





People with Disabilities, the Age of Information and Communication Technology and the Prevailing Digital Divide—A Descriptive Analysis

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ABSTRACT

Technology provides a way forward to bringing improvements in every sphere of life. The issue of disabilities is common throughout the world and the practical implications of information and communication technology (ICT) help people with such disabilities to acquire basic physical and learning support. The purpose of this review is to identify the development of information and technologies for disabled people and to bring into account a broad-spectrum descriptive analysis of the prevailing technologies from a socio-economic perspective. This paper also covers the various shades of ICT practices for disabilities, including future direction related to such practices. The methodology adopted for this purpose was the gathering of the latest and updated data from the scientific platforms to bring to the readers only the relevant and up-to-date information. The results generated illuminate the potential benefits of digital technologies for disabled persons. The article discusses the way these technologies overcome the barriers among digital beneficiaries that may suffer from certain disabilities. It also illustrates how technologies are being improved from time to time as per emerging needs. Moreover, the paper is also a directive for the increasing need for inclusive information and technology spread beyond the barrier of disabilities to truly bring about the digital revolution of the world.

KEYWORDS

ICT for disabilities, digital divide, digital revolution, supportive technologies, disability technologies

INTRODUCTION

Disability refers to any physical or mental impairment that limits or hinders a person's ability to perform certain activities that are considered normal for a human being (Safari et al., 2023). This limitation may affect a person's mobility, hearing, speech, sight, or cognitive function, permanently or temporarily (Park, 2022). Disabilities can range from physical disabilities such as paralysis, deafness, and blindness, to intellectual disabilities such as autism, Down syndrome, and learning disabilities (Marimuthu et al., 2022; Park, 2022). Disabilities can also be acquired because of illness, injury, or adverse environmental factors that significantly impact a person's quality of life and ability to participate in social gatherings (Park, 2022). Technology on the contrary helps to overcome barriers of certain kinds to enable people in general and disabled in particular to reach

a better socio-economic compatible life style by supporting access to information, knowledge, and technology which is counted as a basic right of a citizen (AlSadrani et al., 2020; Grishchenko, 2020). This technological access helps them to better integrate into the community through the support of learning and communication facilities within educational, personal, and administrative environments (Kim and Hwang, 2019; Werner and Shpigelman, 2019). This accessibility proves to be of paramount importance for people with any kind of disability and enable them for better productivity in societies (Longoria et al., 2022; Park, 2022). The governmental agencies, non government organization (NGOs), and private sectors related to education, healthcare, and other professions are thus moving speedily toward digital internalization of such information and communication technologies

(ICTs) to work out better productivity drawn for people with any kind of disability (Scanlan, 2022; Egard and Hansson, 2023). This comes with a dual benefit for the user and beneficiary to live an independent life with max benefits in professional and personal lives (Lebeničnik and Istenič Starčič, 2020; Robinson et al., 2020).

The present age of the digital revolution makes it imperative to overcome the digital divide among the masses regarding accessibility, usability, and other beneficial accounts (Longoria et al., 2022). The technology is hence being programmed from a very formational basis to make it functionally operable for people with disability (Johansson et al., 2021; Cheshmehzangi et al., 2022). If the designs are made in such a way that they lack a developmental and learning approach for disabilities, they might enable people that are behind in the digital catch-up with the remaining community and this may develop feelings of alienation among them which may further disintegrate them for their disabilities (AlSadrani et al., 2020; Grishchenko, 2020; Kolotouchkina et al., 2022). That is a difficult path for technological catch-up as then a new aspect of technological development will be separately needed to be incorporated for disabilities (Kolotouchkina et al., 2022). It is therefore ensured mostly that when technologies are manufactured the account of disabilities is kept in consideration and designed accordingly (Kolotouchkina et al., 2022; Vouglanis and Driga, 2023).

The purpose of this review is to illustrate how the different technologies are overcoming information and communication barriers among people in general and the masses with disabilities. The analytics will be drawn based on the usability and accessibility of such technologies from socio-economic perspectives. The data used will be based on recently updated studies from around the world. The review will help readers to get accustomed to the technological revolutions which help people with disabilities of various kinds to experience better learning and professional development accounts within education, healthcare, and other institutional settings. However, while reading this paper it should be kept in mind that no indirect subjugation or discrimination has been directed against people with disabilities; it rather tries to take into account the beneficial needs of market-based technologies and their need, availability, and accessibilities for users with such mental or physical disabilities such as lacking delivery infrastructure, low employment integrations, and other professional lacking among masses. The theme is to create a solution-oriented environment rather than no solution and long-standing discriminations and digital divide. Every person has the right to live a life with equal opportunities to benefit from mainstream communication and informational products to better integrate with employment, education, administrative, and recreational activities as per the provisions of the UN Convention on the Rights of Persons with Disabilities (Barlott et al., 2020; Medina-García et al., 2021; Chadwick et al., 2022; Kolotouchkina et al., 2022). This would enable people with disabilities to have an inclusive technological utilization in policy and implementation in every sphere of life as a way toward lessening the digital divide in the society (Barlott et al., 2020; Gallegos-Rejas et al., 2023; Safari et al., 2023).

METHODOLOGY

In this review study, a methodological and descriptive approach has been acquired to gather only the updated and relevant data from the past 5 years. A quick search using the search items, such as ICT for disabilities, digital divide, digital revolution, supportive technologies, disability technologies, etc., has been performed for this purpose. Relatable data have been gathered from publications acquired from the platforms of Google scholar, Pub Med, Web of Science, and Scopus, among others. Moreover, the literature from only English language origin has been made part of this review study for ease of global understanding. It is pertinent to mention here that this study is not sponsored by any funding and does not involve any clinical study that may require ethical approval or informed consent.

Eligibility criteria

The studies included mostly were from the last 5 years (2018-2023) which have exacerbated the technological integration within different fields of education, healthcare, administration, and other professional grounds. The search items have been limited to the key keywords as elaborated earlier and the selected article included peer reviews journals, reviews, research studies, short letters to the editors, and periodicals belonging to socio-economic and educational perspectives of such technologies regarding disabilities. Moreover, the data lacking the details of articles, dissertations, thesis, books, technical reports, or conference proceedings were avoided due to a lack of detailed accessibility and understanding.

RESULTS

Defining disability

The international healthcare community defines disabilities as a functional lacking of normal body ability of a person that may prevent them from developing and performing normal life activities (Yeganeh, 2019). These disabilities have profound impact on learning, growth, understanding, and maturity, and development of a complex disability may further impact a person's ability to learn (learning disability) and hence make them step back in acquiring knowledge and performing effectively in academic and professional grounds (Yeganeh, 2019; Bastos et al., 2020). It should be noted that learning disability may often be compiled with low intelligence quotient (IQs) of people which are also accounted for sometimes in intellectual and adaptive disability analyses worldwide (Yeganeh, 2019; Hoq, 2020). Keeping these aspects into account the present study explores the impact of ICTs on people with broad-spectrum disabilities.

Technological revolution vs disabilities

Various applications of the modern age such as mobile, internet, software, apps, different beneficial websites, and social

apps, have surely revolutionized education, healthcare, and the professional world (Afolaranmi et al., 2020; Hoq, 2020). They act to create digital spaces of accessibility and inclusion that help to overcome barriers among the masses regarding information gain and spread and communicational connectivity (Alshahrani et al., 2019). International agencies and national organizations keep imperatively focus the basic rights of citizens to provide quality and equality-based access to ICTs among the masses (Marimuthu et al., 2022). Projects like “Harnessing ICTs for Education 2030” funded by the UNESCO Weidong Group aim to enable the member participating states over the coming years to harness the best possible use of inclusive and equitable use of ICTs for attaining one of the sustainable development goals (SDG4) by 2030 (Ferreras et al., 2017; Ministerial Forum, 2018).

This elaborates the objective approach of the scientific and technological community on scales of the utilization of technology in a subjective manner that overcomes the barriers of disabilities among the masses (Uvarov, 2019; Yazov and Song, 2020). For this purpose, the data are presented to elaborate on what aspect of technology the barriers are being overcome against disabilities. Second, it will also be elaborated on how and why the technological inclusion of disabilities is necessary for themselves as well as for the development and growth of communities on a wider national and international scale. Moreover, light will also be shed on how serious is the disparities among the masses and why there is a further need to enhance technological inclusion to overcoming the digital divide and create a culture of true digital and technological revolution. Additionally, this analysis-based study will help readers understand what fields of research are further needed to achieve better interconnectedness and knowledge spread among people with any kind of mental or physical disability.

ICT and disability—research links

The inclusive approach and efforts for involving disabled masses in the educational and professional fields started two decades ago (Uvarov, 2019). Since then different disabilities such as physical impairments, speech impairment, hearing impairment, and learning impairments have been treated as disabilities, among others (Mavrou and Loizou-Raouna, 2017). With the improvements brought in the fields of biotechnology and biomedical sciences various tools and technologies were introduced especially in the present decade that provided rays of hope for overcoming the underlying disparity barriers in people with disabilities (Ng et al., 2009; Uvarov, 2019). The literature presented over the years also elaborates that technologies that reduce the distance of disabilities in different spheres of life by better equipping them have been developed now using enhanced technologies. For this very reason, the subject of ICT for supporting technologies and rehabilitation of disabilities has been a focus of research for a quite long time (Ng et al., 2009; Harness, 2016). With the rising need for literacy, understanding, and productivity, the masses are now being trained to become a productive part of the society (Berzin et al., 2015; Harness, 2016).

Knowing the implicit needs of this research, it has been encouraged now in academics and social organizations that relevant research studies are conducted, which may provide on-field or soft data for overcoming the prevailing socio-economic barriers in disabled persons (Berzin et al., 2015; Myhill, 2022). Despite the seriousness of the topic, we, however, were not able to generate a greater number of articles on ICT and disability, which showed that further work is needed for the time being to shed light on a critical issue of health science and technology (Witney and Brown, 2016; Osman and Diah, 2017). As some studies elaborated, between the years 1970 and 2011, only a few studies were published on the topic in verified journals, and the actual work began slowly after 2011 (Egan et al., 2004; Adam and Kreps, 2006). Previously the data were more focused on ICT-based learning technologies and how they can be used for disabilities covering a general aspect of assistive technology (Adam and Kreps, 2006). However, presently more focus is drawn on the specific topic owing to the rising understanding of the depth and seriousness of this disability—technology—barrier issue (Adam and Kreps, 2006; Goggin, 2017; Pettersson et al., 2023).

The digital divides among disabilities

People with disabilities often suffer from the lack of accessibility to design, features, facilities, developmental activities, and communication fabrications in services and products that may involve various electronic devices such as television (TV), mobile, internet computer, and other routine devices (Vicente and López, 2010; Goggin, 2017). These disabilities may leave people behind with the regular pace of the technological revolution and indirectly slow down the fast-moving track of development due to disabilities in a certain segment of society (Adam and Kreps, 2006; Ferreras et al., 2017). The difference keeps on increasing as increased resolution technologies are being introduced irrespective of the aspect of disabilities and helps the digital divide manifest at multiple lines such as those linked with IQ, visual and hearing aging, and natural or accidental physical disabilities (Gorski and Clark, 2002; Egan et al., 2004).

The principal areas where these disabilities lack access include the benefits of telephones, TV, internet, and information technology in a broad spectrum and any devices and equipment that are further associated with these technological areas (Cullen, 2003; Guo et al., 2005). Numerous studies indicate functional limitations in areas across analogous and digital technologies where masses suffer from technological lack owing to the inability to use and access based on their particular disabilities (Cullen, 2001). People otherwise with normal functions do not understand and lack enough concern for the accessibility needs of disabilities (Guo et al., 2005). Simple routine tasks, such as attending phone calls, decoding bills and invoices, captioning audios, and website operations, etc., all require the inclusive approach for disabilities for making them part of mainstream social networking (Cullen, 2001; Lussier-Desrochers et al., 2017).

Descriptive analysis

A few accounts where the disabilities and technological hurdles could be exemplified include telephonic barriers for people with hearing disabilities. They feel barriers with all types of telephonic communications whether wireless or landline devices (Lussier-Desrochers et al., 2017). The visually impaired people may also face some barriers to telephonic technologies. Thus, the inclusive implications of such telephonic devices with built-in technologies for making them user-friendly for people with visual and hearing disabilities (Macdonald and Clayton, 2013; Johansson et al., 2021). The design should be made with motor designing of dial and audio outputs compatible with disabilities and normal conditions (Johansson et al., 2021). A range of relay services may also be coupled for such disabilities. Moreover, accessibility can also be improved by providing affordable packages or special concessions for deaf and visually impaired people (Yeganeh, 2019; Johansson et al., 2021).

Similarly, for people who have disability toward TV access, there is a need to improve captioning for people by designing such devices which ensure smooth technological passage to viewers (Sheikh et al., 2019; Afolaranmi et al., 2020; Hoq, 2020). The descriptive video arrangements can also improve the accessibility for visionary disabled individuals. In the same way, independent management and control over the navigation menus can also improve the mechanical switching toward technology (Yeganeh, 2019; Johansson et al., 2021). Similarly, the internet constructs some barriers to accessibility in the user interface and web content sharing for disabled people apart from the lack of general availability and access to computer devices for them (Johansson et al., 2021). Information technology and computer base technologies face the same issues of user inability and interface barriers to properly and efficiently utilize such technologies. Therefore, it is high time that some practical steps are endorsed and practiced within the world to overcome the technological barriers among the masses (Lussier-Desrochers et al., 2017; Johansson et al., 2021).

The right to inclusive communication technologies

In-depth knowledge regarding the specific needs of people with disabilities is very much important for dealing with the infrastructural barriers between masses and technologies. This is important for several reasons, with the most important being that people with audio, visual, and speech disabilities, among others, experience the major barrier toward attaining access to ICTs by acting as the basic consumers of such technologies and services (Macdonald and Clayton, 2013; Mavrou et al., 2017). Thus, they play a vital role by paying a collective impact on manufacturing and service delivery to people. Second, communication technologies that make work easier for people with sensory disabilities may also help people who have intellectual disabilities or those who are aging (Macdonald and Clayton, 2013; Lussier-Desrochers et al., 2017; Mavrou et al., 2017).

Additionally, there is a need that the governments should decide at the national level to promote statistical analyses and proper demographic accounts for enumerating the people with disabilities so that proper supportive arrangements could be endorsed for them and population-based research outcomes could be delivered to the righteous (Lussier-Desrochers et al., 2017; Mavrou et al., 2017; Johansson et al., 2021). Moreover, a detailed policy formation is required for the long-term measures of inclusion for disabilities with technologies. Apart from the government, private companies and international organizations should cooperate with new entrepreneurial settings and technological improvement setups for disabilities around the world (Alshahrani et al., 2019; Afolaranmi et al., 2020; Johansson et al., 2021). The statistical and demographic analyses and number-based approach are important for any practical step ahead, as documented figures always provide a better way to deal with the underlying problems (Werner and Shpigelman, 2019). The economic, social, political, and cultural prospects of disabilities are also linked with the proper figurative account of available technologies and the prevailing rates of disabilities with the aligned access or limitations toward available technologies (Werner and Shpigelman, 2019; Grishchenko, 2020).

Government mandates for technological accessibility to disabilities

There are various arguments in support of government mandates for ensuring accessibility of ICTs for people suffering from disabilities; these may include the necessity to identify the specific groups with geographic allocations so that it becomes easier to identify the disable consumers (Kim and Hwang, 2019; Longoria et al., 2022; Park, 2022). The non-documentation and lack of information increasingly highlight this need. Additionally, there is a need for generalized and market-oriented exercise of such ICT products that enable accessibility to telephone, internet, and computer-based services with technical standard ability and guarantee of greater interoperability in a wider-scale community of people with disabilities (Egard and Hansson, 2023; Gallegos-Rejas et al., 2023; Safari et al., 2023).

Various forms of ICTs and the linked digital divide

Telephonic accessibility

The rising usage of mobile phones worldwide makes it an imperative need of today's man. It ensures the independence of a citizen toward communication and information gathering for masses in general and those with disabilities in particular, as technology is made to assist man in what they lack (Bissoli et al., 2019; Toquero, 2020). Moreover, these technologies enable better integration of disabilities within the community. Telephone access simply enables the disabled to overcome language barriers, access health information, buy food, find family members, and hold a medical appointment, among other such routine tasks (Bissoli et al., 2019;

Goggin et al., 2019). However, if one simply thinks that a normal mobile phone can fulfill these needs for people with disabilities, then that will be wrong as the people with such impairments need a different aspect of improved technologies that may fulfill their needs (Goggin et al., 2019; Campoverde-Molina et al., 2020). Even Smartphone and 3G networking is not compatibility drawn with the impermeabilities of people. It is therefore recommended that future technologies and even present technologies should be developed and designed to overcome the issues of people with disabilities in the future (Borgström et al., 2019; Chadwick, 2019; Jaeger, 2022). The workable solutions may include the manufacturing of hearing, speech, and visually compatible services inbuilt within the modern smartphone and involving relay-based telecommunication services for ensuring industrial-scale technological standards and user accessibility and ease of use (Borgström et al., 2019; Reid, 2020). Moreover, modern solutions may involve a calculative inclusion of services like interactive voice response and voice over internet protocol services to be made as a built-in technology in new-generation smart phones (Alfredsson Ågren et al., 2020; Reid, 2020).

Telecommunications relay services vs the digital divide

A generalized and wide-scale ubiquitous system of telecommunication worldwide holds the potential to significantly reduce the ICT barriers within communities. In advanced countries such services were already introduced a long time ago and now analyses are being drawn about the benefits associated with such measures (Fong, 2009; Ng et al., 2009; Reid, 2020). The data show a wiser beneficial account for bringing updated technologies which may include services like speech-to-speech relay, captioned telephonic relay, internet protocol relay, hearing carry-over, voice carry-over, and the recently introduced video carry-over services (Ng et al., 2009; Harness, 2016; Mavrou and Loizou-Raouna, 2017). These relay services have surely enhanced the overall mandate of digitalization by reducing the prevailing digital divide among the masses to a greater extent (Myhill, 2002; Berzin et al., 2015).

Developing telephone standards for accessibility vs digital divide

Worldwide various networks and industrial units are working to ensure the industrial standard response to telecommunication regulations. Consumer advocates and social media campaigns have influenced the outcomes (Velaga et al., 2012; Ferreras et al., 2017; Ramsetty and Adams, 2020; Pettersson et al., 2023). Several companies including the alliance for telecommunications industry solutions help promote the technical support and operational solutions for the ICT-based digital integration of people with disabilities (Jumreornvong et al., 2020; Reid, 2020). The need is, however, to make advocates of technology and manufacturers for the willingness to compromise a workable environment for the betterment of disabled communities (Reid, 2020).

Television vs the digital divide

TV is uncertainly the most compatible and major source of information and news for the masses as it brings about the current news into account along with the element of the entertainment industry which is needed by the general masses (Fong, 2009; Harness, 2016). Video programming has eased such access which is generalized for granted by the masses but for people with disabilities, the same technology knows the need (Borgström et al., 2019). It is therefore advocated to improve revisioning access by incorporation. Moreover, there is a need to bring some sort of ease of access to other features of operational and control panels and remote-control devices into home appliances (Harness, 2016; Ferreras et al., 2017; Reid, 2020; Jaeger, 2022). It is therefore mandated that a better systemic change may be brought in all TV sets or maybe user-specific TV sets so that people may choose the kind of TV according to their needs.

Captioning and video description against the divide

Captioning, subbing, and dubbing must be rightly utilized in various apparatuses that work on the principal video programming as the aid of captioning helps greatly in accessibility and understanding for people with various disabilities (Witney and Brown, 2016; Ferreras et al., 2017; Ramsetty and Adams, 2020; Meleo-Erwin et al., 2021). This can be achieved by the installation of decoder chips within modern TV sets apart from embedded captioning options in the video programming designs (Reid, 2020; Gu, 2021). This kind of service applies to all types of TV service providers such as TV cable services broadcast stations, satellite TV services, and telephonic or mobile phone-based TV services, among others. Similarly, the aids of video description involving the verbal depictions of key visual elements are necessary for people with vision difficulties. This secondary audio programming will enable people to the TV program with the natural pauses inserted in dialogues in a natural flow (Bissoli et al., 2019; Campoverde-Molina et al., 2020; Jaeger, 2022). All these sorts of efforts are recommended as people need emergency information at best if not entertainment at the very least.

Accessible interfaces vs the digital divide

The basic purpose in all the previously and presently discussed articles is the proposal to reinstate descriptions in audio, visionary, and video formats for better user accessibility and user interface experiences to control the on-screen manual (Fong, 2009; Uvarov, 2019; Yazov and Song, 2020). Such technology is modified to such a great extent that it may provide low vision to blind people and low hearing to people with hearing impairment. The only need is to routinely reinstall them in routine apps and technologies (Mavrou et al., 2017; Uvarov, 2019). This may include accessing a single or a small series of buttons on the remote controls linked with on-screen menus for activating special services linked to ICT technologies for disabled people. Contrarily the technology made through

programming guides such as the online on-screen TV programming display may even help to navigate the real-time information in visual display (Ee Wong, 2012). If the work continues in a positive direction there is hope that soon such electronic and tech products will be in the market which will exhibit the option of self-configuring accessibility, and voice commands to enable the apps with greater ease and speed for disabled persons (Witney and Brown, 2016; Ferreras et al., 2017).

Internet and computer technologies against the digital divide

ICT is the backbone of modern economies, which is an admired fact endorsed by developed as well as developing economies around the world. Technology advocates in general inspire the idea of mainstreaming ICT to each citizen for the associated socio-economic and political benefits; however, they may not likely or always advocate for the cause of disability consumers (Cullen, 2003; Egan et al., 2004; Gorski, 2005). It must be considered that people with disabilities are a major part of the community and there is a need to successfully integrate them into the community for which technology can prove a successful refuge. Due to modern technologies, artificial intelligence (AI)-based devices, and the internet, a diverse range of applications that were not known or experienced by humanity have now been accustomed (Cullen, 2003; Lussier-Desrochers et al., 2017). Novel AI technologies, such as ChatGPT, which have revolutionized the world of e-commerce and learning, have presented a great deal of learning opportunity for mankind, and the same could be utilized for disabled people if programmed in such a manner that may benefit the ignored class of individuals (Macdonald and Clayton, 2013). The accessible user interface on tech equipment, interoperable text transmission speech recognition, and visual audio aids can be made part of such applications to create a sort of helping hand for people with disabilities (Johansson et al., 2021).

The health information and biotechnology field is widely employing such technologies that may help overcome the medical disabilities in people. Wireless internet access for deaf people is one such measure that enables them for emergency services and phone calls (Albejaidi and Nair, 2019; Alshahrani et al., 2019; Afolaranmi et al., 2020). Similarly, such databases are being developed worldwide with an interlink among them that ensures the use of advanced health information with the consumer user interfaces for personal claims or management of an affair. Similarly, efforts are on the way to develop telephonic communications where the telephone prescription (Rx) service connects various forms of relay service (Alsufyani et al., 2020; Marimuthu et al., 2022).

Standard ICT development against the digital divide

The standardization of ICT technologies can only be enacted through governmental policies and private–public partnerships along with community participation to bring about

comprehensive success (Marimuthu et al., 2022; Park, 2022). As the government is the larger purchaser of common marketplace technologies and can enable accessibility toward employees and common masses more easily than private institutes, the steps such as the federal government accessibility to websites for disabled consumers help at a national scale (Longoria et al., 2022; Safari et al., 2023). Similarly, the organization that represents the people with disabilities or who advocates for them can also play a progressive role in implementing the standard-making process and trust-building relations with the ICT companies in a private–public partnership manner (Gallegos-Rejas et al., 2023). Moreover, the participation of the public and disabilities as significant communities of voting can lead to better decision-making in favor of an inclusive community and a better relationship with the disability consumer and industry (Yeganeh, 2019; Johansson et al., 2021). This is significant as disability groups must represent themselves in the federal advisory and standard-making communities to bring their grievances to the notice of community members. All these measures are important for a practical approach toward people with disabilities rather than limiting them to theoretical accessibility of basic needs and rights (Macdonald and Clayton, 2013; Lussier-Desrochers et al., 2017).

Web site accessibility against the digital divide

As elaborated earlier, people with disabilities need to access websites that the common masses can easily approach and take help in various matters. Thus, the key component in good web design may include the website outlook and design with a sure friendly nature and content design with the aspect of disability users in mind (Campoverde-Molina et al., 2020; Ferati and Vogel, 2020). Moreover, the availability of web browsers and media players with reduced gaps and improved user interface will be a positive step in this regard. Similarly, assistive technologies such as screen readers, modern assistive keyboards, switches, lighting signals, and scanning software may also aid people with disabilities (Adam and Kreps, 2006). Furthermore, the consideration of the user's knowledge, experience, age, disability, adaptability, and usability must also be integrated into the web design (Ferati and Vogel, 2020). The web designers, authors, writers, code developers, programmers, and editors who contribute to successful website development must be aware of the ethical concern and the practical notion behind the need to ascertain disable consumers in the accessibility concerns (Ferati and Vogel, 2020).

If these conditions are ignored, the website may present an unfriendly and disability-lacking aspect in its development, and the developer may lose that segment of society who is suffering from some kind of disability. An effective way of overcoming such problems could be exemplified by the common use of video descriptions on websites for product sales that help the hard of hearing people with an accurate judgment of the kind of product they want to purchase (Adam and Kreps, 2006; Ferati and Vogel, 2020). Similarly, the right use of captioning, audiovisuals and other liked descriptions help in certain other sorts. Companies like the World Wide Web

Consortium develop such interoperable technologies with software, websites, tools, guidelines, and user specifications for ease of access and usability for people with disabilities (Campoverde-Molina et al., 2020; Ferati and Vogel, 2020).

Disability access to cyberspace and cyber technologies

Access to cyberspace and cyber technology is crucial for people with disabilities. With technology, individuals with disabilities can communicate, navigate, and participate in social activities in ways that were not previously possible (Harness, 2016). For example, individuals with visual impairments can use screen-reading software to navigate websites and read emails. Individuals with physical disabilities can use assistive technology such as voice recognition software and adaptive keyboards to access the internet and use computers (Harness, 2016; AlSadrani et al., 2020). Cyberspace provides an alternative way for individuals with disabilities to access information, communicate with others, and participate in various activities that they may not be able to do in person. It can also provide opportunities for individuals with disabilities to work from home and access job opportunities that were previously unavailable (Ee Wong, 2012; Goggin et al., 2019). However, there are still many challenges that need to be addressed to ensure that people with disabilities have equal access to cyberspaces and cyber technology. For example, websites and apps need to be designed in a way that is accessible to individuals with disabilities, and there needs to be more investment in assistive technologies and training for those who need it (Chadwick, 2019).

Digital divide: reducing low-level internet use by people with disabilities

Disability curtails internet use automatically for people with disabilities, and despite so many new developments in ICT, there still lies a lag between the usability of disabilities and internet-based products (Vouglanis and Driga, 2023). And this lag includes the difficulty in accessing usability, understanding, and nonprovision of user-friendly devices to the cornered people. And this should not be mixed with the aspect of economic wealth or the metropolitan nature of affairs when considering the national barriers underlying disability people (Jaeger, 2022; Vouglanis and Driga, 2023).

Policy-oriented solution for reducing the digital divide

As elaborated earlier, government-based policy formation and implementation could prove the best solution to increase internet access for people with disabilities. Some of the policy options may include creating incentives and discounted schemes for disabled internet users (Uvarov, 2019), providing modified or discounted loans on assistive ICT technologies for people who are disabled and cannot afford expensive technologies, and coupling the expenditure

of computers-based technologies in generic programs with mainstreaming toward people with disabilities according to budgetary necessity (Uvarov, 2019; Grishchenko, 2020). Similarly budgeting or subsidizing internet provision should be made for special education programs and specialized institutions for disabilities.

Financial and technical assistance for the website content development and design specifically for people with disabilities should also be carried out. Furthermore, in general, inclusion to the already developed websites, such as captioning, sign language, and assistive technologies, for better screen readings and understanding should be carried out for disabled users (Werner and Shpigelman, 2019). Similarly, exhorting content creators to employ standard deadlines and ethical considerations while providing intellectual content to create better ease of understanding for people with both intellectual and physical impairments is a need for the future (Uvarov, 2019; Chadwick et al., 2022).

Further recommendations for catalysis of change

Some recommendations that are advocated worldwide for ensuring positive and inclusive communication age can include statutory and legal mandates, ethical guidelines, and standardized rules and regulations for industries, communities, government, and common masses to include people with disabilities as a regular learned member of the society (Bissoli et al., 2019; Borgström et al., 2019; Ramsetty and Adams, 2020; Toquero, 2020; Gu, 2021). Some of the considerations in this regard may include the following:

- The participation of government agencies, national campaigners, and disability representation for technological integration for the righteous application of proclaimed and devised measures (Yeganeh, 2019).
- Development and deployment of policy, resolutions, legislations, principles and positions, guidelines, and legal statements on practical grounds.
- Technological implications in usual places such as buildings, alerts, websites, and user-friendly technologies (Yeganeh, 2019).
- Creating broadband employment opportunities by the involvement of NGOs, consumer advisory bodies, and nonprofit groups for the better inclusion of disability members in e-commerce and other ICT-oriented economic wings (Barlott et al., 2020).
- Creating special mandates, programs, and calls for entrepreneurship that regard the needs of people with disabilities (Mavrou et al., 2017).
- Disability representatives that advocate the issue to higher statutory and regulatory authorizers for government provision in favor of ICT couple disability inclusion.
- Federal rules and regulations to openly conduct procedures for disability inclusion in organizations for greater participation (Medina-García et al., 2021).
- A public-private partnership between disability representatives and the private sector companies or government authorities for a statutory and regulatory face-to-face

disability inclusion in routine tasks (Ferrerias et al., 2017; Barlott et al., 2020).

- Hiring such a workforce or at least a single point of contact, an ombudsman, or a committee who accounts for the concerns of disability consumers (Ng et al., 2009; Muzafar and Jhanjhi, 2020).
- Creating an environment where sponsorships are given and commercialization is ensured for relay service providers, cybertech specialists, captioners, and underseal design captures in the companies for creating ICT technologies not only help people with disabilities but also other segments of uncommon masses to create a society of inclusiveness (Ee Wong, 2012).
- ICT and disability contact in the research and education sector by mainstreaming the integration of education technologies and software with a couple of regard to disability needs (Witney and Brown, 2016).
- Training of teachers, researchers, professionals, and correspondence establishment between students of disabilities for a positive inclusive nature of community involvement (Fernández-Batanero et al., 2019; Rueda and Cerero, 2019).

CONCLUSION

After the industrial and computer revolution, ICT is the perspective of the modern world that tries to inculcate all

the elements of connectedness, modernism, and inclusiveness. ICT has the potential to access people regardless of where they are and who they are and thus holds the capability to connect and involve people with any kind of disability without creating divide in the society based on exclusion. The major gap lies in the lack of accessibility and usability perspective in designing such technologies that would otherwise hold the potential to successfully overcome this gap of knowledge and practices. The digital divide that persists within a few communities now is only a little behind before it deeply involves all the members of society by creating an electronic interactive system of technologies. The need is to rightly design, promote, implement, employ, and enhance the user application of such disability-driven technologies. Only by acquiring such measures discrimination can be reduced between the masses and a more inclusive environment could be created where people with disabilities could benefit from ICT like common people.

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