Accessible Telecommunications International Best Practices

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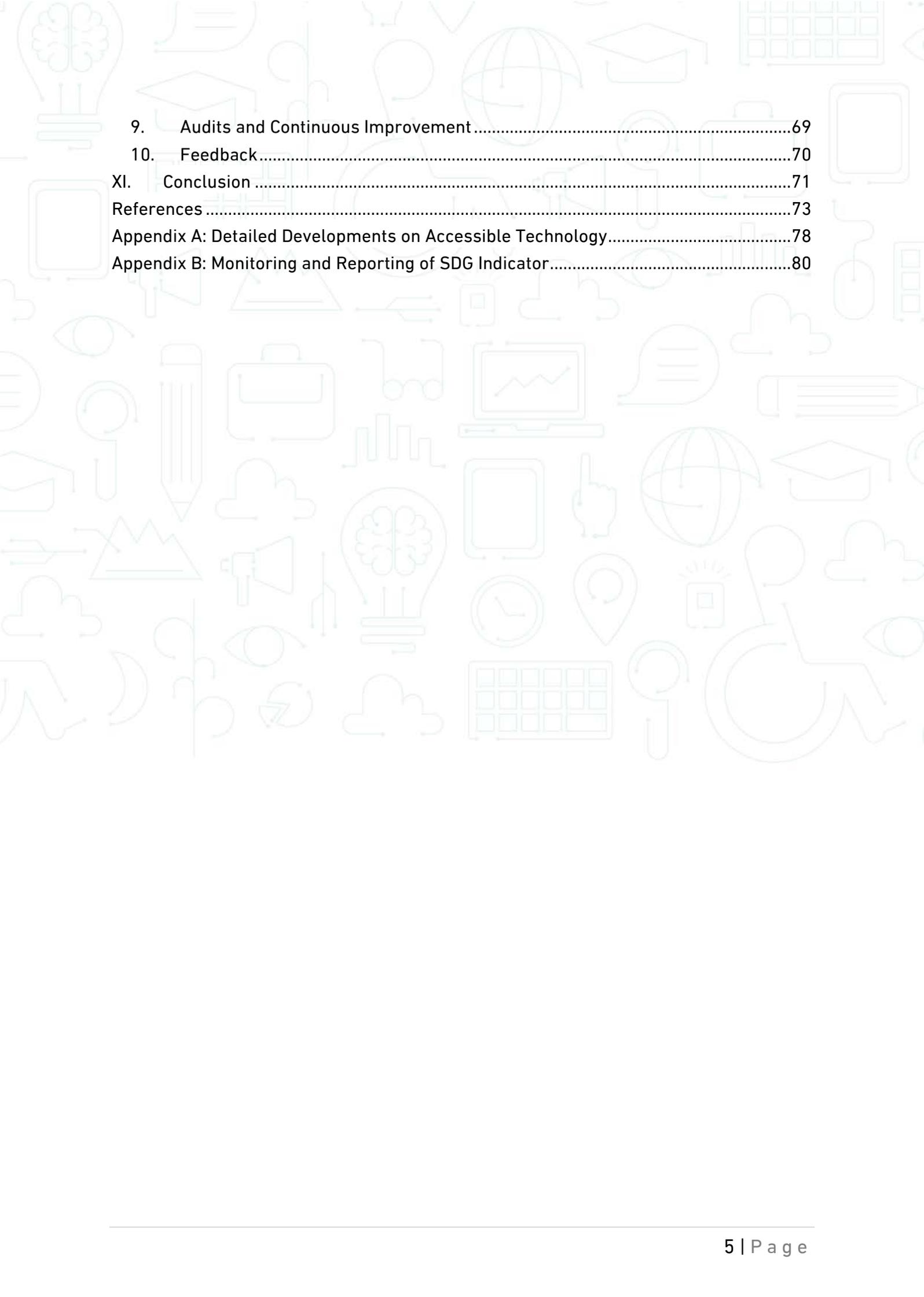
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Abbreviations

ADAAG	ADA Accessibility Guidelines for Buildings and Facilities
ACCN	Australian Communications Consumer Action Network
ADA	American Disability Act
AT	Assistive Technology
ATAG	Authoring Tools Accessibility Guidelines
ATM	Automated Teller Machines
CPA	Consumer Protection Agency
FCC	Federal Communications Commission
FPF	Future of Privacy Forum
G3ICT	Global Initiative for Inclusive ICTs
GAATES	Global Alliance on Accessible Technologies and Environments
GAN	Global Accessibility News
HLPF	High-Level Political Forum
IAAP	International Association of Accessibility Professionals
ICT	Information and Communication Technology
IDA	International Disability Alliance
IoT	Internet of Things
ITU	International Telecommunications Union
NRA	National Regulatory Authorities
PWD	Persons with Disabilities
SDG	Sustainable Development Goals
TRS	Telecommunication Relay Service
TTS	Text-To-Speech
TTY	Teletypewriter
UAAG	User Agent Accessibility Guidelines
UD	Universal Design
UN	United Nations
UNCRPD	United Nations Convention on the Rights of Persons with Disabilities
UNESCO	United Nations Educational, Scientific and Cultural Organization
USF	Universal Service Fund
USO	Universal Service Obligation
VRS	Video Relay Service
W3C	World Wide Web Consortium
WAI	Web Accessibility Initiative
WCAG	Web Content Accessibility Guidelines
WHO	World Health Organization

Report Roadmap

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Introduction

The exclusion of people with disabilities is an economic and human rights issue. Since this demographic represents close to 15% of the world's population, their existence in a society ridden with barriers that prevent them from independent living and joining the labor market, and receiving equitable services erodes their dignity and rights, not to mention that it significantly contributes to a state's welfare burden. Recent advances in telecommunication technologies are making significant contributions to alleviate this problem by providing access to skills, education, and employment. Telecommunication has been marking particularly instrumental contributions through the advent of products like mobile device and tablets, which offer a range of functionalities to allow people with disabilities to access information and communication. For example, there has been a significant increase in devices with in-built text-to-speech functionalities, screen readers, voice recognition, and screen magnification features with enhanced accessibility.

Therefore, ICT has significantly eliminated barriers to information and communication encountered by people with disabilities. Despite their significant contribution, ICT and technological advancements on their own cannot bridge the inclusion gap faced by people with disabilities. This is because their use and adaptation to enhance inclusion are dependent upon other factors such as policies, support from various stakeholders, and stakeholders' awareness of the accessible solutions available. This report revolves around the state of digital accessibility in the telecommunication sector in Qatar and discusses international best practices in accessible telecommunications with reference to the topics outlined in the CPRD policy framework.

I.   What is Accessible Telecommunication?

a. Accessibility

Accessibility relates to resources that are user-friendly, low-cost, and easily accessible. Within the telecommunications sector, the term is used to describe the development of digital media basing on principles and processes which allow the support of devices, options, and customizations geared towards meeting the needs of people with different disabilities (Ellcessor, 2015). Accessibility allows people with disabilities to effectively access and use the internet and other media technologies. The United States Federal Communications Commission, FCC, requires that, if possible, manufacturers of telecommunications devices and related service providers make their products and services utile and obtainable to people with disabilities (FCC, n.d.). However, suppose it is impossible for the services and products to be accessible. In that case, the commission requires that they are compatible with specialized equipment and peripheral devices which people with disabilities use. In this regard, manufacturers and service providers are tasked with ensuring telecommunication services and devices can be accessed and used by all people, regardless of disability.

Many people with disabilities are unable to use computer technologies without the help of assistive devices such as customizable interfaces, alternate input devices, and screen readers. According to the World Health Organization, close to 15% of the world's population comprises people with disabilities (WHO, 2020). This statistic attests to the significantly high number of people whose needs should be taken into account when developing digital media since it translates to more than 1 billion people. Furthermore, the design of regular telecommunication devices often obstructs PWDs from being able to use them. For instance, people who are deaf cannot use regular

telecommunication devices as they rely on text and sign-language based communication. A similar situation applies to blind users who heavily rely on tactile and audio feedback making it challenging for them to use smartphones without specialized accessibility features and applications. The impact of telecommunications on human life can hardly be understated. In recent times, much of the world's economy relies on some aspect of technology. Therefore, accessibility allows people with disabilities to improve their economic status by engaging in different activities, not to mention it will enable them a broader social integration.

b. Historical Challenges of Accessibility in Telecommunications

Accessibility has come a long way in telecommunications. Its history can be traced back to 1808, when Pellegrino Turri built a typewriter to enable a blind friend to write legibly (See Appendix A for detailed developments on accessible technology). Presently, telecom accessibility is a more widespread phenomenon. For instance, accessible public payphones contain features like braille and low height. There are also special tariff rates and plans to enhance accessibility, awareness campaigns, and accessible emergency services.

Environmental factors like policies play a significant role in facilitating accessibility. As the International Telecommunications Union, ITU (2014) contends, widespread accessibility depends on an enabling environment. Increased telecoms accessibility is sparked by regulatory and policy frameworks, which result in growth in TV and mobile phone accessibility. In 1998 an amendment of the United States Rehabilitation Act of 1973 was effected, which increased accessibility for Federal

Telecommunications. The amendment stipulated that federal agencies who use or procure telecommunications ensure they do so in a manner that will allow the public and federal employees with disabilities to use the products and services similarly to people without disabilities.

However, in as much as the amendment increased access, it was limited in that it only applied to Federal Agencies, with no mention of private institutions. Additionally, there was vagueness regarding the benchmark to be used in examining compliance with accessibility regulations. For instance, the amendment led to an increase in adjustments and devices that accommodated visual impairments, while other types of impairments received less attention. Another challenge was defining the term 'accessibility.' Instituting benchmarks was likely to leave out people with other forms of disabilities. For example, the Americans with Disabilities Act (ADA) in 1990 regarded disability as a social construct. The ADA acknowledged medical impairments, but a given condition was only fit to be considered a disability when social conditions constrained the individuals in one way or another.

There have been major developments over the years that increased the scope of accessibility in telecommunications services. Signatories of the United Nations Convention and Rights for Persons with Disabilities (UNCRPD) must adopt measures that facilitate access for people with disabilities in equal measure to those without disabilities (UN, n.d.-a). The measures apply to ICT, emergency services, and telecommunication services.

Technological developments have also enhanced accessibility in telecoms. For example, disruptive technology in the form of home automation is rapidly gaining traction in the telecoms sector. Home automation relates to the control and monitor of smart homes using telecommunication devices like mobile phones. This development relies on the use of Internet of Things (IoT) to connect home devices to internet protocols.

II. Why is Telecoms Accessibility Important?

Telecommunications have taken a central role in modern-day interactions and activities. For this reason, they should be accessible to all people, not just persons with disability. This will allow everyone to communicate in diverse educational, cultural, and professional situations. Aside from this, telecommunications should also encourage inclusion and participation. This section considers the importance of accessibility in allowing telecommunications to achieve these and other ends.

a. Equitable Communications

Human beings should be able to access information regardless of whether they have a disability. This access relates to their empowerment to seek, impart, and receive information and is a fundamental component of the freedom of expression. According to Article 19 of The Universal Declaration of Human Rights (UN), it is stated that "Everyone shall have the right to freedom of expression; this right shall include freedom to seek, receive and impart information and ideas of all kinds, regardless of frontiers, either orally, in writing or in print, in the form of art, or through any other media of his choice." The current technological and economic environment has facilitated the development of the internet, which has led to an unprecedented opportunity for information sharing. Allowing everyone to access information is beneficial because it gives them a chance to participate in dialogues and conversations that affect them and improve the quality of their lives. Communication is powerful because it gives people a voice to demand better services and contribute to a better society. It is a human and civil right that people with disabilities 'access the same content at the same time and cost as people without disabilities' (Lazar & Stein, 2017).

Given that communication plays a critical role in sustainable development, it should be equitable to give everyone a chance to contribute. Further evidence of the crucial role of communication in development can be found in the United Nations Sustainable Development Goal 16, SDG-16. Target 10 of the goal is to 'ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements (see Appendix B). Equitable access to information underpins inclusive, knowledgeable, and healthy societies. This can be achieved by modern telecommunications technologies, which can be accessible to people with disabilities when the manufacturers include these aspects in designing and manufacturing the device. A significant factor is that this process does not include incredibly higher costs.

b. Inclusive and Participatory Knowledge

It is undeniable that telecommunications have revolutionized learning and education. E-learning has gained significant traction in recent years, not to mention that it has also increased in terms of credibility. Telecommunications play a crucial in enhancing the learning process because of the presence of tools and services that offer differentiated learning tailored to meet individual student needs. This development provides incredible opportunities for people with disabilities because they can participate in different capacities. For example, students with disabilities can interact with teachers and peers using their communication devices including text instead of voice, electronic picture boards, instant messaging, conferencing tools

Additionally, accessibility also benefits people without disabilities. For example, the text-to-speech functionality available in iOS devices, while this feature ensures the devices are accessible to people with disabilities, people without often use them as well,

as it is convenient in certain circumstances (Lazar & Stein, 2017). Besides, accessible telecommunication also ensures that learning and knowledge acquisition is inclusive. For instance, speech recognition software allows students with disabilities to participate in class activities concurrently with other students, such as working in groups. Accessibility ensures that people with disabilities are not excluded from information acquisition and communicating with their peers, creating an environment that enhances creativity and fosters engagement, which results in innovation.

As illustrated in Figure 1, telecommunication accessibility can contribute in several ways to advance inclusive and participatory knowledge to benefit people with disabilities

Accessing and Understanding Content

- Learning resources can be offered in electronic formats
- Apps and online resources facilitate learning of math and science for students with visual, hearing, and cognitive disabilities
- Differentiated learning materials - videos, pictures, text
- Devices can be equipped with assistive software and apps (touch navigation, magnification, text-to-speech, voice recognition)
- Smart devices such as tablets can be provided as accommodations for students with disabilities
- Lectures can be recorded for conversion to a suitable format or to replay later as suited to a students's needs
- Photos can be taken in real time and used with photo editing, story making and other software for learning

Content Creation and Classroom Participation

- Students can use alternate means for content creation such as voice recognition software
- Students with disabilities can interact with teachers and peers using their communication devices including text instead of voice, electronic picture boards, instant messaging, conferencing tools
- Electronic whiteboards enable paticipation accross all functional abilities

Organization and Memory

- Calendars, memory aids, categorization and organization apps can assist in reducing concentration, focus, abd memory barriers
- Memory aids can support both learning tasks as well as daily functioning tasks in an educational setting

Figure 1: Using ICT to enhance and participatory knowledge

These tools enhance the learning process by allowing the accommodation and differentiation of students with disabilities in writing, reading, and mathematical concepts. Figure 1 indicates that there are a variety of accessible telecommunication resources designed to aid people with different forms of disabilities to excel in their academic journey. This is a significant aspect because inclusion is only relevant if it can meet the unique needs of each student. Accessibility fosters mechanisms that help break down barriers to education and literacy. For instance, modern day classrooms are increasingly incorporating tablets for instructions. While these devices have accessibility features, they also contain applications that aid students with disability to understand concepts in science and mathematics, and help them with electronic note taking. These examples of incorporating the concept of accessibility in telecommunication technology used in classrooms demonstrates how it can empower people with disabilities by allowing for participatory and inclusive knowledge.

c. Economic Empowerment

Accessibility of telecommunication also fosters economic empowerment for people with disabilities. This feature stems from the ability of telecommunication to link people with jobs and employment opportunities, skills, and professional networks. The internet and technology have revolutionized the corporate world in multiple ways. For instance, people can look for jobs online, and apply from their homes via emails. Ensuring such resources are accessible to people with disabilities allows them to receive and harness such opportunities to attain economic empowerment. Aside from these, various work processes have also shifted and are being conducted in online spaces. For instance, companies are increasingly adapting cloud-based content sharing, video collaborations, and content management, not to mention the advent of virtual collaboration groups. Accessibility allows these developments to consider the needs to people with disabilities and ensure they are not disadvantaged with technological advancements in telecommunication field.

Aside from these changes in the employment sector, self-employment and freelancing areas have also seen a change in how business is conducted. People are relying more on the internet to source clients and deliver work, which allows collaboration among individuals from diverse countries or continents. This development increases the opportunities available for freelancers as it has greatly contributed towards the growth of economies. Fostering accessibility allows people with disabilities to use ICT to empower themselves. For instance, people with disabilities can opt to pursue self-employment and entrepreneurial venture via the internet because formal employment poses different barriers to them.

As illustrated below telecommunication accessibility can enhance economic empowerment for people with disabilities.

Completing Work Tasks (e.g. Document Processing, using the Web, Accessing Benefits Information)
- All types of documents and data can be provided and accepted electronically instead pf print only
- Computing devices for work can equipped with test-to-speech, Voice Recognition, Magnification, Braille Displays, Optical Character Recognition, and other Accessibility Features
- Documents and data can be accessed and worked on electronically

Communications and Interactions (with clients, colleagues)
- Desktop and mobile instant chat platforms and real-time text facilitate communication for persons with hearing and speech impairments
- Text and video telephony can facilitate internal and external phone calls through an interpretor

Schedule and Process Flexibility (e.g. to accommodate needs for breaks, schedule medical provider visits)
- Remote work platform and policies allow employees schedule flexibility
- Mobile devices facilitate anytime, anywhere work
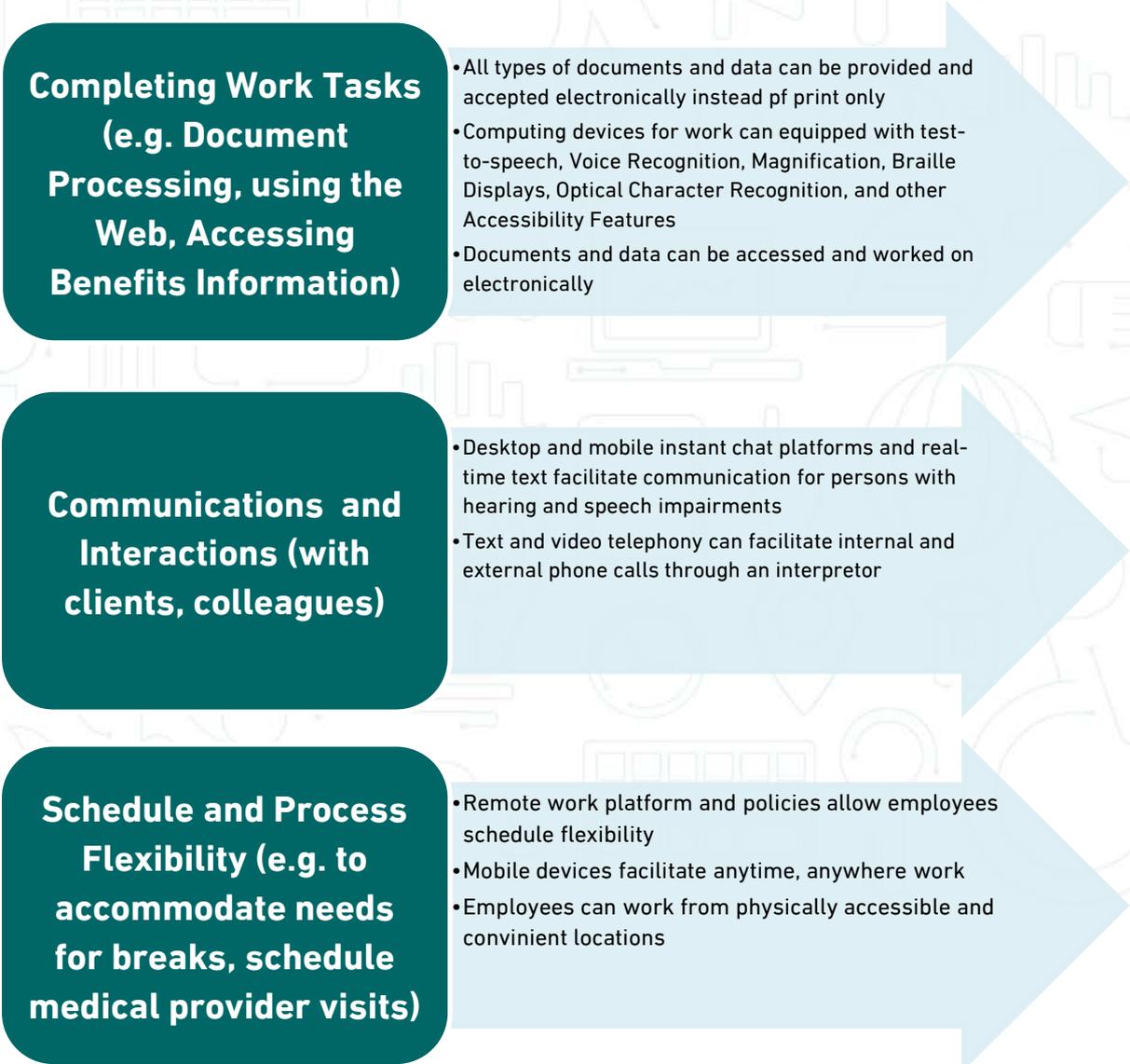- Employees can work from physically accessible and convinient locations

Figure 2: Telecom Accessibility and Economic Empowerment

d. Independence and Autonomy

Accessibility can enhance the independence and autonomy of people with disabilities through ICT. The role of ICT in the current labor economy can hardly be overstated. Even so, people with disabilities are disadvantaged because they are constrained by environmental, social, and financial barriers that prevent them from acquiring ICT skills. UNESCO (n.d.) contends that advocating for accessibility using ICT will enable the organization to achieve several milestones, including:

- Developing innovative solutions to fight discrimination, social exclusion, and poverty by applying ICT through Open Solutions.

- Building the capacity for media, education, information, and ICT professionals regarding the design and application of accessible content and inclusive technologies and services.

- Mobilize partners from all over the globe to advocate for the rights of people with disabilities.

- Design the appropriate and effective policy frameworks to integrate inclusive ICT in organizations and various institutions

Ultimately, these steps will allow people with disabilities more independence because it will create a society in which they can freely and comfortably participate, not to mention that it will also open up opportunities for empowerment at different employment levels. In addition, the advent of IoT in telecoms greatly enhances accessibility for people with disabilities in various capacities. For example, people with visual impairments can access products like Aira Smart glasses and Orcam, which enable them to access written information and easily navigate their surroundings (The Future of Privacy Forum, FPF, 2019). This enhances their independence. Furthermore, there are smart home technologies that benefit people with physical disabilities. An example is Nest, which allows them to control items they may have difficulty controlling,

like doorknobs, lights, and security systems. There are also reminder apps that provide people with developmental disabilities with reminders to take their medication.

Accessibility also allows IoT to collect more information to enhance the experience of people with disabilities. For example, IoT can collect data on the unaddressed needs of this demographic. This data can be used in research and development to create products and services more aligned to their specific needs. In this regard, it facilitates closing in on the data divide. The Universal Design of IoT also benefits this demographic with other services that enhance autonomy, such as virtual assistants, voice recognition, and auto-complete technologies. Besides, these features are also used by people without disabilities for convenience purposes.

III. United Nations Convention on the Rights of Persons with Disabilities

The United Nations Convention on the rights of persons with disabilities, UNCRPD, was adopted in 2006. According to the United Nations, the convention is intended to 'promote, protect and ensure the full and equal enjoyment of all human rights and fundamental freedoms by all persons with disabilities, and to promote respect for their inherent dignity.' People with disabilities as relates to the convention include those with long-term mental, physical, sensory, or intellectual impairments who are hindered from achieving a full participation in society due to various barriers. The UNCRPD guides and enhances the understating of significance of accessibility in allowing equal opportunity to people with disability. Accessibility allows people with disability to 'live independently and participate fully in all aspects of life'. Enforced in 2008, the convention set the standard for understanding and implementing the rights of people with disabilities globally.

The UNCPRD comprises a political and legal commitment of the international community to include the perspectives of people with disability and the disability concept in development and other societal aspects. The UNCRPD requires the state parties to protect and promote the human rights of people with disabilities and ensure they can lawfully enjoy these rights. Additionally, the parties are required to promote and facilitate full equality of people with disabilities under the law.

UNCRPD comprises of 50 articles which address diverse concepts. For example, article 3 outline the Convention's general principles, article 4 is concerned with the general obligations of the parties, while articles 5-32 comprise the rights of people with

disabilities and the state parties' obligations towards them. Article 9 of the convention focuses on accessibility.

a. Article 9- Accessibility

Article 9 of the UNCPRD aims to empower people with disability participate in society without restrictions and live independently. The article requires state parties to facilitate the removal of barriers and obstacles to accessibility such that people with disabilities can have a fulfilling and all-encompassing experience as everyone else in society. The state parties are to fulfil this requirement in different sectors including transportation, the physical environment, information and communications-and associated technologies and systems-, and other services and facilities that are provided to the public. The article also requires that state parties facilitate the training of other stakeholders on issues pertaining to accessibility, and ensure that private entities who offer services and products to the public also comply with the convention. The premise of article 9 is that accessibility is a developmental concern as well as a human rights issue.

Member states can realize social, economic, political, and social inclusion by advocating for and facilitating accessibility for people with disabilities. Article 9 fosters the realization of human rights by ensuring people with disabilities are well taken care of in society. However, this can only be achieved once people with disabilities have equal access to quality education, information, shelter, work, and other significant aspects in society. Ensuring people with disabilities can fully enjoy their human rights calls for policy intervention accompanied with implementation procedures that facilitate the removal of barriers and provision of accommodation, which will ensure full participation and equal access. The United Nations contends that accessibility as applied to people

with disability relates to services, items, spaces, and places, virtual or physical, that are 'easily approached, reached, entered, exited, interacted with, understood or otherwise used.'

Beyond being a right for people with disabilities, the United Nations also affirms that accessibility is a way to ensure they can exercise their freedoms and participate equally with other societal members. Article 9's approach to accessibility also includes an aspect of universal design. This can be seen is subsection h of the article, which contends that member states are required to take measures 'to promote the design, development, production and distribution of accessible information and communications technologies and systems at an early stage, so that these technologies and systems become accessible at minimum cost'. The concept of universal design is also present in subsection a of the article, which is concerned with the construction of buildings, roads, and other infrastructure. This notion of 'universal design' as advanced by the convention relates to intentionally designing programs, products, environments, and services to be usable by all people without the need for specialized design or other forms of adaptation.

Accessibility enables and facilitates a valued existence for people with disabilities, not to mention their contribution to the diversity and well-being of their communities. By advocating for the full participation of people with disability to the society, the convention acknowledges that accessibility enhance these people's sense of belonging, and, in so doing, promotes the social, economic, and human development that allows for poverty eradication. Aside from that, the convention also portrays the significance of including matters pertaining to disability in sustainable development agendas. The United Nations has spearheaded the discourse on accessibility and development, as evidenced by internal development goals like the 2030 agenda for sustainable development.

Below is a visual representation of the number of SDG indicators that address disability and advocate accessibility.
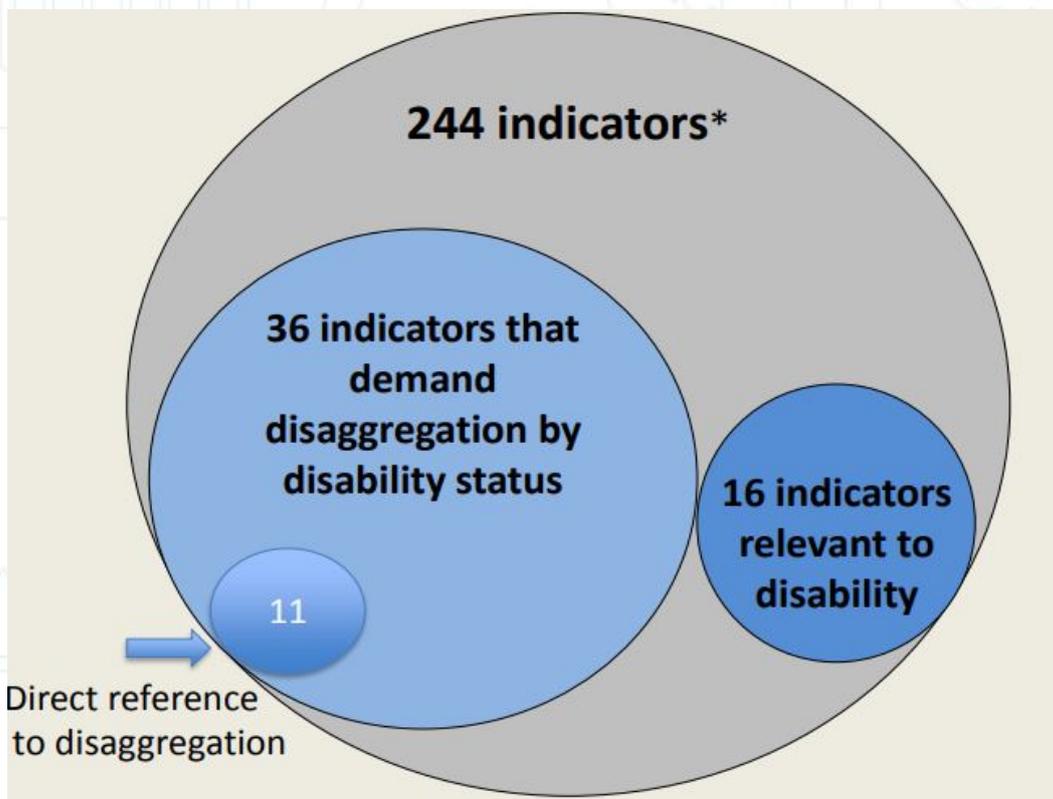

Figure 3: SDG Indicators and Disability

In addition, as illustrated below, eleven of the 17 SDG goals are also relevant to disability.

IV. Accessibility Telecommunication Services

a. Hearing Impairment

Accessibility services for people with hearing impairment is necessary because of telecommunication major reliance on audio communication. There are various types of hearing impairments, ranging from total deafness to minor losses. These affect different parts of the ear. Outlining a few hearing impairments is necessary to rationalize the necessity of accessibility services for these individuals.

Impairment	Explanation
Conductive hearing loss	Damaged middle or outer ear, which prevents sound from getting to the inner ear. This results in a muffled sound.
Sensorineural hearing loss	Damaged inner ear or auditory nerve.
Auditory Neuropathy Spectrum Disorder	The Central Nervous System, CNS, cannot process sound entering into the ear.
Mixed Hearing Loss	A combination of sensorineural and conductive hearing loss
Tinnitus	The presence of crackling or whistling noise, which interferes with hearing. Results from damage by loud noises or old age.

Table 1: Examples of Hearing Impairments

These varieties of hearing impairments give rise to a diverse degree of conditions. Some hearing losses are mild, such that individuals can hear some sounds. Other losses are moderate, severe, or profound. Individuals with mild or moderate hearing losses can hear some sound depending on the loudness. The WHO estimates that 2.5 billion people will be affected by at least one hearing impairment by 2050 (WHO, 2021). Currently, more than 5% of the world's population have hearing impairment. Therefore, enhancing accessibility is necessary to ensure than these individuals are not excluded from participating in society.

There are various telecom accessibility services to support individuals with these hearing impairments.

i. **Teletypewriter (TTY)**. This device allows people to send out messages via their phone by typing instead of speaking and listening. TTY devices come with a display screen on which messages are displayed and a keyboard for typing purposes.

Figure 2: A TTY Device

Mobile phones designed with a TTY mode are compatible with the device and perform the same function as the TTY when connected to one. While analogous cellular networks were compatible with a TTY, digital wireless networks were not until FCC ruled that manufacturers must ensure TTY users can access emergency

services (FCC, 2020). This indicates the significant impact of regulations in enhancing telecoms accessibility. A TTY is advantageous because it allows direct communication and provides privacy to conduct confidential conversations. However, the device is not without limitations. For example, the device requires the availability of compatible devices and may be difficult to operate for individuals with physical impairments or dexterity difficulties. Additionally, using the device requires literacy and soft skills to use the keyboard effectively, and it does not benefit sign language users with hearing impairments.

ii. **Text Relay Service, TRS.** This service can substitute a TTY device. The service uses an operator as a third party between an individual with hearing impairment and another person. The individual texts the message, which the operator voices to the other person. This other person responds, and the operator texts the response to the individual with a hearing disability.

Figure 3: TRS Systems

iii. **Video Relay Service, VRS.** This service is similar to a TRS in that there is the use of a trained operator. However, the service depends on video instead of texts. The operator and the person with a hearing disability communicate via sign language, while the communicator voices the communication to the person at the other end of the line.

DEAF CALLER   SIGN LANGUAGE INTERPRETER   HEARING CALLER

Figure 4: VRS System

This service can be accessed using a VRS caller or a computer with a broadband internet connection. Its advantages are that it can be used by people who use sign language, and it also facilitates the use of facial expressions and body language for better expression. Additionally, the communication flows back and forth like a telephone conversation, and it occurs more quickly. Besides, unlike using a TTY or a TRS, the conversationalists can interrupt each other if needed. A benefit of TRS is that someone who uses sign language can use the service with the help of a video phone. This way, the service covers more users than a TTY. However, like TRS this method is non-ideal for passing confidential information due to the presence of another individual.

iv. **Amplifiers.** These devices raise the loudness and/or the pitch of volume to the listener. All amplifiers can be used alone but some of them also have hearing aid compatibility If a user uses a hearing aid, an amplifier can be connected to the mobile phone to increase the sound for the user. However, the amplifier devices will vary in their volume strength and frequency characteristics.

Figure 5: A Telephone Amplifier

v.   **Signaling/Alerting Device.** This device use sound, light, vibrations, or a combination of these signals to notify the user know when a particular event is taking place. This device can work to signal phone notification and ringing as well as to signal other such as alarm clock, doorbell ringing and smoke detector alarms.

Figure 6: Wearable Vibrating Alerting Device

b. Blind/Visual Impairment

Accessibility for individuals with visual impairment is also significant to ensure these individuals are not excluded from accessing telecommunication. According to the WHO, close to 2.2 billion people suffer from some type of visual impairment. As with other types of disabilities, there are various types of visual impairments. The table below presents a few of the common visual impairments.

Visual Impairment	Characteristic
Color Blindness	Difficulty of complete inability to perceive color. Individuals may also be sensitive to bright colors
Low Vision	Blurry vision, clouded vision, or seeing only the middle/edges of a visual field. Can be caused by various conditions like cataracts and glaucoma.
Severe Blindness	Loss of complete vision in both eyes.

Table 2: Examples of Visual Impairments

These conditions make it challenging for individuals to access telecommunication services and devices. There are various services to support them.

i. **Alternative Formats.** There are various alternative formats that provide accessibility to people with visual impairments. These include:

- Braille

- Large Print

- Online Formats, e.g., HTML

- Digital Formats

Figure 7: Alternative Formats

ii. **Text-To-Speech.** Text-to-speech software is embedded in many telecommunication devices in the form of screen readers. These simplify navigation for people with disabilities by allowing them to identify content

Figure 8: Text-to-Speech Software

heading and reading out text alternatives to images. This service benefits people who are totally or partially blind and those with dyslexia or other types of cognitive disabilities, who require to listen and read the text for better comprehension. The service also allows users to identify internal and external links in content. Additionally, it highlights text as it is being read out, enabling people to follow along with the content easily. The software requires proper content-coding such that the functionality syncs appropriately with the text material.

iii.   **Other services.** These mainly apply to web content and include:

- Adjustable color contrast

- Adjustable visuals, e.g., background color and text sizes

- Texture and pattern variations

c. Physical Impairment and the Elderly

This category of individuals includes people with motor-related challenges, such as tremors, limited muscular control, involuntary movement, lack of coordination, paralysis, missing limbs, pain during movement, and other conditions that affect mobility. Aside from people with physical impairments, another demographic is the elderly. Providing accessibility for the elderly population is akin to accessibility for people with disabilities because the design of the products and services is similar. The elderly struggle with accessibility because of the changes and limitations that come with aging, such as reduced mobility, visual and hearing capabilities, reduced reflexive capacity, and memory loss. Most of the accessibility needs of the elderly generation often overlap with those of individuals with disabilities. For instance, they also have trouble with their vision, hearing, cognitive ability, and physical ability. Therefore, tools, techniques, and services that provide accessibility for people with disabilities also advantage the elderly community.

This demographic may be capable of seeing and hearing web content but face challenges in controlling peripheral devices like the mouse and the keyboard. Additionally, they face challenges in operating telecommunication devices. There are various accessibility services to support people with physical disabilities. For instance, Smart Home systems to help home automation. These systems allow people with physical disabilities and the elderly to use various items in their homes with ease. They can allow the user to open doors, switch the lights on and off, and interact with appliances through their mobile phones.

Figure 9: Smart Home

Smart home technology relates to using devices connected via the internet or local LAN. Through the IoT, the technology uses sensors and other appliances to link devices to each other and the internet. This allows the devices to be monitored, controlled, or accessed remotely (FPF, 2019). The home automation systems cater to a user depending on their needs.

Smart home technology is advantageous because it allows more efficient energy and electric use, not to mention that it makes the home more secure. It also enhances the health of the elderly and people with disabilities, such as reminding them when to take their medication.

Smart home technology is part of self-monitoring analysis and reporting technology, initially developed by IBM as predictive failure analysis. Smart home

technologies became available for commercial use between 1998 and 2000. With the rampant use of smartphones, this system can be harnessed to allow people with disabilities and the elderly autonomy and independence. This technological development is now being used to create smart cities. The cities' functions are analogous to those of smart homes in that the systems are monitored to allow more efficient use of resources.

People with physical disabilities also benefit from other services that enhance web accessibility and allow them to acquire information. Some of these include:

- Keyboard accessibility. This service is beneficial to individuals that may be unable to operate using the mouse, as it requires finer movements.

- Error identification services and allocation of adequate time to navigate various content sections.

- Labels. These simplify navigation when users are using assistive technologies.

- Compatibility with assistive technologies. The most common assistive technologies for people with physical disabilities are mouth sticks. These allow the users to navigate content using the mouth. Mouth sticks are easy to use and low-cost. Additionally, they enable the individuals to use a trackball mouse for navigation, depending on their level of control.

Disability	Accessibility Services
Hearing impairment	-Teletypewriter, TTY -Telecommunication Relay Services, TRS -Video Relay Services, VRS - Amplifiers - Alerting device -Closed captions and subtitles -Web accessibility (Media player controls, transcripts, sign language provisions in audiovisual media)
Visual impairment	-Alternative formats (Braille, large print, online formats, digital formats) -Text-to-speech -Web accessibility (Adjustable color contrast, adjustable visuals, e.g., text size, background color, texture, and pattern variations)
Physical impairment and the elderly	-Smart home systems -Web accessibility (Keyboard accessibility, error identification services, providing labels, ensuring compatibility with assistive technology)
The elderly	Web accessibility (Providing instructions, providing input assistance, providing consistent navigation, understandable language)

Table 3: Summary of Accessibility Services

V. The Need for a Universal Service Obligation (USO)

Universal Service Obligation relates to ensuring that all people receive a minimum level of telecommunication services at a reasonable and affordable charge (Zhu, 2020). USO have a social inclusion agenda at their core, in that they aim to safeguard the provision of services to the whole population. The underpinning argument for USO is that basic telecommunication services are a right for all individuals. States' responsibility to safeguard the availability of telecommunications to everyone in society stems from the association between telecommunications and social human rights.

USO facilitate the promotion of public interest in various ways. Firstly, they allow an explicit definition of universal service, which ensures that demographics like the elderly and people with disabilities are not left out of the agenda. Such a definition also facilitates specific inclusions that promote the development of quantitative standards that can serve as benchmarks. These features enhance the quality of telecommunication services provided. Secondly, the 'obligation' aspect of the USOs allows them to be protected by legal mechanisms since they would be legal requirements. This factor makes telecommunications a legal concept, which facilitates enforceability and enhances compliance. Aside from facilitating the provision of telecommunications to all people, USO also promote infrastructural and economic development.

The need for a Universal Service Obligation is fostered by developments in technology, increased liberalization in the telecommunications sector, and pricing differences. USO is necessary to oblige the provision of accessibility to people with disabilities and the

elderly. Article 9 of the CRPD confers upon states and governments various responsibilities to ensure accessibility, it does not explicitly refer to accessibility as a right. The obligations to facilitate accessibility are provided in the convention as general principles and specific duties. The CPRD Committee has affirmed that the convention intends to remove all forms of discrimination, thereby assuring all people equality before the law regarding the access of public goods and services. As discussed, an USO 'obligation' feature would confer a legal aspect to accessibility, which would enhance the rate of implementation in various regions and states.

VI. International Use Cases

a. USO Case Study: US Federal Communications Commission

The FCC accessibility program is hinged on section 508 of the Rehabilitation Act and section 255 of the communications act. However, the standards for compliance are maintained by the United States Access Board. Firstly, the commission asserts that per section 508, all ICT developed, maintained, or procured by a federal agency should be accessible to people with disabilities (FCC, n.d.). The commission further contends that the access granted to this demographic must be comparable to that of other people. This section leaves out the public sector because it only applies to federal agencies. However, per the USO premise, section 508 is inadequate to cover universal access because it does not cater to the social aspect of affordability. The act only covers the service provision aspect of a USO. Chapter 2 of section 508 covers access to functionality (US Access Board, n.d.). The section addresses two primary concepts regarding access.

Firstly, accessibility allows federal employees with disabilities to access and use ICT in a manner comparable with other employees. Secondly, public citizens seeking data and information from federal agencies can access it in a manner comparable to people without disabilities (US Access Board, n.d.). Regarding the user needs, the provisions are that federal agencies must identify how people with disabilities function in regards to different ICT and how the ICT will be configured and maintained to support their use. In this regard, the section fulfills the USO requirements as far as ensuring the concerned demographic receives the minimum level of service. While the omission of an affordability statement is of concern, the requirement to ensure that the service provision is 'comparable to Federal employees who are not individuals with disabilities'

arguably caters to this factor. This is because the inferred equality can be taken to mean accessible service provision at no extra cost.

Aside from section 508, section 255 of the communication act also underpins FCC's ruling. Section 255 requires that, where achievable, manufacturers of telecommunication equipment ensure that their services and products are accessible to people with disabilities. If such access is not readily achievable, then the manufacturers must design their equipment to be compatible with peripheral devices and user assistive technologies that are used by people with disabilities in the event that such compatibility is readily achievable. These regulations apply to software and hardware telephone and telecommunications equipment, such as wireless handsets, telephones, pagers, fax machines, and answering machines. The 'readily achievable' condition allows a company to weigh the cost and nature of accessibility features against their financial resources.

Firstly, the Act requires the provision of minimum telecommunication services without discriminating against people with disabilities. This is congruent with USO's requirement of providing services to all people. Second, the Act also fulfills the social objective of USO, which relates to providing services at an affordable cost. This can be seen where the requirements allow companies to comply depending on their financial status. The US Access Board provides accessibility guidelines to facilitate compliance with the two Acts. On the other hand, the FCC is in charge of ensuring compliance by the concerned parties. It does this by providing implementation regulations and enforcing the guidelines contained in section 255. A significant development in the sector is the design and implantation of the US Access Board's final rule.

The final rule is founded on the WCAG 2.1 and updates the provisions of sections 508 and 255 to reflect functionality. This was a necessary step because the Acts mainly address products and are incongruent with the present technological advancements, which also demand accessibility for people with disabilities. The Final Rule comprises

guidelines for content, specific applications, data processing, and communications hardware, authoring tools, and non-web software applications. The final rule requires that ICT and associated programs and systems meet the success criteria of the WCAG 2.1, specifically Level A and Level AA, and the specified conformance requirements. This aspect ensures that the developments in technology do not compromise accessibility. In so doing, they further enhance the implementation of the requirements of an USO.

b. Accessibility Regulation Case Study: Ofcom

The accessibility regulations in the UK apply to public sector organizations, which are required to ensure their mobile applications and websites comply with the Accessibility Regulations 2018 (Gov.UK, n.d.). Aside from ensuring compliance, public organizations are required to publish an accessibility statement. The regulations aim to ensure online telecommunications are accessible to all users, including individuals with disabilities. The UK regulating body is Ofcom, and it covers television channels, communication services, electronic programs, and other systems related to telecommunications (Ofcom, n.d.). For instance, in enforcing the accessibility of communications services, Ofcom contends that it meets the needs of people with disabilities as per the Communications Act. This is done both in the development and implementation of policy decisions. For example, the organization requires mobile and fixed communication providers to meet several requirements aligned with increasing service accessibility to people with disabilities. Examples include:

- Providing access to a 'next generation' text relay service benefits people with speech or hearing impairments. Providers are also tasked with providing special tariffs whose rates compensate for the additional communication time taken by this demographic.

- Providing access to emergency SMS in mobiles for people who are unable to make voice calls.

- Providing free directory services and walk-through connection for users who cannot access printed directories on account of disability.

- Priority fault repair for people with disabilities who depend on their telephones for communication.

- Allowing third-party bill management for users with a disability, which empowers their friends or relatives to help them manage their affairs.

- Providing contracts and bills in alternative formats like braille and large print, if requested.

Ofcom also requires service providers to ensure they publish these provisions such that people with disabilities are aware of them. The UK accessibility regulations also provide a four-step approach to public organizations to enable them to confirm the accessibility state of their online services. The steps include:

i. Deciding on how to check apps and websites for accessibility issues. The regulations provide guidance on how to carry out this step. For instance, one can do an audit themselves or engage a third party. Additionally, as opposed to checking every page on a website, it is advisable to use a sample page with a variation in functionality and content. Moreover, this checking is expected to be congruent with the WCAG 2.1 standards.

ii. Developing a plan to fix detected problems. The plan depends on the audit results conducted in step 1 and requires consultation with suppliers, developers, and content editors. The plan should also ensure compliance with current accessibility standards. A significant aspect of this requirement is that organizations can prioritize the issues to fix and can opt out of others if they establish a disproportionate burden after

conducting a guided assessment. Issues like prerecorded videos and maps can be exempted from fixing since they are not included in the accessibility regulations.

iii. Publishing an accessibility statement. This statement should be published in plain English such that it is available to users who are not experts in the field. It comprises an explanation of the degree of compliance of an app or a website with the regulations. Organizations are also tasked with reviewing this statement often to ensure it captures changes made to the website.

iv. Ensuring new features added to the app and websites are accessible. This can be achieved by ensuring the availability of tools that enable website editors to add accessibility features.

Ofcom has provided a plethora of resources to facilitate compliance with the regulations. It has also published enforcement guidelines that explain the audit process used to check compliance with the regulations. This provision, coupled with step-by-step directions, makes it easier for organizations to ensure compliance.

c. Relay Service Case Study: National Relay Service (Australia)

The National Relay Service (NRS) is a nationwide phone service that addresses the communications accessibility issues for people who are deaf, hearing and/or speech-impaired and allow them to communicate with anyone who uses a standard telephone and vice versa (Australia's Department of Infrastructure and Transport, n.d). The NRS

is an Australian Government initiative funded by a tax on eligible telecommunications service providers.

Making a call through the NRS lets you communicate with a hearing person who is using a phone. The NRS has specially trained staff called Relay Officers who help people with hearing impairment with every call. The relay officer will make the call voice to text or text to voice and Australian Sign Language (AUSLAN) to English or English to AUSLAN, Depending on the hearing and speech ability of the caller, and the equipment they have. Relay officers stay on the line throughout with each caller to help them and make the call go smoothly. The NRS is available 24 Hours a day, every day. Except for calls made through Video Relay. All calls made through NRS are confidential and the user privacy is protected by the Australian Privacy Act of 1988. NRS staff must sign an agreement to only use access and disclose user's information in the course of their duties and for no other reason.

Which type of relay call is right for you?

	If you are deaf, can't hear well or have difficulty using your voice. NRS Chat	If you are deaf, can't hear well or have difficulty using your voice. SMS Relay	If you don't hear well but can use your voice. NRS Captions	If you don't hear well but can use your voice. TTY Speak and Read	If you have difficulty being understood on the phone. Voice Relay	If you have difficulty being understood on the phone. SMS Relay (Text and Listen)	If you want to use Auslan. Video Relay	If you don't want to use a computer or mobile phone. TTY Type and Read	If you don't want to use a computer or mobile phone. TTY Type and Listen
Prefer to type?	✔	✔				✔		✔	✔
Prefer to speak?			✔	✔	✔				
Have some hearing and like to listen?			✔	✔	✔	✔			✔
Like to read captions or text?	✔	✔	✔	✔				✔	
Use Auslan?							✔		
Need bigger print?	✔		✔						
Make a call on the move?	✔	✔	✔		✔	✔	✔		
Equipment?	Internet + computer, tablet or smartphone.	Any mobile phone	Internet + phone (e.g. phone + computer, or smartphone on speaker or using headphones.)	TTY	Any type of phone	Any mobile phone on speaker or using headphones	Internet + smartphone, computer or tablet	TTY	TTY

Figure 10: Type of relay calls offered by NRS

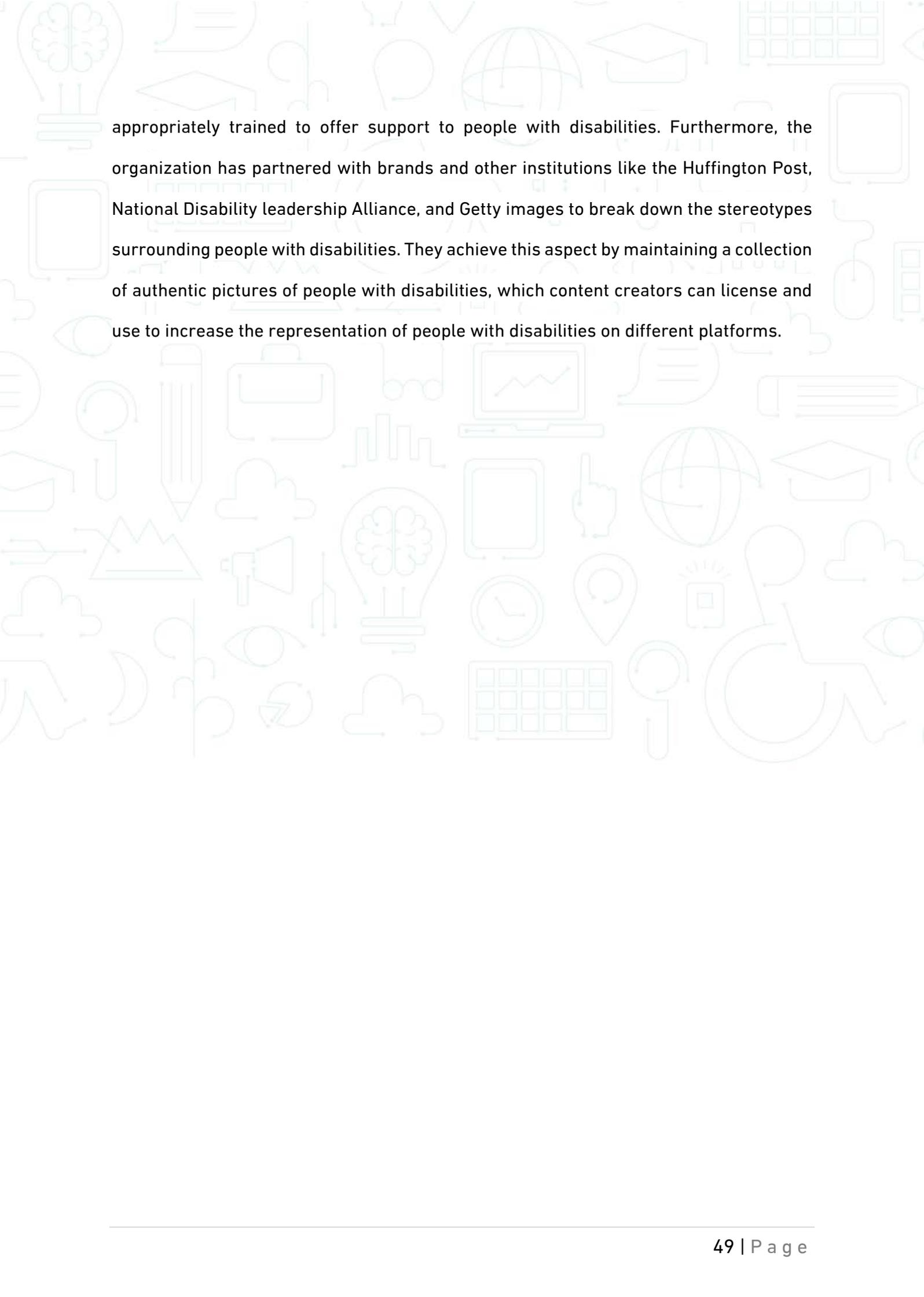## d. Operator Case Study: Verizon (USA)

Verizon is a telecoms operator based in the USA, which strives to provide accessibility services and products for people with disabilities. The organization affirms that it complies with the WCAG 2.1 standards in its operations (Verizon, n.d.). It has various websites that offer different services for different types of disabilities, including auditory support, visual assistance, mobility tools, and accessibility resources. For example, Verizon provides a variety of resources for people with auditory disabilities. These include information on how to locate downloadable applications, information regarding accessibility features on different handsets, and information regarding hearing aid settings in common devices. It also offers various mobile phone devices that are compatible with hearing aid per the FCC's standards. The devices also offer accessibility features like real-time text, and directory assistance. Others included remote controls with close captioning features and unlimited plans for people with disabilities.

Verizon also offers visual assistance to individuals with visual disabilities. This spans a range of products and services, also in accordance with FCC's standards. These include features like text-to-speech, descriptive video services, and TV guides in different formats. Moreover, the organization offers its customizers different billing formats, such as in large text and braille. There are mobility tools to aid people with physical disabilities. Examples include TVs with text-to-speech functionality, remote controls with bigger buttons, and alternate billing formats inclusive of MP3 and audio CDs. The table below is a compilation of Verizon's products and services aimed at enhancing accessibility for people with different types of disabilities. While some of the services are more beneficial for specific kinds of disabilities, most of them benefit people with varying types of disabilities.

Auditory Support	Visual Assistance	Mobility Tools
- Accessible features on Verizon's wireless devices. -Devices with hearing aid compatibility. -Rael-time text features. -Free 411 searches. -Channel lineups and TV guides in accessible formats. -Directory assistance. -Billing in alternate formats, e.g., large print, audio CD. -Video calling features. -Remote controls with closed captioning. -Unlimited & pre-paid plans -Connected device plans	-Accessibility features. -TVs with text-to-speech functionalities. -Descriptive video services. -Channel lineups and TV guides in alternative formats. -Unlimited plans. -Billing in alternative formats, e.g., braille, large print. -Prepaid plans. Connected device plans	-Accessibility applications. Remote controls with big buttons. -Text-to-speech functionality. -Alternate billing formats.

Table 4: Verizon's Products and Services

Aside from these provisions, Verizon also has a microsite that provides a wide range of information on accessibility and a customer service center whose staff is

appropriately trained to offer support to people with disabilities. Furthermore, the organization has partnered with brands and other institutions like the Huffington Post, National Disability leadership Alliance, and Getty images to break down the stereotypes surrounding people with disabilities. They achieve this aspect by maintaining a collection of authentic pictures of people with disabilities, which content creators can license and use to increase the representation of people with disabilities on different platforms.

VII. Funding Universal Access in Telecoms

The Universal Service Fund, USF, relates to the subsidies and telecommunication fees under the oversight of the Federal Communications Commission. The fund enhances universal access to telecommunications by ensuring that services are accessible to a wide range of people at affordable prices (ITU, 2013). Universal access has three primary principles, availability, affordability, and accessibility. Availability relates to ensuring that all users, regardless of their geographical location, can access the same level of service at home and in their workplaces. Affordability refers to the concept that the price of telecoms services should be a barrier to access. Accessibility is the non-discriminatory treatment of telephone subscribers in terms of service quality, service, and price. The ITU asserts that various jurisdictions use different approaches to facilitate universal service requirements. These include market-based reforms, cross-subsidies, mandatory service obligations, access deficit charges, private, public partnerships, and universal funds.

However, the ITU also contends that the past few decades have seen institutions like National Regulatory Authorities (NRA) and telecommunications administrations adopt universal funding mechanisms. These have been instrumental in incentivizing operators to participate in achieving universal service goals through USF. The rampant use of USF stems from the widespread expert consensus that USF are more effective at achieving universal access objectives than USO. Providers make their contribution in different ways depending on the country. The first way is through a levy. Using this method, operators are levied a percentage of their operating income annually. The second way is through annual regulatory fees.

This way, the funds are included in the fees such that operators do not make a separate contribution. Aside from operators, other contributions also make up the USF. These include governmental budgets, spectrum auctions, licensing fees, and contributions from institutions at different levels like regional development banks and the World bank. The collection, operation, and management activities involving the USF vary depending on the jurisdiction.

The USF conducted a study on global USFs and their use, as illustrated in figure below.

Region	Africa	Arab States	Asia Pacific	Europe and CIS	The Americas	TOTAL
Total Number of Funds Studied	22	7	16	8	16	69
Funds that Permit Broadband	4	4	9	2	8	27
Number of Funds with High Activity	4	2	8	3	9	26
Number of Funds with Moderate Activity	6	2	2	1	1	12
Number of Funds with Low Activity	5	0	1	4	3	13
Number of Inactive Funds	7	3	5	0	3	18
Funds that Include Tele-centres or Community ICT Centres	10	3	5	2	7	27
Funds with Inclusion for Persons with Disabilities	9	1	5	5	4	24
Connectivity of Anchor Institutions[4]	8	2	6	1	8	24
Funds with Special Inclusion for Women*	1	0	3	0	0	4
Consistent published financial reporting	2	1	4	2	8	17

Figure 11: USF Programs Across the Globe

High activity relates to the funds in which more than 15 applications made to them are complete or in progress. Moderate activity is when the applications in progress or

complete are between 6 and 15, and low activity relates to when the applications in progress are less than 5. The classification of 'inactive' was done on funds whose operational structure is still underway or was actively operational in the past, but it has been suspended or stopped.

    The figure below is a visual representation of the percentage of funds in the four categories per ITU's study.
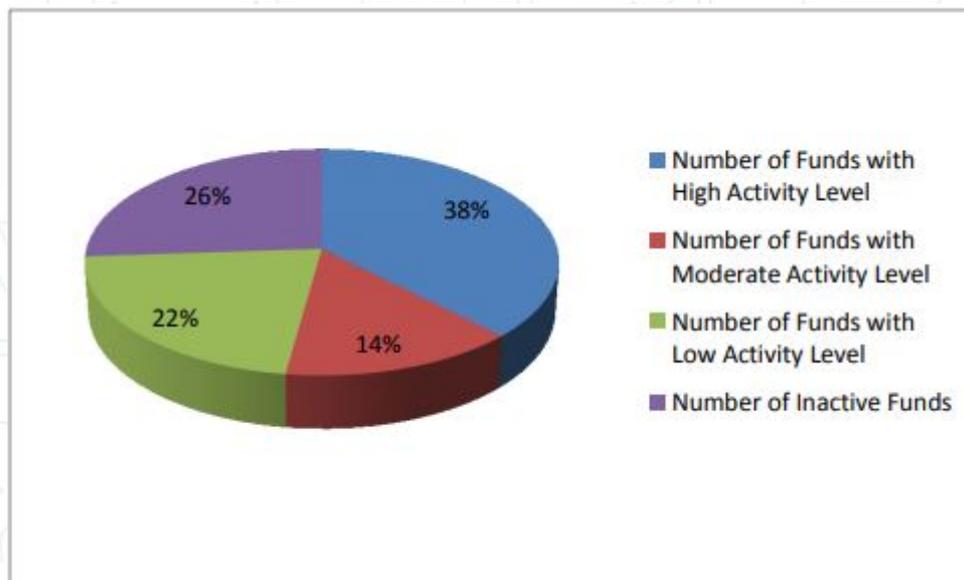

Figure 14: Activity Levels of Global Funds

ITU outlined several combined factors that foster the success of USFs, which are highlighted in the table below.

Success Factor	Explanation
Legal Framework	-USF requires a solid yet flexible legal framework that supports change and development in technologies and population needs.
Independence and Autonomy	-The ITU study observed that the countries with active USF had granted the fund different degrees of independence. This aspect allows them to handle performance issues, re-orient the fund, and make necessary decisions to ensure they fulfill their objectives.
Policy Articulation	-Each USF requires a vision, policy, and elaborate activities. These provide an in-depth framework than that provided in the telecommunications law. The policy depends on the fund's specific objectives and how the resources should be used to realize these objectives.
Consultation with the stakeholders	-Stakeholders in the telecom industry are essential because they can provide guidance and direction on executing projects due to their experience in the field. Consultation also leads to better management of the USF.

Delineating responsibilities of USF from those of other agencies	-This practice enhances clarity, which simplifies administrative effectiveness. USF projects are often urgent. Clarity ensures the process is streamlined to facilitate the projects' execution. Delineating responsibilities is an important aspect because USF interrelates with governmental agencies and other external stakeholders.
Defining measurable objectives	-Defining objectives is an essential step to determine the efficiency of the USF in fulfilling the intended tasks. Objectives make it possible to assess the extent to which a USF has fulfilled service requirements and contributed towards attaining its vision. When objectives are met to a measurable great degree, stakeholders are empowered, not to mention the funds receive more support.
Flexibility in service deployment	-service deployment must be flexible and technologically neutral for a USF to be successful. This is because it allows the USF to incorporate new technology, provided it meets internationally recognized standards and fulfills the service requirements. The importance of flexible service deployment can be seen in the extensive use of technology for broadband deployment.

The fair project allocation process	-Project allocation should be equitable and objective, as should the fund contribution. This is because USF contributors should also be able to apply for funding for different projects from the fund. The administration must outline clear criteria for evaluating project proposals. They should also disseminate bid announcements to enhance participation from a wide range of participants.
Capacity building and complementary services	-These are important to ensure sustainability and self-efficacy through educational programs and training.
Innovation and incentives	-This relates to innovative ways of ensuring successful project execution. For instance, as opposed to full reimbursement, the funds can be allocated according to project milestones. Efficient project oversight and fund administration are necessary to ensure all installments are duly paid. This method can also result in cost-saving.
Visibility, Accountability, and Transparency	-These are necessary to ensure the USF is successful. It is necessary to maintain regular financial reporting per the regulations.
Digital inclusion responsiveness	-The funds must address the particular needs of specific demographics such as people with disabilities and the elderly

Table 5: Successful Management of USF

VIII. International Telecoms Accessibility and Special Needs-Related Initiatives

Initiative Name	Scope
International Telecommunication Union, ITU	The International telecommunications union also comprises accessibility initiatives. ITU is a UN specialized agency concerned with information and communication technologies. It has taken various steps to support and advocate for telecoms accessibility. ITU has close to 193 member states, and other institutions like regional and international organizations, academic institutions, and businesses
The Global Initiative for Inclusive ICTs, G3ICT	The G3ict was launched in 2008 as a result of the combined efforts between the global Alliance for ICT and development, the secretariat for the CRPD, and the United Nations. The organization intends to advocate for the rights of people with disabilities globally in the digital age. The organization's mission is to enhance the provision of digital solutions for all people, so that every human being can benefit from information technology (G3ict, n.d.).

Accessible Telecoms	The Accessible Telecoms initiative is a project by the Australian Communications Consumer Action Network, ACCN. The initiative was begun to address the lack of consolidated information regarding accessibility in telecommunications devices (Accessible Telecoms, n.d.). The initiative provides a variety of resources related to accessibility. This initiative helps people with disability find accessible devices and assistive technologies that suit their needs as well as funding options to cover the cost of these device.
International Association of Accessibility Professionals, IAAP	IAAP connects accessibility professionals from all over the world to improve and promote the accessibility profession via education, networking, and certification. The initiative is a membership-based for organizations and individuals that are enhancing their accessibility strategies or focused on accessibility (IAAP, n.d.). It aims to assist accessibility professionals progress in their careers, and support organizations to incorporate accessibility into their infrastructure, services, and products
Global Alliance on Accessible Technologies and Environments, GAATES	GAATES is an international organization that promotes accessibility of the built and virtual environments, per the CRPD requirements. Founded in 2007, the organization boasts of a presence in six regions, South America, North America, Europe, Africa, Asia Pacific, and Arab (GAATES, n.d.).

World Enabled	World Enabled organization is an international consultancy group. It promotes inclusion by supporting governments and companies in the development and implementation of legal diversity and inclusion mandates. The organization aims to foster the development of inclusive societies in which the elderly and those with disabilities are empowered to reach their full potential (World Enabled, n.d.).
International Disability Alliance, IDA	This alliance comprises 14 regional and global organizations that advocate for inclusivity globally at the United Nations. Established in 1999, the organization fosters the implementation of the CRPD through the involvement of people with disabilities at various levels of governance (IDA, n.d.). The organization has a global presence, with members from Africa, Europe, the Americas, Arab, and Asia Pacific. Examples of member organizations include Blind Union, Inclusion International, and European Disability forum.

Table 6: International Telecoms Accessibility Initiatives

IX. State of Telecommunication Accessibility in Qatar

The State of Qatar aims to build a vibrant ICT sector that will help the country to transition to an advanced knowledge economy as per Qatar's National Vision 2030, with modern telecom infrastructure at the heart of its transition. Governmental initiatives such as Qatar Digital Government and TASMU Smart Qatar are the forefront of the country's efforts to develop its ICT infrastructure and make Doha into one of the most digitally connected cities worldwide. These developments allow citizens and residents to communicate with each other and the rest of the world as part of education, employment and cultural exchange. The country has experienced rapid growth and evolution in ICT over the last decade. This is reflected through the ICT usage rate across the country. Qatar enjoys a high rate of ICT penetration in individuals. Almost 100 percent of the country's population, across all segments, have access to computers and mobile phones in Qatar, with high penetration of smart phones across many segments of society.

The State of Qatar has ranked 1st globally among 137 countries on the second edition of the Digital Accessibility Rights Evaluation (DARE) Index 2020 , which has been released by the Global Initiative for Inclusive Information and Communication Technologies (G3ict), a UN initiative. The ranking reflects the country's noticeable advancements in the field of ICT Accessibility and the government's efforts in empowering persons with functional limitations – people with disabilities and the elderly through various local programs and policy initiatives related to ICT Accessibility in different domains, among them was the Telecommunication domain. Qatar has

scored 5 out 5 on the level of implementation of country policies and program in the field of mobile telephony.

One of the key policies driving the change in the field ICT accessibility Qatar is the National e-Accessibility Policy, a first of its kind document to address digital inclusion in the MENA region. The policy addresses accessibility to different domains of ICT. The Policy was launched officially in 2011 after a thorough consultation process that measured the potential impact of such a policy on key industry partners, telecoms operators and persons with disabilities and the organizations that represent them.

a. e-Accessibility Guidelines

The National E-Accessibility Policy has four key provisions: Web Accessibility, Telecommunication Services, ATMs and Public Access Terminals/Kiosks, Assistive Technologies & Accessible Digital Content.
With regards to Telecommunications, the Policy says "As access to telecommunications services is mandatory for inclusion and integration in the ordinary economic and social mainstream of society today, ictQATAR (now Ministry of Communication and Information Technology) requires that telecommunications service providers in Qatar ensure accessibility to critical telecommunications services and technologies…"

As per the national e-accessibility policy, telecoms service providers are expected to ensure the provision of accessible technologies and telecommunication services in different ways, including:

- Accessible handsets and user interfaces

- Accessible Public Payphone Services

- Sign Language Relay Services

- Special Rates and Plans

- Awareness Campaigns

- Accessible Emergency Services

The e-accessibility guidelines are hinged upon internationally recognized standards. For example, new ICT equipment for public use must be accessible to the elderly and people with disabilities. Secondly, the elderly and employees with disabilities are expected to attend training programs relating to the use of various ICT-based products and services. The e-accessibility policy also outlines other best practices related to accessibility. For instance, such policies require that when developing public technologies, equipment, and information, relevant parties must ensure to consider the needs of both the majority and minority public members. In addition to the development of products, equipment, and services, manufacturers and public companies must involve people with disabilities in the designing and testing stages.

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b. Qatar Telecommunications Accessibility Assessment

Since the inception of the national e-accessibility policy, Qatar has made strides in the field of telecommunication accessibility with initiatives such as Emergency Service for the Deaf and the "Connected" initiative. However, there is still gaps in accessible telecommunication in Qatar. Particularly in the lack of relay service and the unavailability of accessible handsets.

As a direct response to the National e-Accessibility Policy, the Ministry of Interior established a video relay service that would enable the deaf community to contact emergency services such as Police, Fire and Ambulance in a convenient way. This service aims to respond to people with hearing impairment to their calls in case of facing any emergency at any time of the day, on the number '992' (Hukoomi, 2021). The project also involved the Qatar Social Cultural Club for the Deaf to offer feedback and to train Ministry of Interior staff on the use of sign language to dispatch emergency services. In addition to sign language, the Emergency Service for the Deaf also allows for people with hearing disabilities to request emergency services through SMS.
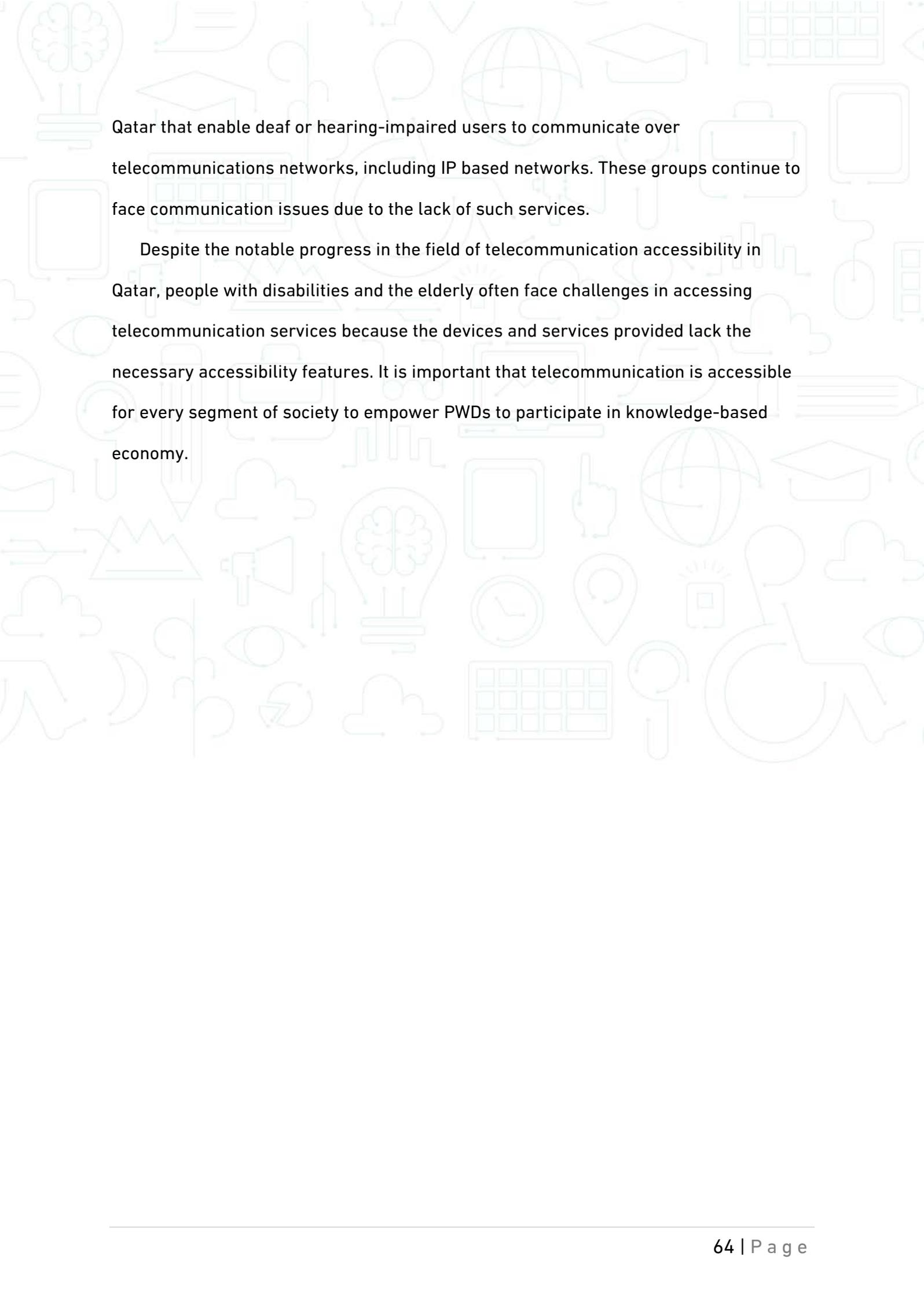
Furthermore, both telecom operators in Qatar have Sign Language Interpreting staff in some of their retail stores to support communicating with the deaf community. However, there is limited information about the services and facilities that are provided for persons with disabilities. For instance, accessible bill formats and priority assistance service.

Another initiative that emerged since the inception of the Policy is the "Connected" initiative, launched on International Day for Disabled People, December 3, 2012. Which brought together Qatar's two telecom operators, Vodafone and Ooredoo, in a unique initiative that would address the socio-economic barriers associated with gaining access to telecoms services. "Connected" initiative established a series of facilities that exist till today for People with Disabilities, aimed at breaking the socio economic barriers to accessing ICT at home, work or in everyday life (Ooredoo, 2012). The two telecom operators contributed to the initiative through offering a special discount for all customer with disability on all post-paid plans. In addition to discounts on selected handsets, including those equipped with accessibility features and applications.

Besides, Ooredoo Qatar has recently launched the free calling service as well for the hearing impaired in cooperation with the Qatari Center for Social Cultural for the deaf to inform the caller that the person is hearing impaired.

The fast change of technology has meant that many, not all, of accessible features can now be made available through smartphones. However, some people with disabilities require special alternative handset that incorporate accessibility features within it. Alternative handsets are not currently available at retail stores operated by either mobile operators in Qatar.

A telecommunications relay service, also known as TRS, or IP-relay, or Web-based relay service, is an operator service that allows people who are deaf, hard of hearing, deafblind, or have a speech disorder to place calls to standard telephone users via a keyboard or assistive device. Currently, there are no such relay services in

Qatar that enable deaf or hearing-impaired users to communicate over telecommunications networks, including IP based networks. These groups continue to face communication issues due to the lack of such services.

Despite the notable progress in the field of telecommunication accessibility in Qatar, people with disabilities and the elderly often face challenges in accessing telecommunication services because the devices and services provided lack the necessary accessibility features. It is important that telecommunication is accessible for every segment of society to empower PWDs to participate in knowledge-based economy.

X. Ten-Step Plan

1. Needs Assessment

A needs assessment should be the first step in developing an accessible telecommunication service or device. This step involves consultation with experts in the field who will offer guidance during the design and development process. Different media and equipment have different requirements. For instance, a needs assessment would provide direction on existing equipment that is inaccessible and would benefit from modifications that make them compatible with assistive technologies. It also brings into perspective the adjustments that would need to be made on such items to ensure their accessibility or whether there is a need to replace them with other accessible equipment. This stage should incorporate people with disabilities to ensure their perspective and input are considered from the onset. As the plan would also require finances, the needs assessment is crucial to prioritize the needs and decide those that can wait until a later time, suppose the funds an insufficient to make all adjustments at once.

2. Stock-Taking

The United Nations emphasizes the necessity of taking stock of existing principles and standards. This is because of the existence of national guidelines and several other programs regarding accessibility. These can be overwhelming when deciding on compliance. Therefore, it is necessary to consider the available international standards and national programs and guidelines and then select those to use in enhancing accessibility. Stocktaking also allows for an assessment of the context and purpose served by different standards, which leads to informed decision-making. It also enables

the development of an outline of the minimum accessibility international standards to use that allows enough flexibility to accommodate local needs and conditions.

3. Policy Development

Local policy development is substantiated by the fact that the UNCPRD only provides general accessibility guidelines. Therefore, to ensure the success of an accessibility program, it is imperative to develop more detailed policies tailored to a local requirements & capabilities, and provide a more in-depth direction. The policies should comprise regulations, standards, and implementation timelines appropriate to local capabilities and conditions. Moreover, they should also include functional requirements and monitoring strategies. This aspect will ensure the sustainability of the program. This calls for more stringent measures to ensure the regulations are followed in accordance with the provided standards.

As in the former step, this step should also incorporate people with disabilities as co-creators and co-determinants of the policies. A significant element of the policies is that they should focus on removing barriers to access and cultivating an accommodating environment for people with disabilities and the elderly. They should also include institutional frameworks such as guidelines regarding the committee for oversight and evaluation.

4. Capacity Building

Capacity building is an inextricable component of achieving sustainable accessibility. It relates to the availing of toolkits and models for the implementation stage. These strengthen the organization's capacity to ensure its systems and equipment are accessible. Capacity building also includes collecting the knowledge and skills necessary to complete the task. This stage depends on the standards chosen and

the selected accessibility features depending on the prioritized needs. It includes sourcing accessibility experts to engage in the process and formulating an implementation roadmap. As the U.N. affirms, such processes should be participatory and include people with disabilities. Expert and talent sourcing should also ensure the design team comprises people with disabilities if possible.

5. Acquiring Funding

Accessibility initiatives can be funded by USF, which are dominant in most countries per the Universal Service Obligation. Some items, such as websites, can be made accessible without expensive adjustments, which can be funded by the organization. However, acquiring new accessible equipment and other tools to allow telecoms devices to be accessible may be costly and beyond the organization's capability. In such an instance, USF can assist in achieving accessibility objectives. These funds can be acquired by involving the ministry or national institutional responsibility for the oversight of national disability policy. Depending on the country, there are also other funding mechanisms. For example, Spain's national lottery profits go to the ONCE Foundation, which allocates funding to accessibility programs and organizations for people with disabilities. Aside from that, other funding options include independent donor institutions like the United Nations Voluntary Funds on Disability and aid agencies such as USAID.

6. Universal Design Development

Universal design development relates to designing products and services that are usable by everyone without needing customizations and adaptations. In ensuring accessibility, the goal is not so much to develop equipment that can be tailored to be

usable by people with disabilities as to create those that everyone can use without needing modifications. An advantage of universal design is that it is advantageous to the organization in the long run. Firstly, it leads to saving money because the organizations that invest in accessibility from the start do not need to adjust their equipment later on to accommodate other individuals. Secondly, it enhances innovation and contributes to staff engagement through the inclusivity that comes with universal design. Therefore, the organization should ensure the experts and accessibility programs are not just aimed at satisfying standards but comprise a broader perspective.

7. Awareness Creation

Creating awareness is essential to inform people of the accessibility of the equipment and systems. This will facilitate their use as people with disabilities will be aware of the developments. Creating awareness can be done in the form of a public accessibility statement. The statement should contain the accessible features and elements and the people that can benefit from their use. For example, due to financial constraints, the project may begin by only implementing programs accessible to people with hearing disabilities. Aside from this, there is a need to increase awareness among organizations and companies responsible for providing telecoms services and manufacturing telecom equipment like mobile phones.

Awareness creation will enhance their knowledge on the matter and encourage them to adjust their processes and make their products more accessible. Clarifying this is essential for those with other types of disabilities who may not yet be able to access some systems and equipment. The statement should also contain the standards upon which the program is based. For example, websites developed to fulfill WCAG 2.1 guidelines should state their level of compliance with the W3C's success criteria.

8. Oversight and Evaluation

Oversight and evaluation are critical components of accessibility programs. Oversight ensures that milestones in program development are achieved within the required time frame. Aside from saving on time, oversight also enhances the program's success by ensuring stakeholders collaborate and conduct their duties as needed. This enables the program to achieve its stated objectives without conflicts. As with other projects, conflict among stakeholders can undermine its success. On the other hand, evaluation is necessary to ascertain that the program and implemented mechanisms are working as intended. For example, evaluation can provide information on the increased use of accessible equipment by people with disabilities in the organization who previously could not access the equipment. The evaluation process should be based on measurable metrics and project objectives in order to provide information on the success or failure rate of the program.

9. Audits and Continuous Improvement

Audits are a mechanism of ensuring compliance with the standards. Regular audits are necessary to ensure that the equipment and systems are still accessible with changes in technology. These can be done individually, but thorough audits require engaging experts in the field. Audits are a combination of automatic and manual assessments that check an item's accessibility. Periodic audits facilitate continuous improvements because they shed light on features that are lacking. Accessibility audits cover different areas depending on their scope. For instance, a risk audit sheds light on barriers that people with disabilities can encounter when using a website or a telecommunication tool. The audit results can guide the corrective measures per the organization's capabilities, enhancing the achievement of the accessibility objectives.
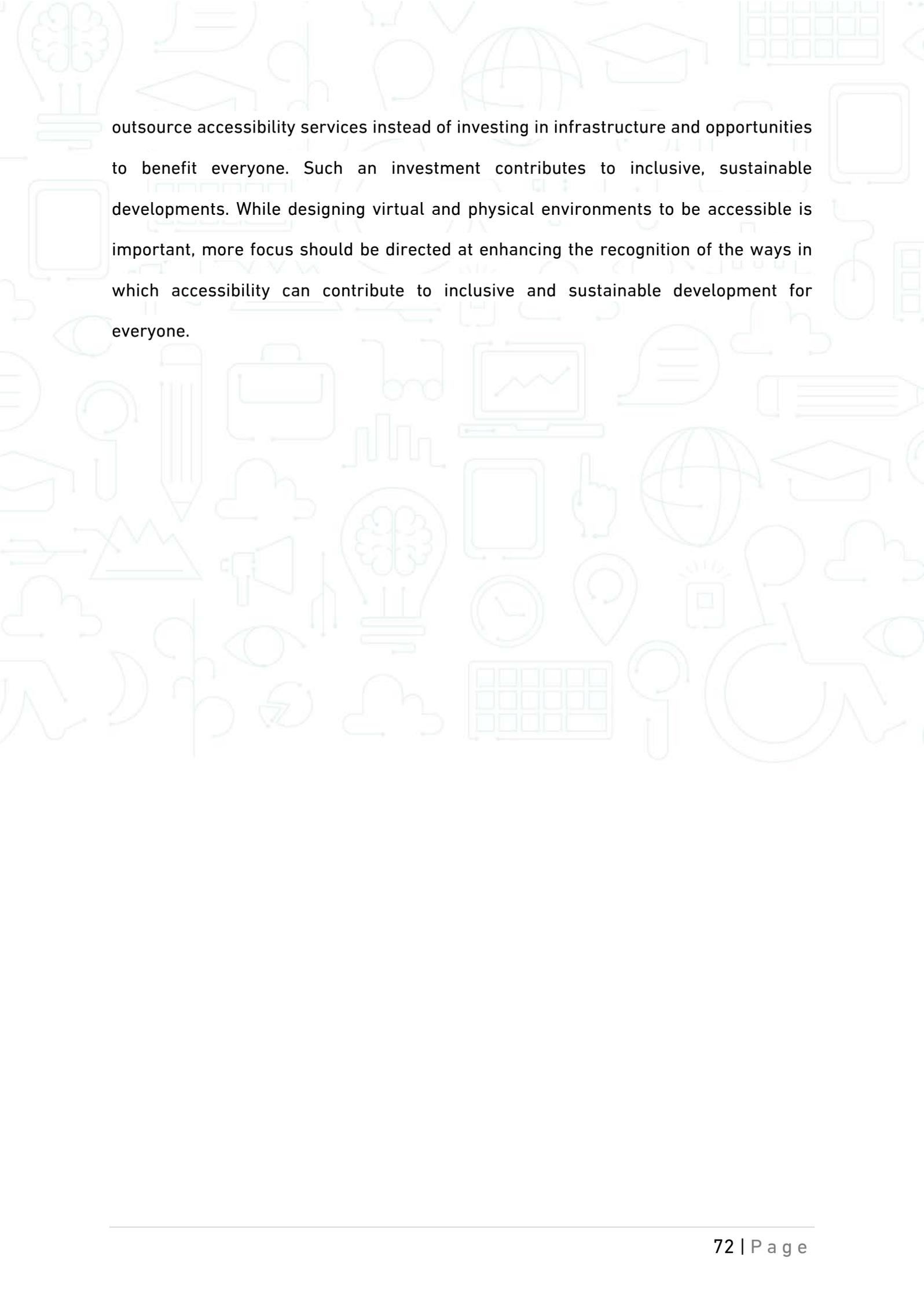
10.   Feedback

The final step in an accessibility program development is obtaining feedback. Feedback is essential to gather the perception of organizational members and the public regarding the program. The UN stresses the importance of perception in accessibility initiatives. Feedback allows the collection of information regarding the awareness of different groups of people on the mutual benefits of the program. Additionally, it is also crucial to gather feedback from individuals with disabilities after they use the systems and equipment. This information can assess the level of access from their perspective. Moreover, they can also provide suggestions on enhancing the systems or equipment to make them more accessible. This way, the features developed in the future will be tailored to their specific needs.

XI. Conclusion

ICT enhances the economic, social, and civic participation of societal members. However, this can be challenging if people with disabilities are denied access to make such contributions, which is why telecoms accessibility is an important phenomenon. Accessibility facilitates direct and indirect access to services, products, and devices to people with disabilities. Using multiple channels and different content formats allows people with disabilities to interact with information and communicate in a way that they can comprehend and prefer. ICT and the internet are crucial tools that drive development due to their widespread use in delivering private and public services. They have also been key players in enhancing accessibility through assistive technologies and accessible functionalities.

Accessibility is crucial in bridging the digital divide, not to mention it is necessary for empowering people with disabilities to be independent and contribute positively to society. A sustainable approach to accessibility should regard people with disabilities as co-determinants of the mechanisms. This element ensures inclusivity and helps to break down damaging stereotypes that regard this demographic as charity cases. Considering the high percentage of people with disabilities, accessibility plays a crucial role in development agendas. The progressive removal of barriers ensures that every societal member is empowered to enjoy their constitutional rights and freedoms, such as the right to information and freedom of expression. The concept of universal design facilitates the development of spaces, environments, products, and systems that can be easily interacted with people with various abilities.

The universal design approach is spearheaded by the UNCPRD. It is rationalized by the fact that viewing accessibility as a compliance issue cultivates a perception of the concept as an expense to provide and maintain. In this regard, organizations can opt to

outsource accessibility services instead of investing in infrastructure and opportunities to benefit everyone. Such an investment contributes to inclusive, sustainable developments. While designing virtual and physical environments to be accessible is important, more focus should be directed at enhancing the recognition of the ways in which accessibility can contribute to inclusive and sustainable development for everyone.

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Appendix A: Detailed Developments on Accessible Technology

Accessible Technology in the 21st Century
|| a stanford sophomore college project ||

.history of accessible technology.

Courtesy of

navigation

:: Home
:: Introduction
:: The First Wave
:: Software
:: Hardware
.. :: Accessibility and OS's
:: Website Accessibility
:: The Future
:: Bibliography
:: About this site

http://www.infinitec.org/learn/learningaboutat/ATYTT/techhistory.htm unless otherwise noted.

- 1808 – The first typewriter is built by Pellegrino Turri to help a blind friend write legibly.
- **1886 – Herman Hollerith, who had a cognitive processing disability, implemented the idea of using punch cards to transport data from the 1890 census. He later founded the Tabulating Machine Company. In 1924, it became known as IBM.**
- 1916 – At Bell Labs, Harvey Fletcher built the Western Electric Model 2A hearing aid.
- 1934 – The Readphon Talking Book was invented.
- 1935 – The American Foundation for the Blind publishes the first issue of the Talking Book Bulletin (books on tape).
- 1936 – Bell Labs invents the first electronic speech synthesizer called "Voder" (for "voice coder").
- **1948 – John Bardeed, William Shockley and Walter Brattain at Bell Labs invented the transistor to create more reliable, smaller, cheaper, more efficient hearing aids.** They won the 1956 Nobel Prize for Physics.
- 1960 – Pilgrim Imagine started captioning for the deaf.
- 1964 – A deaf orthodontist sent a teletype machine to a deaf scientist, beginning the TTY (Teletypewriter) revolution.
- 1972 - The first national open-captioned program aired on PBS (The French Chef with Julia Child).
- **1972 – Vinton Cerf, who had a hearing impairment and was married to a deaf woman, developed host level protocols for ARPANET. He communicated with his wife through the computer using text – the precursor to e-mail.**
- 1975 – Ray Kurzweil created the Kurzweil Reading Machine and the first OCR technology and created one of the first CCD (charge coupled device) scanners.
- 1986 – Jim Thatcher created the first screen reader at IBM, called IBM Screen Reader (for DOS). At first it wasn't trademarked because it was primarily for low vision staff members. He later created a Screen Reader/2 for graphical interface PCs (4).

https://cs.stanford.edu/people/eroberts/courses/soco/projects/2005-06/accessibility/firstwave.html   1/2

- 1988 - Retail registers began to use picture based keyboards, originally created to help those that couldn't speak be able to use a synthesizer to talk.

- **1990 – The Americans with Disabilities Act (ADA) is passed.** This Act requires "civil rights protections to individuals with disabilities similar to those provided to individuals on the basis of race, color, sex, national origin, age, and religion. It guarantees equal opportunity for individuals with disabilities in public accommodations, employment, transportation, State and local government services, and telecommunications" (17).

- 1994 – National Federation of the Blind created a synthetic speech newspaper updated daily.

- 1995 – Microsoft issued Windows 95, the first time their OS had built in accessibility features (rather than as an add-on) (5).

- 1996 – Productivity Works created pwWebSpeak, a browser that translated text into speech.

- 1997 – NCR Corp created the first audio ATM, accessible to blind or illiterate users.

- 1998 – Synchronized Accessible Media Exchange (SAMI) released to allow simplified ability to caption and audio describe videos (5).

- **1998 – Section 508 is added to the Rehabilitation Act, requiring that government agencies make their websites more accessible to people with disabilities.** Some of these requirements include text descriptions of images, elimination of flashing colors, and regulations against changing a user's preset contrast setting (16).

- **1999 – World Wide Web Consortium (W3C) released Web Content Accessibility guidelines.**

- 2000 – Microsoft Windows 2000 released, with an on screen keyboard option and the ability to translate text to speech for illiterate or blind users (5).

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Appendix B: Monitoring and Reporting of SDG Indicator

UNESCO
United Nations
Educational, Scientific and
Cultural Organization

Sustainable
Development
Goals

COMMUNICATION AND INFORMATION SECTOR

IPDC THE INTERNATIONAL PROGRAMME
FOR THE DEVELOPMENT OF COMMUNICATION

MONITORING AND REPORTING ON SDG INDICATOR 16.10.2

GOAL 16
Peace, Justice and Strong Institutions

Target 16.10
Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements
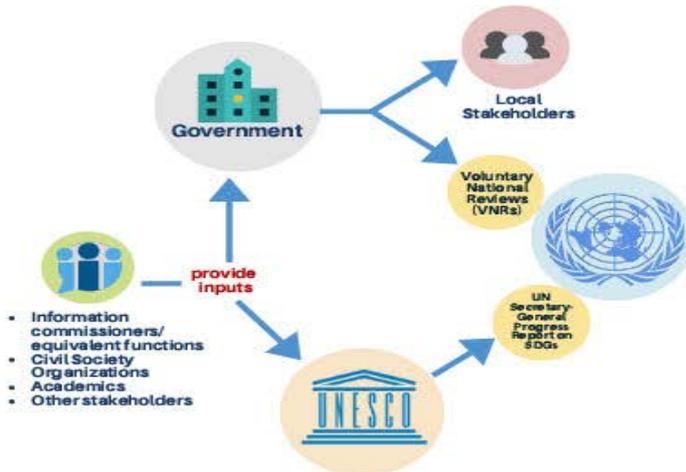
Indicator 16.10.2

ACCESS TO INFORMATION

"Number of countries that adopt and implement constitutional, statutory and/or policy guarantees for public access to information"

Tracking progress towards Access to Information

Government

Local Stakeholders

Voluntary National Reviews (VNRs)

provide inputs

- Information commissioners/ equivalent functions
- Civil Society Organizations
- Academics
- Other stakeholders

UNESCO

UN Secretary-General Progress Report on SDGs

Access to information (ATI) is critical for:

- ✓ an enabling environment for investigative journalism
- ✓ media to effectively monitor and hold government to account
- ✓ the public to be informed about decisions affecting their lives

125 countries* have adopted ATI guarantees

20	Sub-Saharan Africa
12	Northern Africa & Western Asia
12	Central & Southern Asia
9	Eastern & South-Eastern Asia
23	Latin America & the Caribbean
6	Australia, New Zealand & Oceania
43	Europe & Northern America

Source: 2019 UNSG Report on Progress towards SDGs. *Countries monitored are UN Member States.

Ver. August 2019

UNESCO as the custodian agency for 16.10.2

What we do

Develop standardised monitoring and reporting instruments for SDG indicator 16.10.2 to assist countries in tracking their ATI progress.

Pilot global data collection in collaboration with UNESCO Institute for Statistics (UIS) on the implementation of ATI guarantees in 43 developing and least developed countries that submit Voluntary National Reviews (VNRs) to the UN High-Level Political Forum (UNHLPF) in 2019.

Produce global reports on progress in the field of access to information, including in the context of SDGs.

Strengthen the capacity of Member States to monitor and report progress in access to information.

Advocate for SDGs and ATI, and promote concrete actions to improve public access to information through public awareness-raising activities, such as the Open Talks on the International Day for Universal Access to Information (IDUAI), with governments, civil society, media and academics.

Pilot countries for UNESCO's global data collection in 2019

AFRICA
- Algeria
- Burkina Faso
- Cameroon
- Central African Republic
- Chad
- Côte d'Ivoire
- DR Congo
- Eritrea
- Eswatini
- Ghana
- Kenya
- Lesotho
- Mauritania
- Mauritius
- Rwanda
- Sierra Leone
- South Africa
- Tanzania
- Tunisia

ASIA
- Azerbaijan
- Cambodia
- Fiji
- Indonesia
- Iraq
- Kazakhstan
- Mongolia
- Nauru
- Pakistan
- Palau
- Philippines
- Timor-Leste
- Tonga
- Turkey
- Turkmenistan

EUROPE
- Bosnia and Herzegovina
- Croatia
- Serbia

LATIN AMERICA AND THE CARIBBEAN
- Brazil
- Chile
- El Salvador
- Guatemala
- Guyana
- Saint Lucia

Key findings from the data collection:

Highlights from the 2019 UNESCO Monitoring and Reporting of SDG Indicator 16.10.2:

http://bit.ly/ATIReport2019

Capacity-building projects on SDG 16.10.2

- Regional Latin America
- Côte d'Ivoire
- Ethiopia
- Ghana
- Indonesia
- Mongolia
- Morocco
- Rwanda
- Senegal
- Tunisia

News

UNESCO launches SDG survey on access to information at the UN
http://bit.ly/HLPF19B

Information commissioners key to successful monitoring and reporting on SDG 16.10.2
http://bit.ly/ICIC19A

UNESCO convenes experts to advance monitoring and reporting on access to information
http://bit.ly/ATI16102

UNESCO event advocates for access to information within the sustainable development agenda
http://bit.ly/HLPF19A

UNESCO promotes SDGs to the world's Information Commissioners, discusses cooperation
http://bit.ly/ICIC19B

UNESCO's Monitoring and Reporting Instruments for indicator 16.10.2
http://bit.ly/SDG16102

UNESCO pilots global data collection on access to information
http://bit.ly/ATIPilot

IPDC Council encourages further development of mechanism to monitor and report on access to information
http://bit.ly/IPDCATI

ipdc.secretariat@unesco.org   https://en.unesco.org/programme/ipdc

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