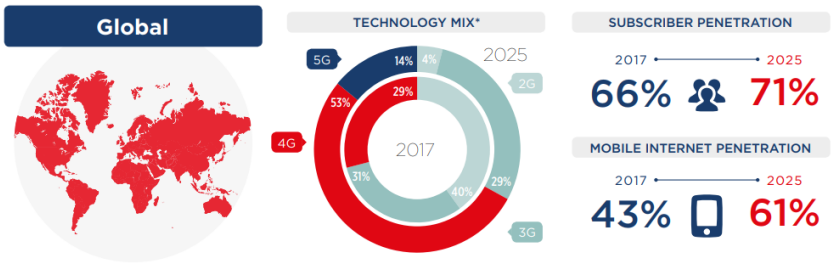
A major and important component of the ICT industry is mobile technology. By 2017 over 5 billion people globally were connected to mobile services. It is expected that the number of unique mobile subscribers will reach 5.9 billion by 2025, equivalent to 71% of the world's population. Growth is being driven by developing countries, particularly India, China, Pakistan, Indonesia and Bangladesh. The regions of Sub-Saharan Africa and Latin America are also experiencing high growth. However, globally, the speed of growth is slowing as high income countries reach saturation. Mobile internet offers a significant growth opportunity and could add 1.75 billion new users over the next eight years, with 5 billion mobile internet users predicted by 2025. It is predicted that mobile internet adoption will become the key metric by which to measure the reach and value created by the mobile industry, including its contribution to the UN's Sustainable Development Goals (SDGs). It also contributes to developments in the wider digital ecosystem, as mobile internet users are the addressable market for e-commerce, fintech and a range of digitally delivered services and content (GSMA 2018).

[5] http://blogs.worldbank.org/edutech/using-mobile-phones-data-collection-opportunities-issues-and-challenges

[6] https://www.un.org/development/desa/disabilities/resources/monitoring-and-evaluation-of-inclusive-development.html

[7] http://aptivate.org/en/work/projects/cbm-mobility-india-mobile-data-collection/

[8] https://www.sightsavers.org/programmes/mhealth/



Credit: GSMA

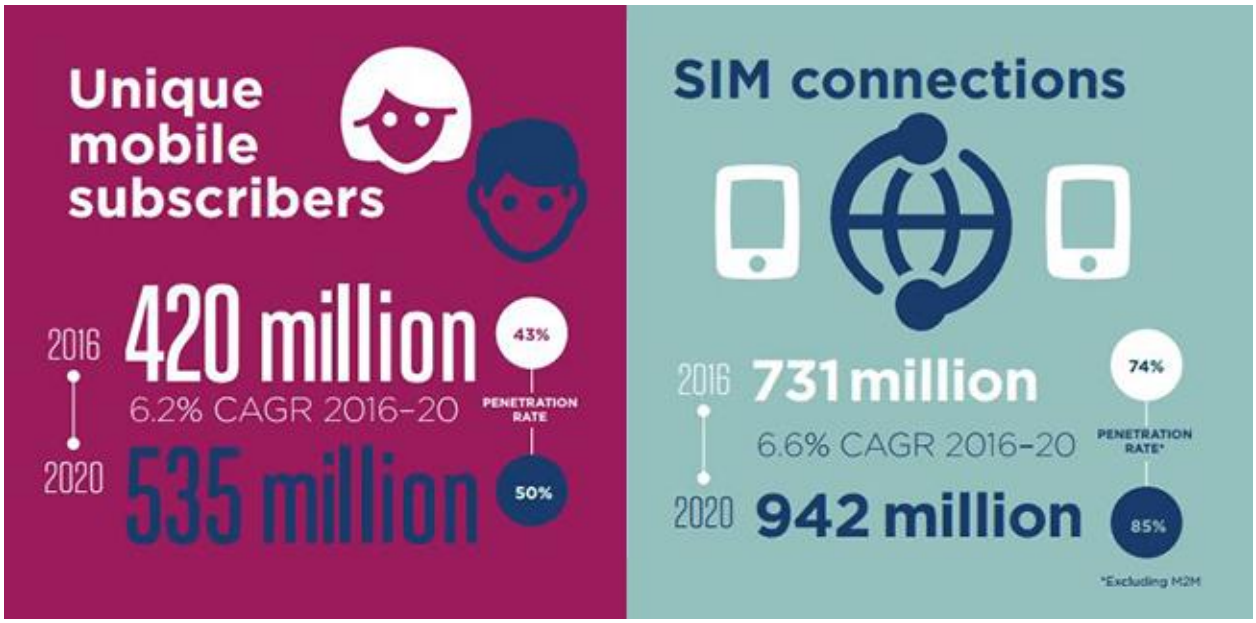
Some of the key features of the global mobile phone market are illustrated in this infographic:[9]

Credit: GSMA

Sub-Saharan Africa is a region that has seen high growth in mobile usage. At the end of 2016, there were 420 million unique mobile subscribers in Sub-Saharan Africa, equivalent to a penetration rate of 43%. The compound annual growth rate (CAGR) for mobile technology in Africa is 6.1% over 5 years – which is 50% higher than the global average and indicating faster growth than any other region. Growing at this rate, Africa will have more than half a billion unique mobile subscribers by 2020, with half the population subscribing to a mobile service. The total number of SIM connections in the region reached 731 million at the end of 2016, and will rise to nearly 1 billion by 2020.[10]

[9] https://www.gsma.com/mobileeconomy/

[10] https://www.gsma.com/mea/mobile-economy-2017-sub-saharan-africa-2017



Credit: GSMA

Mobile enabled technology

In recent years, mobile connected devices (mainly smartphones and tablets) have become the primary characteristic of the post personal computer era. In 2011, globally, smartphone sales surpassed the personal computer sales. Mobile devices are increasingly being used as assistive technology as they are more affordable than specialised systems or devices. Many software applications across different operating systems have been developed to increase the inclusion of people with disabilities. As the post personal computer era is currently evolving, the research into the accessibility and impact of mobile devices is relatively limited. Many tablets and other mainstream technologies have built-in functions that are useful to people with disabilities including Internet access, phone (voice and texting) and other applications such as navigation based on built-in capability (e.g. accelerometers, GPS tracking and cameras). As well as being smaller and cheaper, many mobile technologies with apps and sensors now have the functionality equivalent to special-purpose assistive technology – for example with regards to fall detection, wayfinding and sound amplification. While not specific to disability initiatives, mobile enabled technology is increasingly regarded as the preferred technology for ICT projects due to their widespread use and availability in lower-income countries. Mobile devices can improve access to information, promote local knowledge, as well as facilitate sharing and improving social interaction for marginalised populations, such as persons with disabilities countries (Barlott, Adams & Cook 2016).

While some applications designed to improve the inclusion of persons with disability will be developed in low and middle income contexts, others will be developed in high income contexts but may still increase the inclusion of persons with disability in low income settings. For example, in 2015 IBM announced that they had created a new tool for iOS and Android mobile applications expected to potentially benefit as many as one billion people with disabilities worldwide, including those who are vision and hearing impaired, as well as the elderly. The new Mobile Accessibility Checker is an automated test to help strengthen the accessibility features of mobile applications. Speaking at the Mobile World Congress in Barcelona in 2015, Frances West, IBM Chief Accessibility Officer, said: *"Mobile technology has sparked a new era of opportunity for people of*

all ages and abilities, yet many mobile apps have design flaws that prevent people with disabilities and the elderly from using them effectively. Our researchers saw an opportunity to address this by inventing technology that identifies and corrects usability issues early in the software development process. This makes mobile apps easier to use for people with disabilities, helps developers save on costs and satisfy compliance requirements, and drives greater inclusivity in our communities through mobile technology". [11]

For innovative mobile enabled technology to be successful, the cost of intelligent mobile terminals (smartphones) and rates for data use must be affordable (Abascal et al 2016). As well as being affordable, accessibility and usability must also be assured for persons with disabilities (Eid 2016). Innovation in this sector will require funding. Mobile technology may have the potential to result in increased inclusion, but it is important to note that there is limited research on the use of mobile phones to address the needs of people with disabilities in lower income countries (Barlott, Adams & Cook 2016).

Barriers to access to technology

Members of marginalised groups, including those with disabilities, are reported to have unequal access to computers and internet technologies (Guo, Bricout & Huang 2005, Dunn 2009, Hasan et al 2017). People with disabilities often experience economic and linguistic restrictions in addition to accessibility barriers. This inequality of access is sometimes called the 'digital divide' – a term used in the 1990s to describe inequalities among countries, but more recently applied to inequalities within countries (Abascal et al. 2016). People with more disabilities have far more to gain from the use of ICTs than those who have fewer disabilities (Unwin 2017). The most marginalised groups are the least likely to gain access to ICTs but that when they do it can make the biggest difference to their lives (in terms of enhanced capabilities and functionings). This is true in many different settings and sectors (Heeks 2018).

Despite the great potential ICT and mobile technology has to improve the inclusion of persons with disabilities, advances in technology alone are insufficient to address all forms of inclusion of persons with disabilities. The success of the internet and ICT for the inclusion of persons with disabilities is heavily impacted by stakeholders' knowledge and awareness of the technology available, as well as knowledge of laws and policies (Samant Raja 2016). In several countries laws exist that cover ICTs, although the relevance of the laws to accessibility, and levels of compliance, are not well documented. The ICT landscape is developing rapidly, leaving existing regulation outdated. Compared to accessibility standards for other sectors (such as transport/accommodation) standards for the development of ICT are lagging behind (WHO & World Bank 2011).

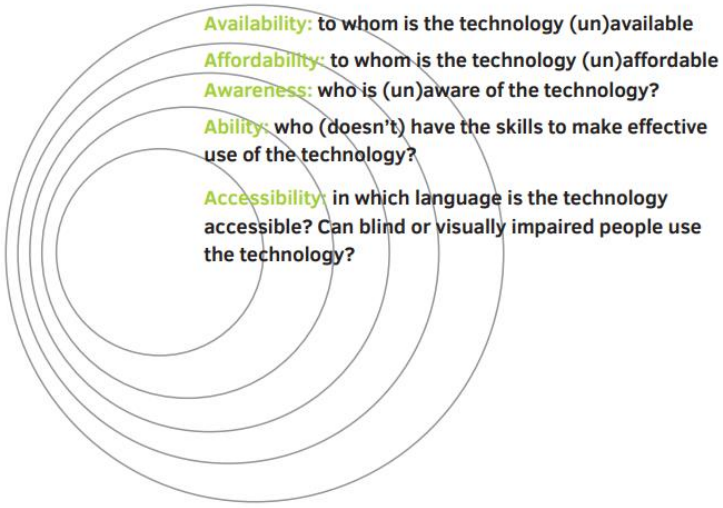
Poor persons with disabilities face significant challenges in acquiring digital technology, due to cost and availability (Samant Raja 2016). A number of initiatives have been developed to promote accessible web content and inclusive ICT. For example, the Web Accessibility Initiative (WAI) develops guidelines widely regarded as the international standard for web accessibility, develops support materials to help understand and implement web accessibility.[12] Also, the

[11] https://www-03.ibm.com/press/us/en/pressrelease/46232.wss

[12] https://www.w3.org/WAI/

World Wide Web Consortium (W3C) is an international community where Member organisations, a full-time staff, and the public work together to develop web standards, to ensure the web is accessible for all.[13] G3ict is the Global Initiative for Inclusive Information and Communication Technologies. It was launched in 2006 by the United Nations Global Alliance for ICT and Development, in cooperation with the Secretariat for the Convention on the Rights of Persons with Disabilities at UN DESA. Its mission is to facilitate and support the implementation of the dispositions of the Convention on the Rights of Persons with Disabilities on the accessibility of Information Communication Technologies (ICTs) and assistive technologies.[14] These initiatives are important in promoting accessible web content. Accessibility may be underwritten by law in countries that pass inclusive legislation, although the laws must be adhered to if they are to be effective. For the web to be universally accessible, a coordinated international effort is required (Abascal et al 2016). In addition, stakeholder capacity to support accessible ICT services will be important. The internet and ICT could potentially increase the exclusion of persons with disabilities if they are not designed to be accessible and inclusive. Although not focused specifically on mobile enabled technology, there is a risk that if ICT enabled development programs are inaccessible, the internet and ICT may result in marginalisation and exclusion for persons with disabilities (Samant Raja 2016). Action is needed by both government and non-government organisations to accelerate the development of ICT-enabled tools, including those with mobile connectivity, to enhance the ability of persons with disability (Hasan et al 2017).

Assessing who has access to technology can be complex. It may not be as simple as either being fully connected or not at all connected. The situation may be complicated, for example, by some people having two mobile phones, but still not having reliable access to either calls or Internet for a number of reasons. Assessing connectivity using the five 'A's of technology access (Roberts 2016): Assessing the availability, affordability, awareness, ability and accessibility of technology will develop an understanding of who has access and who does not (Roberts and Hernandez 2017).



Credit: Roberts and Hernandez 2017, p. 7.

[13] https://www.w3.org/

[14] http://g3ict.org/

ICTs have been shown to be personally transformational for persons with disabilities when they do have access, yet underlying factors resulting in unequal access to technologies for marginalised groups continue to undermine the potential for significant change.

To ensure access to ICT is inclusive, collaboration of stakeholders in every sector will be required, as well as concrete actions by each group of stakeholders while relevant indicators to monitor progress need to be developed. A report by the International Telecommunication Union (ITU), UNESCO, and partners (2013) concluded that the following action is required:

- Governments must ensure ICT-enabled solutions are adapted to the needs of persons with disabilities, increasing the availability of accessible ICTs and promoting the affordability of assistive technologies in social and educational programmes, business, and other areas.
- The UN and international organisations should continue implementing operational activities to meet disability-inclusive development goals, complemented by the monitoring and evaluation of development efforts at the global, regional and national levels.
- Private sector organisations must increase research and development efforts, incorporating universal design principles at the earliest stage possible and recruit persons with disabilities in product development departments to develop accessible ICT. Attitudinal barriers can be challenged by hiring persons with disabilities and promoting accessible workplaces.
- Civil society organisations can raise policymakers' awareness of accessibility barriers, and should become more active in the work conducted by international standards organisations. They can also raise awareness of social progress and economic growth with regards to capacity-building among persons with disabilities and their relatives regarding the use ICT to facilitate their own economic and social inclusion. They can advocate for the mainstreaming of the use of the universal design principle in all development efforts is crucial to ensure that the international development framework is disability-inclusive.
- International standards organisations can enable a disability-inclusive development agenda by providing a neutral platform from which to develop and harmonise international standards and provide recommendations related to accessible ICT and their applications.

4. Evidence and examples

The main body of this emerging issues report is structured loosely around the six themes of social inclusion, which are i) being accepted; ii) having relationships; iii) being involved in activities; iv) living accommodations; v) employment; and vi) support systems (Hall 2009). It is recognised that there is some overlap between themes. For each of the six themes of inclusion, a brief overview of the academic literature is provided, followed by some examples of how mobile enabled services can help increase inclusion of those with disabilities.

Being accepted

Although not specific to mobile technology, research from China has indicated that internet connection significantly reduced social barriers in the physical and social environment for

disabled people (Guo, Bricout & Huang (2005). Pal et al (2013) undertook research in Peru, Jordan and India to better understand marginality, aspiration and accessibility in ICTD. Although the research is not specifically focused on mobile connectivity, the findings are relevant, as participants with vision impairments reported changes in their economic and social aspirations following technology usage. However, multiple forms of exclusion from the public sphere were reported due to negative social attitudes towards disability. Therefore, it is argued that the nature of marginalisation caused by disability has yet to be adequately addressed.

Bonnah Nkansah and Unwin (2010, P. 206) found that ICTs are very important tools in addressing some of the social barriers that have typically limited the participation of persons with disabilities in many social spheres. The Director of the Ghana Association of the Blind reported: *"When I exchange mails with my colleagues from other NGOs, and I read their mail and they read mine, there is no blind written anywhere on anyone's mail and so at that point we are equal ... so it helps to break that social barrier"*. Mobile telephony enhanced the communicative abilities of persons with hearing impairment through text messaging. Video phones and devices with webcams also enable people to communicate via both sign language and text messaging.

A campaign called WeCare is run by GSMA. It was launched in Latin America and involves operators joining forces to make a series of commitments in every country in the region where mobile phones and networks can provide solutions to social problems. The WeCare campaign has already been launched in Bolivia, Brazil, Colombia, the Dominican Republic, El Salvador, Honduras, Mexico and Nicaragua, and will continue to expand throughout the region. Under the campaign in Costa Rica, in 2016 three mobile operators (Claro, ICE and Telefónica) committed to working together to facilitate greater accessibility for consumers with disabilities with the support of Costa Rica's telecoms regulator, Superintendencia de Telecomunicaciones (Sutel), and the Deputy Ministry of Telecommunications. The mobile operators signed an agreement with the Mobile Manufacturers Forum to improve access from their websites to the data system of the Global Accessibility Reporting Initiative (GARI). The system enables users to identify mobile handsets in their area that offer services designed to assist users with disabilities.

Emilio Arias Rodriguez, Deputy Minister of Telecommunications of Costa Rica commented: *"Mobile penetration has reached 151 per cent in Costa Rica, and this trend is set to continue. In this context, and as we work to build an integrated, inclusive and caring society, it is essential to keep taking action to enable every citizen, without exception, to have access to affordable, quality telecommunications services through the development of infrastructure that supports sustainable, efficient, secure and robust mobile networks. These networks will also be key to enabling people to develop their skills and knowledge, in particular those people who are the most vulnerable, through productive, safe and meaningful use of these tools".*

Jaime Palermo, Telecommunications Manager, ICE: *"These initiatives reaffirm our commitment with actions to help support the efforts of the Costa Rican government to [increase] accessibility of services for the entire population. In ICE we believe that technology is key to economic and social development and should contribute to the protection of the rights of Costa Ricans."*

Jose Pablo Rivera, Regulatory Manager, Telefónica Movistar Costa Rica: *"This agreement allows us to support Costa Rica through Telefónica Group's various initiatives in the area of disability and which aim to promote social inclusion."*[15]

A similar commitment has been made in Mexico where the GSMA, Mexican mobile operators and ANATEL have signed an agreement with the Mobile Manufacturers Forum to improve the access from their websites to the GARI system, which enables users to check and identify mobile devices in their region that offer features to aid users with disabilities.[16]

Having relationships

Research based on interviews conducted with blind masseurs in Indonesia reports that mobile phones play significant roles in micro-entrepreneurs' perceived well-being. As well as facilitating inclusion in work, mobiles are facilitating communication with family and friends, as well as improved physical mobility and independence. Having a mobile phones was shown to facilitate beneficial 'functionings', which were reported as valuable by participants (Anwar & Johanson 2015). A study that gathered survey data from 122 persons with disabilities in China found internet use can lead to significantly improved frequency and quality of social interaction. Evidence from Jamaica reports that for persons with disabilities, mobile phones help them to stay informed, meeting their emotional needs to interact with their peers (*Dunne 2008).* To realise increased inclusion, high speed connection at an affordable price is essential. For example for persons with hearing impairment may require high quality video conferencing services for communication, for which connection needs to be reliable and high quality (Eid 2016).

Mobiles phone (and in particular texting features) are now being used extensively by people who are deaf or have hearing impairment to communicate with each other. As an example, parents of children with hearing impairment can now communicate with them throughout the day, satisfying themselves that their children are safe. Before mobile phones existed, the lack of communication resulted in a state of perpetual worry and fear. The connectivity that mobile phones bring are particularly valued by poor parents, because compared to their wealthier counterparts, they cannot afford to arrange escort services for their disabled children (*Dunne 2008).*

A study by Hasan et al (2017) investigated the impact of ICT on the change in the quality of the daily lives of persons with disabilities in Bangladesh. The findings show that the acceptance of ICT by PWDs was at moderate level, and there is a positive correlation between acceptance of ICT and quality improvement in the lives of PWDs. ICTs can support persons with disabilities by offering alternative means of communication, access to education and enhancing learning motivation.

Being involved in activities

Although not specific to mobile connection, the internet has been shown to improve the frequency and quality of social interaction among persons with disabilities, as well as having the

[15] https://www.gsma.com/newsroom/press-release/gsma-and-costa-rican-operators-commit-to-a-safer-mobile-environment/

[16] https://www.gsma.com/latinamerica/we-care-mexico

potential to help persons with disabilities to overcome physical and social barriers (Guo, Bricout & Huang 2005, Chigona et al 2009).

Mobile enabled technologies including internet-ready phones, voice services, texting, and other features present opportunities for inclusion those with physical, visual, hearing, or other forms of disability. These opportunities can be further realised when coupled with specialised training and special technology designs that facilitate accessibility (Dunn 2009).Mobile connected technology presents a real opportunity for marginalised groups to be included in the mainstream of digital society. Software can be used by individuals to engage in outsourcing opportunities such as data processing and administrative work (Dunn, 2008). An example of such software is Job Access With Speech (JAWS) - a screen reader, developed for people whose vision impairment prevents them from seeing screen content or navigating with a mouse. JAWS provides speech and Braille output for the most apps.[17]

Bonnah Nkansah and Unwin (2010) argue that there is strong evidence from higher income countries that ICTs can provide very significant learning support for those with special educational needs. Although not entirely specific to mobile enabled technology, it was found that those involved in delivering special educational recognise that ICT has the potential to significantly contribute to the learning processes of people with disabilities. ICTs and assistive technologies can substitute for the impairments that people have, enabling them to lead more fulfilled lives. Bonnah Nkansah and Unwin (2010) give the following examples of how ICT can increase inclusion of persons with disabilities:

- Text to speech software enables people with visual impairment to hear what others read
- Calls converted to text on mobile phones can assist those with hearing impairment
- Students with severe physical disabilities can participate actively in university lecture and fieldwork classes through assistive technologies.

In fragile or conflict affected contexts, ICT can increase the participation of refugees with disabilities, as long as appropriate inclusive pedagogical support for ICT use is provided. A low tech ICT approach is recommended using local knowledge constructions in refugee camp environments (Eid 2016).

BarrierBreak is an Indian for-profit social enterprise that has designed an app called Newz Hook that provides news access for persons with various disabilities. Since its start in 2016 it has been downloaded 8,000 times. Newz Hook provides access to news for persons with hearing and visual impairments as well as intellectual disabilities. It also provides disability-focused updates for parents and special educators. The app supports the use of screen readers that read aloud the text displayed on a mobile phone. It also allows for a high contrast view and to increase the size of the text, supporting partial visual impairment. To address the needs of persons with a hearing impairment, simple understandable language is used, e.g., a complex word like “infrastructure” is simplified as “roads and bridges.” It includes sign language news videos. The app is supported and developed by a team of accessibility experts and persons with disabilities (who make up 70% of the staff). The Newz Hook project is fully funded by BarrierBreak but in the

[17] http://www.freedomscientific.com/Products/Blindness/JAWS

future it may be funded by advertising. . Going forward, Newz Hook aims to generate advertising-based revenues (Charles et al 2018).

A community-based research (CBR) project in Colombia used FrontlineSMS, an open-source text message delivery program created specifically for international development. The computer running FrontlineSMS and a mobile phone acted as a two-way SMSmessaging hub for sending to, and receiving messages from the participant's personal mobile phone. The keyword INFO was used to send information messages to caregivers. The keyword PREGUNTA ("question") was used by caregivers to ask health-related questions. Messages including the keyword PREGUNTA were automatically forwarded to the community clinician. During the three months that the project was undertaken, 56 information messages were sent to participants by the community clinician and community leader. More than half of the participants confirmed that they participated in a community event after receiving one of the project text messages. One of the major outcomes of the project was that the participants were shown the possibility of community participation. The technology opened a window to a new possibility of being a participatory member of their community. The project aimed to investigate whether mobile phones and SMS could be used by people with disabilities and their caregivers to access information. Although the community in focus was resourced-limited, mobile phones were readily available. This case study found mobile phones were a useful tool for addressing the information exclusion of people with disabilities and caregivers (Barlott, Adams & Cook 2016).

AlManarah ("lighthouse") is a non-profit association for persons with disabilities in Israel's Arab-speaking population. It has developed the International Accessible Library – the first free Arabic digital audio library in the world, which contains over 4,500 audio books. It receives over 200,000 visits per month and has 60,000 users. The audiobooks can be accessed via a mobile app or from website. Over 4,500 books have been professionally recorded to date, providing access to over 50,000 hours of audio for persons with visual impairments or print disabilities. It is currently funded through donations from non-profit organizations working in Israel, along with grants from the government, corporate sponsorship and advertising. Israeli National Insurance Institute and the Ministry of Culture and Sports, as well as from advertising on the website through Google AdWords. There is a plan to transform the library from a non-profit project into a social business by moving to a small subscription-fee service to ensure long-term sustainability. The Israeli Ministry of Education has shown interest in including the app as part of the educational curriculum for persons with print disabilities in schools (Charles et al 2018).

The Ministry of Information and Communications Technology of Colombia (MINTIC) launched an initiative called Plan Vive Digital para la Gente ("Live Digital for the People") to promote access, effective use, and massive appropriation of ICT. Through this initiative a project called Cine para Todos ("Cinema for Everyone") supported a Smart Films festival. The festival encouraged Colombians with any type of disability to make short films with their cell phones, and compete for a €7,000 prize (Charles et al 2018).

Living accommodations

According to the WHO (2011), the standards of ICT development are lagging behind the standards for public accommodations and public transport in terms of accessibility. However, there are some examples of where Qureshi (2016) argues that among other uses, location-based mHealth applications have the potential to assist the independent living of persons with disabilities. Although not focusing specifically on low income contexts, Boulos et al (2011) report

that GPS (Global Positioning System) and location-enabled smartphones and applications offer opportunities to assist the independent living of persons with disabilities.

In some low income countries, persons with disabilities are not allowed to independently open and operate bank accounts or use banking facilities and services due to policy barriers. Such barriers are primarily based on assumptions the capacity of persons with disabilities. Inclusive financial services offering access to all are vital to poverty reduction and participation in economic prosperity and growth and development (Eid 2016). Advances in mobile enabled technology have improved the inclusion of persons with disability in accessing financial services. In the past financial services were predominantly paper based, Technology-enabled banking - including internet banking, phone banking, mobile banking - has made it easier for persons with disabilities to access these financial services increasing independent living. In particular mobile banking allows persons with disabilities to manage their own accounts and finances without having to depend on someone else (Samant Raja 2016).

Helm ("Dream") is a non-profit organization based Egypt that aims to promote the full inclusion of persons with disabilities. In 2015, they developed a mobile app and website called Entaleq to provide details on the accessibility of venues across Egypt through crowdsourced reviews. A consulting service provided by a social enterprise is also offered to companies that wish to improve their accessibility. Over 1,000 people with disabilities are using Entaleq regularly. Although Egypt does have accessibility standards and building codes relating to accessibility, they are not always implemented or enforced. The app was co-funded by Vodafone Egypt Foundation and co-developed with Microsoft as a technology partner. It is available on Android and IOS smartphones. Persons with physical, hearing and visual impairments can search for venues such as shops, restaurants, and public offices that provide the accessibility features that they require. Venues can be added and reviewed. Since 2015 700 venues (mostly in Cairo) have been reviewed. As a result of the app and the consultancy services, more than 140 venues have implemented accessibility modifications. The app is currently financed through grants and sponsorships. As traffic increases it is planned that the app will become sustainable through commercial advertising (Charles et al 2018).

In Colombia, under the Plan Vive Digital para la Gente initiative, the Cine para Todos project aimed to enable people with disabilities, in particular with visual and hearing impairments, to be able to access cinema. MINTIC reduced regulatory and tax barriers to facilitate the development of accessible infrastructure and the availability of telecommunications services. It prioritising state capital investments into digital accessibility. These actions aimed to encourage the private sector to expand their accessible infrastructure. Under the initiative MINTIC has partnered with the Saldarriaga Concha Foundation (an inclusion not for profit) and Cine Colombia (a film distribution company) to make their venues accessible through various interventions. MINTIC developed an app and a free download that allows people with disabilities to access audio descriptions, sign language, and subtitles. In 2017 over 3,500 people had downloaded the app. Currently, the initiative is financed solely by the government (Charles et al 2018).

Wayfindr is a project and standard to make audio navigation systems accessible for persons with visual impairments. Although it was developed in the UK, it is relevant to this report as in March 2017 it was approved as the first Open Standard for indoor audio navigation by the International Telecommunication Union (ITU). It is the world's first internationally recognised standard for accessible audio navigation, giving governments, companies, and non government organisations around the world an accepted benchmark along with a host of resources to implement the navigation technology in their own organisations. Wayfindr is an Open Standard for indoor

navigation technologies that provides audio instructions to users' smartphones to help them find their way through built environments. A toolkit of information is provided to help implement an accessible audio navigation system or to develop products and services that work with the technology, such as mobile phone applications. The toolkit provides details on disabilities, recommendations for best practices, guidelines on development, suggestions for further investigation; and considerations for app development (Charles et al 2018).

Employment

ICT enables and empowers persons with disability to do almost all types of work and contribute to society (Hasan et al 2017). In particular, advances in technology, including mobile connectivity, have increased opportunities for persons with disabilities to be included in employment (Ansong & Boateng 2018, Dunn 2009). People with physical disabilities who are employed to work remotely, an affordable and reliable connection is a pre-requisite (Eid 2016).

Although not specifically referring to mobile enabled technology, Samant Raja (2016) argues that ICT is increasing the inclusion of persons with disabilities in the world of work. For example, persons with disabilities can be included in communications and interactions with clients and colleagues through mobile instant chat platforms and real-time text displays facilitate communication for persons with hearing and speech impairments. Text and video telephony can also be used to facilitate internal and external phone calls through an interpreter. As mobile devices facilitate remote working, persons with disabilities can use the technology to work more flexibility, allowing for needed breaks, medical provider visits and other appointments. Remote work platforms and policies allow employees schedule flexibility. They also allows employees to work from physically accessible and convenient locations (Samant Raja 2016).

Telecommuting - where employees work remotely - offers opportunities to people (including persons with disabilities) who were previously excluded from work. Based on their research into telecommuting in Ghana, Ansong & Boateng (2018, P.7) present an interview with the Service Delivery Manager Ericsson, who stated *"It has become more accessible if you go back to a decade or a decade and half ago, having internet at home was a thing that people didn't have. Now internet has become vastly cheap and more accessible and so it's now easy to access information from a remote location so you do not need to be in the office to plug in your LAN cable to access the internet. With the introduction of wireless, MiFi devices, Dongles or even the mobile phone, tethering of your mobile phone allows you to access the internet. Once you can access the internet you have access to all the information you need to be able to perform your functions. Also, the advancement of mobile phone, Skyping, face-to-face calling and video call. You are able to cluster people in groups and disseminate information faster on Apps like telegram, WhatsApp etc. So, these kinds of technologies have helped."*

Poor people and marginalsed groups often engage in micro enterprise as a form of entrepreneurship. Mobile phones are rapidly becoming an essential tool for people's work. Dunn (2009) reports that people with disabilities, along with other marginalised groups, have a special need for these technologies. Mobile technology allows for connection and participation in the global economy. Evidence from research undertaken in the Caribbean suggests that workers who are visually impaired, but have access to email with software programs that enlarge the text or generate speech from the text, have no different level of productivity compared to other workers. Mobile technology is now being used extensively among persons with hearing and/or visual disabilities. In particular, the texting feature has been shown to assist with communication for social networking and for conducting business (Dunn 2009). Evidence from Indonesia also

shows that mobile technology is increasingly important for the work prospects of micro-entrepreneurs who have disabilities (Anwar & Johanson 2015).

Dunne (2008) presents a case study of Inez, a 40-year old Jamaican fruit and tuber vendor in Kingston. She lives in an adjoining area of the city and commutes daily to and from the market. Inez has a physical disability and requires a wheel chair to assist with mobility. A basic mobile phone allows her to make personal contact with her suppliers and customers on a daily basis. The phone has helped her to gain additional income and to procure and deliver her goods more efficiently.

*"Yes man, I can get me business going by calling suppliers who deliver my goods right to my stall or at a location where somebody can pick it up for me. I don't know about anybody else but the cell phone is important to me. Since cell phone came about, it has been more comfortable for me. For example, if my phone is not working now, I cannot eat because I am worried about it, because my business is going to go bad, because some people who are supposed to contact me cannot do so. Therefore, I must have a phone" (*Dunne 2008, P.46).

Bonnah Nkansah and Unwin (2010, P.206) report that computers and the Internet were generally considered as equalizers of opportunities, familiarity with which improved the employability of persons with disabilities. ICT (including mobile enabled technology) provides people with disabilities the independence to work and generate outputs of similar quality to that by those without disabilities. As the Director of the Ghana Association of the Blind observed: *"I see ICT as an equaliser ... now when we sit behind the computer and we are working, at that point we are equal with our sighted colleagues, because we can bring out the same quality of work ... and that can open up employment opportunities for us".*

Enable India is an Indian non-profit organisation that has developed a mobile phone-based information sharing service called Namma Vaani ("our voice"). It allows users to listen and respond to recorded voice messages from the disability community regarding education and employment opportunities, workplace solutions and enhanced life skills. It aims to provide better information to persons with disabilities living in rural areas. Namma Vaani is a voice-based social network. Information is shared via regular mobile phones, so no smartphone or web-access are needed. A variety of stakeholders, including non-government organisations, private companies, persons with disabilities and parents record and upload voice messages, which are then accessed by the system users. An Enable India team manage, moderate and publish the information. Much of the information uploaded relates to employment opportunities, but education, training, life skills and other themes are also included. The service allows for information to be spread easily, quickly, and at a low cost. By 2017, Namma Vaani had received over 200k calls from 15k unique callers. It was first launched in Kannada language and a Hindi version (Hamari Vaani) was introduced in mid-2017. The service is privately funded and costs approximately $50,000 per system (Charles et al 2018).

DFID and Humanity and Inclusion are collaborating to prototype an app that will help employers in developing countries share information on how to adapt tools - including prosthetics - and working environments, to make sure that workplaces are accessible for employees and entrepreneurs with disabilities. For example, in Cambodia, farmers are using low-cost prosthetic legs made for unstable terrain, such as swampy fields. The app will share this adaptation with

other farmers with similar disabilities in developing countries so they can adapt their own prosthetics and continue to work.[18]

Support systems

In countries were access to civil rights, such as voting, is increasingly provided through digital channels, services must be accessible to all to avoid any discrimination. Services must be accessible to all users regardless of their physical, sensory or cognitive abilities, language or equipment used. While initiatives, such as WAI and W3C, are working to promote accessible Web content, the guarantee of accessibility must be reinforced through inclusive legislation (Abascal et al 2016). E-government websites are government websites that have been developed for use in public administration and service/information delivery to citizens. Although not specifically related to mobile connectivity, it is important to note that e-government websites are increasingly becoming the fundamental platform for interaction between governments and citizens, presenting new opportunities for political inclusion for persons (Verkijika & De Wet 2018). Increased accessibility is a recognised public value of e-government websites, which should aim to be transparent, providing citizens with engagement mechanisms that allow their voices to be heard, and providing equal access by ensuring accessibility for disabled people (Karkin & Janssen 2014). E-governance is increasingly regarded as important to ensure inclusion of persons with disabilities. E-governance can promote independent and autonomous interface with government services and offices. Various mobile enabled technology and services, including Government websites, social media, and crowdsourcing platforms, are increasingly recognised as being important sources of information for persons with disabilities. As such, it is essential that such support systems are designed to be accessible. Digital technologies such as SMS, mobile apps, accessible web-based forms, and web portals can meet demand while enabling improved interaction between the government and citizens with disabilities (Samant Raja 2016).

In Sri Lanka, growth in mobile connectivity suggests potential for further development of e-government services accessible via mobile phones (Karunasena, Deng & Singh 2011). Verkijika & De Wet (2018) evaluated 279 e-government websites from 31 countries in Sub-Saharan Africa from a public values perspective. They found that currently, the performance of Sub-Saharan Africa e-government websites was highly unsatisfactory when it comes to the delivery of public values. The majority of websites were found to display poor implementation of accessibility guidelines, lack feedback forms, are plagued with numerous privacy and security issues, numerous broken links, are not mobile responsive, and have limited dialogue features. Governments responsible for these websites in sub Saharan Africa must update, or develop their policy frameworks for e-government website development to include public values within their design (Verkijika & De Wet 2018). The potential of e-government websites to be more inclusive of persons with disability is clear. However, the current reality suggests that this potential is not being optimised.

Support systems are not limited to e-governance. Mobile enabled technology is increasingly being used for rehabilitation purposes or to provide support to people with disabilities who require assistance with management of a disability. The World Report on Disability states that the use of mobile technologies for rehabilitation is an emerging resource that can enhance rehabilitation

[18] https://www.gov.uk/government/news/uk-aid-supports-worlds-first-mobile-app-to-help-the-poorest-people-with-disabilities-into-work

measures by providing interventions remotely (WHO & World Bank 2011). Such interventions have become known as 'telerehabilitation' and can include video and teleconferencing technologies in accessible formats, data-collection and telemonitoring. Such technology may be used by a range of stakeholders including people with disabilities, rehabilitation workers, peers, trainers, supervisors, and community workers and families. The WHO (2011) states that evidence on the efficacy and effectiveness of telerehabilitation is growing and shows that it can lead to similar or better clinical outcomes when compared to conventional interventions. Examples of where mobile enabled technology may benefit rehabilitation include the following:

- Telepsychiatry services.
- Cardiac rehabilitation.
- Speech and language therapy.
- Cognitive rehabilitation for people with traumatic brain injury.
- Remote assessments to provide home modification services to underserved elderly people
- Training and support of health-care personnel.
- Computerized guidelines to help clinicians use appropriate interventions.
- Consultation between tertiary hospital and community hospitals for problems related to prosthetics, orthotics, and wheelchair prescription.
- Sharing professional expertise between countries, as well as at critical times such as in the aftermath of a disaster.

At present, the evidence focused on the effectiveness of these interventions is focused on high income contexts.

Some evidence does exist from low and middle income contexts. For example, in India, a mobile application called 'Care for Stroke' has been developed as an educational intervention for the management of physical disabilities following a stroke. It aims to address the unmet needs and growing magnitude of disability experienced by the stroke survivors in LMICs. In particular, the intervention was developed for use by stroke survivors who have any kind of rehabilitation needs to independently participate in his/her family and social roles. With limited resources for - or complete absence of - organised stroke care rehabilitation services, a Smartphone-enabled educational intervention for management of disabilities has potential to meet the substantial rehabilitation needs of stroke survivors in low income contexts (Sureshkumar et al 2015).

In 2015, the Special Talent Exchange Program (STEP) in Pakistan developed an Android mobile application to connect persons with disabilities with information on disability rights. The Disability Inclusive Voter Education (DIVE) app offers potential for persons with disabilities for greater inclusion in political processes by providing information to enable on rights and opportunities. [19] One feature of the app enables persons with disabilities, disabled persons organisations and other stakeholders to learn about how to take part in elections. Another provides information about relevant services available. It also provides information on registering as a voter or running for office. The development of the app was supported by the International Foundation for Electoral Systems (IFES). As of May 2017, STEP had circulated a link for the app through 8,000 SMS messages to persons with disabilities and over 900 persons with disabilities have downloaded the application. The following are feedback from Pakistani disabled persons organisations about the DIVE app:

[19] http://www.ifes.org/news/technology-inclusion-persons-disabilities

"It is one of the biggest achievements of the disability movement in Pakistan. Through this application all persons with disabilities and their families can easily be informed about their civic rights." –Society for Special Persons

"Through this application we can have the latest information in real time and persons with disabilities can have better information about their civic rights." –Disability Welfare Association

"It is an informational revolution in the disability movement of Khyber Pakhtunkhwa (KPK) and we should extend the information platforms to the northern parts of KPK." –Special Life Foundation

FENASCOL (National Association of the Deaf in Colombia) started a project called Centro de Relevo ("Relay Service") in 2001, which enables telephone communication between deaf and hearing people through sign language interpreters. The service allows people with a hearing impairment to find an interpreter via their phone who will provide them with free translation for 15 minutes. The communication service can be used for medical appointments, work-related consultations, legal formalities, and similar situations for a maximum of 30 minutes. No specialised equipment is needed – only access to the Internet or a mobile app. The project is a public-private initiative but the government provides 95 per cent of the funds. The annual cost of the service is approximately $800k. The project is led by persons with hearing impairment. The technology allows the project's team of 50 interpreters to operate from home in all areas of the country, every day including weekends. 2 million free calls have been made and 15,000 online interpreting services have been provided since 2009. There is a strategy in place to make the service available to other countries in the region (Charles et al 2018).

The non-government organisation Sightsavers is incorporating mobile technology into its programmes in two ways. The first is to utilise the technology to improve the quality, speed and access of data collection. For example in Cameroon, Nigeria and Zambia, data for mass drug administration for neglected tropical diseases which can cause blindness are being collected by mobile phones. Also the Global Trachoma Mapping Project saw Sightsavers partner with 53 organisations to collect and transmit data on 2.6 million people in 29 countries using smartphones.[20] In Zambia they are working with Akros, an organisation that utilise mobile devices to collect data about water and sanitation.[21] The second is through behaviour change, with mobile devices being used communicate and interact. For example, in Kenya Sightsavers are working with Amref Africa using its Leap platform to help community health volunteers with remote learning via a mobile learning package. 300 volunteers are currently signed up to the trachoma module, where they can use a basic mobile phone to complete quizzes, have group chats via SMS and listen to audio recordings of training material.[22] While using mobile technology in this way does not directly increase inclusion of persons with disabilities, it is

[20] https://www.sightsavers.org/programmes/mhealth/

[21] http://akros.com/

[22] http://www.leaphealthmobile.com/

relevant to this report as it does strengthen local health systems and contribute to the reducing the burden of blindness and vision impairment.[23]

People with disabilities frequently remain marginalised in the process of disaster planning and preparedness. Communication of information before, during and following a disaster can be life-saving. For those communication channels to be successful they have to be accessible to all, requiring forward planning. The Emergency 2.0 Wiki Accessibility Toolkit was developed to empower people with disabilities to use social media for disaster preparedness, response and recovery. The toolkit includes information on how to access certain types of media, such as the Easy Chirp; an alternative twitter portal which enables tweets to be read with assistive technologies. An important consideration as social media plays an increasingly prominent role in information sharing and communication during disasters. The toolkit includes accessible YouTube videos specifically aimed at preparedness for different types of disasters, and tailored advice for people living with disability.[24]

Limitations

This K4D Emerging Issues report highlights research and emerging evidence that show how mobile-enabled services can help increase inclusion of persons with disabilities. It provides an introduction to the current evidence on how mobile technology and mobile-enabled services can help increase inclusion of persons with disabilities. It is non-systematic in nature and was based on 12 days desk based work. As such, it has limitations.

There are several other relevant areas that have potential for further research. For example, as well as directly impacting on the inclusion of persons with disabilities, it is recognised that mobile technology has the potential to benefit health systems through data collection and education services. However, further investigation into these themes was not possible within the scope of this report. Also, while the growth in the mobile industry is made clear in this paper, further investigation is needed to assess whether persons with disability are proportionately represented in those benefiting from accessing mobile services. Future research could seek to establish levels of access to technology for persons with disabilities, as well as exploring the barriers to access that may exist.

While this paper does make reference to the growth in the smartphone industry, it does not consider the potential of non-smart phone technology. Further research could focus on the potential of non-smart phone technology to increase the inclusion of persons with disabilities. A noted limitation is the lack of focus on funding for mobile technology that is designed to address inclusion of persons with disability. Future research could investigate funding modalities that exist and measure their impact. Another area for future work is the potential for mobile technology to influence citizenship and the impact this would have on the inclusion of persons with disability.

[23] For further information on the effectiveness of mobiles for improved health in low-income contexts, see DeRenzi et al. 2011. Mobile Phone Tools for Field-Based Health care Workers in Low-Income Countries. Mount Sinai Journal of Medicine; 78

[24] https://www.gsma.com/mobilefordevelopment/programme/disaster-response/living-with-disability-and-disasters-towards-accessible-communication-for-all

References

Ansong E, Boateng R. 2018. Organisational adoption of telecommuting: Evidence from a developing country. *The Electronic Journal of Information Systems in Developing Countries*; 84

Anwar M, Johanson G. 2015. Mobile Phones and the Well-Being of Blind Micro-Entrepreneurs in Indonesia. *The Electronic Journal of Information Systems in Developing Countries;* 67 (1)

Barlott T, Adams K, Cook A. 2016. Increasing participation in the information society by people with disabilities and their families in lower-income countries using mainstream technologies. *Universal Access in the Information Society*; 15 (2)

Bastawrous A, Armstrong M. 2013. Mobile health use in low- and high-income countries: an overview of the peer-reviewed literature. *Journal of the Royal Society of Medicine*; 106.

Bonnah Nkansah G, Unwin T. 2010. The contribution of ICTs to the delivery of special educational needs in Ghana: practices and potential. *Information Technology for Development*; 16 (3)

Boulos M, Wheeler S, Tavares C, Jones R. 2011. How smartphones are changing the face of mobile and participatory healthcare: an overview, with example from eCAALYX. *BioMedical Engineering OnLine*: 10

Charles P, Fembek M, Kainz W, Mundackal S, Saupe A, Vaughan-Spitzy M, Kahane A, Wagner C. 2018. *Zero Project Report – Accessibility* - Essl Foundation, Austria.

Chigona W, Beukes D, Vally J, Tanner M. 2009. Can Mobile Internet Help Alleviate Social Exclusion in Developing Countries? *The Electronic Journal on Information Systems in Developing Countries*; 36 (7)

Dunn H. 2008. “Wha’ a Gwaan?” Research Report on a Qualitative Study of Mobile Telephony and Poverty in Jamaica. *TPM-MSB*, UWI.

Dunn H. 2009. Teleworking the Mobile Caribbean: Enabling Remote Work Among the Marginalized in Jamaica and Trinidad and Tobago. *Information Technologies and International Development*; 5 (2)

Eid N. 2016. Disability and Bridging the Digital Divide - ICT Accessibility and Assistive Technology For People of All Abilities. *Telecentre Foundation, Philippines*.

GSMA. 2018. *The Mobile Economy 2018*. GSMA, London.

Guo B, Bricout J, Huang, J. 2005. A Common Space or a Digital Divide? A Social Model Perspective on the Online Disability Community in China. *Disability and Society*; 20 (1)

Hall S. 2009. The social inclusion of people with disabilities: A qualitative meta-analysis. *Journal of Ethnographic and Qualitative Research*; 3 (3)

Hasan N, Ashraf M, Ahmed E, Hasan M, Bhattacharjee V. 2017. The impact of information and communication technology (ICT) on the lives of disabilities: a case in Bangladesh. *International Journal on Disability and Human Development*; 16 (3)

Heeks R. 2018. *Information and Communication Technology for Development (ICT4D)* Routledge, UK

International Telecommunication Union (ITU) and UNESCO. 2013. *The ICT Opportunity for a Disability-Inclusive Development Framework*. International Telecommunication Union (ITU) and UNESCO.

Karkin N, Janssen M. 2014. Evaluating websites from a public value perspective: A review of Turkish local government websites*. International Journal of Information Management*; 34 (3)

Karunasena K, Deng H, Singh M. 2011. Measuring the public value of e-government: a case study from Sri Lanka. *Transforming Government People Process and Policy*; 5(1)

Mannell J, Abubakar I, Bastawrous A, Osrin D, Patel P, Piot P, Prince M, Smith J, Wilkinson R, Horton R. 2018. UK's role in global health research innovation. *The Lancet*; 391 (10122)

Pal J, Ammari T, Mahalingam R, Alfaro A, Lakshmanan, M. 2013. Marginality, aspiration and accessibility in ICTD*. Paper presented at the proceedings of the sixth international conference on information and communication technologies and development*; 1

Peace R. 2001. Social exclusion: A concept in need of definition?' *Social Policy Journal of New Zealand*; 16

Qureshi S. 2016. Creating a Better World with Information and Communication Technologies: Health Equity. *Information Technology for Development*; 22 (1)

Rimmerman, A. 2013. Social inclusion of people with disabilities: National and international perspectives. *CUP, UK*.

Roberts T, Hernandez K. 2017. *The techno-centric gaze: incorporating citizen participation technologies into participatory governance processes in the Philippines.* Institute of Development Studies, UK.

Rohwerder, B. 2015. Disability inclusion: Topic guide. Birmingham, UK: *GSDRC*, University of Birmingham.

Samant Raja D. 2016. Bridging the disability divide through digital technologies. Background Paper for the 2016 World Development Report: Digital Dividends. *World Bank, Washington DC*.

Sureshkumar K, Murthy G, Munuswamy S, Goenka S, Kuper H. 2015. Care for Stroke - a web-based, smartphone-enabled educational intervention for management of physical disabilities following stroke: feasibility in the Indian context. *BMJ Innovations*; 1

Thompson S. 2017. Disability prevalence and trends. *K4D Helpdesk Report*. Brighton, UK: Institute of Development Studies.

UN. 2014. Disability Data and Statistics, Monitoring and Evaluation: The Way Forward- a Disability Inclusive Agenda Towards 2015 and Beyond. New York, USA: UN

Unwin T. 2017. *Reclaiming Information and Communication Technologies for Development*. Oxford University Press, UK.

Verkijika S, De Wet L. 2018. Quality assessment of e-government websites in Sub-Saharan Africa: A public values perspective. *Electronic Journal of Information Systems in Developing Countries*

WHO & World Bank. 2011. *World report on disability.* WHO, Geneva.

Annex 1 - Methodology

The evidence in this report was identified through a rapid desk-based search. The following six journals were identified as the most relevant to Information and Communication Technology for Development and searched for relevant literature.[25]

Journals	1. The Electronic Journal of Information Systems in Developing Countries 2. Information Technology for Development 3. Information Technologies & International Development 4. African Journal of Information and Communication 5. International Journal of Education and Development using Information and Communication Technology 6. Asian Journal of Communication

The following search terms were used:

Search terms	disab* and mobile disab* and app inclus* and app disab* and inclus*

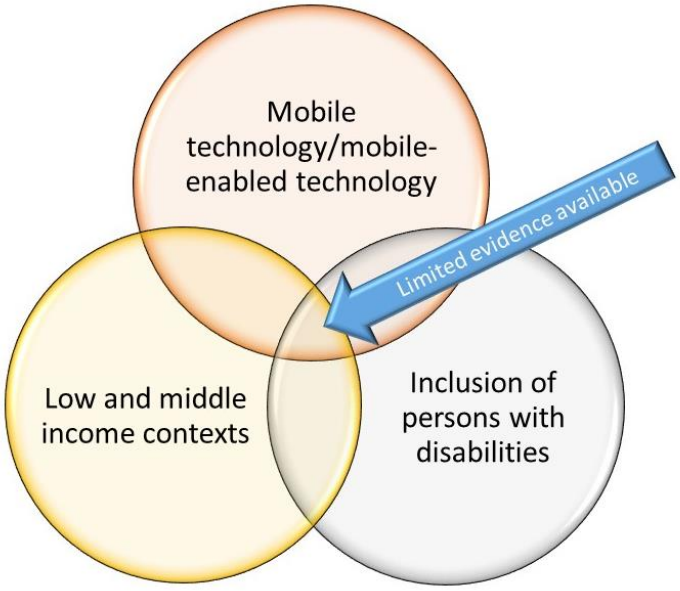
The search of these ICT focused journals was accompanied by internet search and appropriate key words and search terms. A number of experts in the field (listed in the Acknowledgements section) were also identified and approached for recommendations and contributions. Many of the examples included are taken from blogs, product launches, news articles or webpages

[25] https://ict4dblog.wordpress.com/2010/04/14/ict4d-journal-ranking-table/

Annex 2 - Strength of the evidence base

Using the DFID How to Note on Assessing the Quality of Evidence for guidance, 15 papers included in this report could be considered 'evidence'.[26] 18 papers were not considered as evidence. Ten out of the 15 individual studies included as evidence were judged to be of high quality, three were judged to be of moderate quality and two were judged to be of low quality. The quality of the body of evidence was found to be high, as the majority of single studies reviewed were assessed as being of a high quality, demonstrating adherence to the principles of research quality. As only 15 studies were included in the assessment, the size of the body of evidence is considered to be low. In terms of context, from the papers classed as evidence, four of the papers focused on multiple countries. Two studies focused on Ghana, while one study was included for each of Indonesia, Colombia, South Africa, China, Bangladesh, Turkey and Sri Lanka. The geographical focus of two papers was not clear. The consistency of the body of evidence could not be established, as the papers assessed were based on a variety of different designs or methods and applied in a range of contexts.

It was noted that some investigations focus on mobile technology and social inclusion (for example Chigona et al 2009), but do not focus specifically on disability. Other research focuses on internet connection and its impact on persons with disability (for example Guo, Bricout & Huang 2005) but do not focus specifically on mobile enabled connection. There is a wealth of literature on relevant topics including the digital divide, mHealth, inclusive innovation, ICT for development and other relevant themes. Where possible, this report has included relevant literature while acknowledging where it does not specifically relate to the question in hand. In general, the literature that directly addresses mobile technology/mobile-enabled services and inclusion of persons with disabilities in low and middle income contexts was found to be limited (Barlott, Adams & Cook 2016).



26 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291982/HTN-strength-evidence-march2014.pdf