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Assessing the Readiness of Government and Semi-Government Institutions in Qatar for Inclusive and Sustainable ICT Accessibility: Introducing the MARSAD Tool

Achraf Othman ^{*}, Amnah Al Mutawaa, Amani Al Tamimi and Maha Al Mansouri

Mada—Assistive Technology Center Qatar, Doha P.O. Box 24230, Qatar

^{*} Correspondence: aothman@mada.org.qa

Abstract: Information and Communication Technology (ICT) has revolutionized the lives of persons with disabilities globally through opportunities for improved social inclusion. Technology enables persons with disabilities to access information, media, education, employment, and ICT-related assistive technologies. Decision makers must clearly understand the current state of available ICT products and services, their compliance with international accessibility standards, and their usage within the country to propose effective inclusive policies and legislations. This paper presents an e-readiness assessment tool (called MARSAD) created and implemented from 2019 to 2021 to identify factors that influence the adoption of ICT accessibility for people with disabilities in Qatar. It aims to measure the national ICT accessibility adoption rate and develop key recommendations to improve digital access for persons with disabilities to access digital platforms of various Qatari government and semi-government institutions. The tool was administered to 14 institutions in the domains of education and culture. It was found that participating institutions had considerable gaps in their ICT infrastructure to offer an inclusive digital environment, which is in line with the principles of sustainability and SDG 11, to make cities and human settlements inclusive, safe, resilient, and sustainable. The participating institutions demonstrated a genuine willingness to invest in implementing the required changes based on the results acquired by conducting MARSAD. As a suggestion, the tool can be used as a foundation to conduct e-readiness assessment studies to offer accessible ICT products and services catering to the needs of persons with disabilities, women, children, and older persons.

Keywords: SDG 11; inclusion and disability; digital transformation; inclusive society; e-readiness assessment; ICT accessibility; digital accessibility; policy adoption rate



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1. Introduction

The exclusion of persons with disabilities from adequate access to information and communication technology (ICT) can significantly decrease their quality of life [1]. Article 9 of the United Nations Convention for Rights of Persons with Disabilities (UNCRPD) outlines that the provision of accessible ICT is a fundamental obligation for all State parties. The requirement for digital accessibility when accessing ICT products has increased since the endorsement of the UNCRPD [2]. Furthermore, the article ensures the preservation of fundamental human rights and economic opportunities for sectors of society, including the persons with disabilities communities [3]. The increasingly available public and private services offered through ICT and the integration of ICT in various assistive technologies enable them to break traditional barriers in communication, interaction, and access to information [4]. In this context, it is of paramount importance that the provision of accessible ICT is in line with the sustainability principles such as intergenerational equity, the polluter pays principle, and the principle of sustainable development, in order to ensure that the needs of persons with disabilities are met in a sustainable manner and that the provision of

accessible ICT can contribute to achieving the Sustainable Development Goal 11 (SDG 11) of making cities and human settlements inclusive, safe, resilient, and sustainable [5].

UNCRPD acknowledges the importance of statistics and data collection for policy-making [6]. Digital accessibility for persons with disabilities can be a vital indicator of developing effective disability-inclusive policies. For example, the e-handbook of the United Nations Economic and Social Commission for Western Asia (ESCWA) on Sustainable Development Goal Framework and Metadata identifies the proportion of youth and adults with information and communications technology skills as a crucial indicator for policymakers to ensure the provision of quality education for individuals with disabilities [7]. However, it is vital to collect and analyze relevant data to facilitate effective disability-inclusive policy development by policymakers [8].

As a ratified signatory of the UNCRPD, Qatar has been taking steps toward making technology accessible for all. In 2018, Qatar ranked fifth in the Digital Access Rights Evaluation Index (DARE Index), a global study conducted by policymakers to measure the country's progress related to digital accessibility and compliance with the Convention on the Rights of People with Disabilities [9]. The study considered country laws and regulations and the country's ability to implement existing ICT access programs and policies. The second edition of the DARE Index conducted in 2020 comprised an analysis of developments across 137 countries from the 182 State Parties to the UNCRPD in eight regions: Africa, Central Asia, East Asia, and Pacific, Europe, Latin American and Caribbean, the Middle East and North Africa, Northern America, and South Asia accounting for 90% of the world population. The population with disabilities in Qatar comprises individuals with varying disabilities. All members of this population can potentially benefit from improved quality of life from equal digital access through accessible ICT. In 2019, Qatar ranked second highest among Arab countries and 38th worldwide in the Network Readiness Index, which publishes annual rankings assessing the readiness of countries to leverage information technologies to be future-ready [10].

The digital divide, which refers to the unequal access and utilization of technology between different populations, is a pressing sustainability issue, particularly for persons with disabilities [11]. The lack of accessible technologies, high cost of assistive devices, and limited training opportunities result in this vulnerable group being excluded from the digital realm and exacerbating existing socio-economic inequalities [12]. To ensure a more sustainable future for all, it is crucial to address the digital gap for persons with disabilities by integrating accessibility into the design of digital technologies and providing training and support to fully participate in the digital world [13]. This will not only benefit this group but also contribute to a more inclusive and sustainable society as a whole [14].

As a follow-up, Mada designed and implemented an ICT Accessibility Adoption Rate (called "MARSAD" and means observatory), an e-readiness assessment tool [15], to measure the adoption rate of accessible ICT and develop key recommendations to improve digital access of people with disabilities and those with functional limitations for all digital platforms managed or owned by Qatari institutions. This tool was implemented over three years, from 2019 to 2021. After conducting the MDS in 2018, the primary focus area requiring enhancement was identified to enable persons with disabilities through ICT within the domains of education, community, and culture. It is important to note here that community and culture are defined broadly to include access to all aspects of social life. Inclusion in social life is critical for independent living, including but not limited to access to museums, digital broadcasts, cinemas, retail spaces, sports facilities, transportation, and the use of smart homes.

MARSAD is a dedicated tool focused on aspects related to ICT accessibility standards that facilitate ICT adoption by the organizations and institutions in the State of Qatar. Qatar is firmly committed to maximizing Internet utilization across its businesses and households. The growth of the Qatari e-commerce market is expected to rise three-fold over five years, from QR4.7 bn (\$1.3 bn) in 2017 to almost QR12 bn (\$3.2 bn) in 2022 [16]. In 2017, Qatar ranked second highest among the Arab Gulf States in the ICT Development

Index conducted by the International Telecommunication Union (2017). In 2018, Qatar had an Internet penetration rate of 94% among households and had maintained this rate above 90% since 2013 [16].

This paper discusses the factors that influence the adoption of ICT accessibility and the importance of having a specialized e-readiness tool to measure aspects of digital accessibility. Sections 2 and 3 discuss the importance of implementing accessible ICT to improve the lives of persons with disabilities and considers the development of an e-readiness tool to measure the utilization of accessible ICT in various domains. Section 4 describes the alignment between the e-readiness assessment tool and the DARE Index components for an inclusive digital society and economy. Sections 5 and 6 discuss this tool's methodology and implementation process through a survey conducted on 14 institutions in the State of Qatar. Furthermore, the last section presents the outcomes of the assessment and its key findings.

Our study focuses on the adoption of ICT accessibility for persons with disabilities and the identification of factors that influence this adoption. The novel contribution of our work lies in the development and implementation of the e-readiness assessment tool, MARSAD, which measures the national ICT accessibility adoption rate and provides key recommendations for improving digital access. This tool can serve as a foundation for future e-readiness assessment studies and support the development of accessible ICT products and services catering to the needs of persons with disabilities. Our study highlights the importance of understanding the current state of ICT products and services, their compliance with international accessibility standards, and their usage within a country in order to propose effective inclusive policies and legislation. This work contributes to the growing body of knowledge on the role of ICT in promoting social inclusion for persons with disabilities.

2. Background on the E-Readiness Concept and E-Readiness Assessment Tools

2.1. Understanding the Concept of E-Readiness in Relation to Persons with Disabilities

In the literature, the concept of e-readiness emerged because it became necessary to provide a unified framework to evaluate the breadth and depth of the digital divide at the macro-level between more and less developed countries during the late 1990s. We conducted a literature review to understand in depth the e-readiness concept and existing tools. E-readiness measures the capacity of nations to participate in the digital economy. It is also perceived as a country's ability to leverage digital channels for communication, commerce, and government to further economic and social development [17]. Another perception of e-readiness is related to the readiness of nations to benefit from a networked world. In this context, it is measured as a community's relative advancement in the most critical areas for ICT adoption and the essential applications of ICTs. A broader approach to e-readiness describes it in terms of the availability of ICT infrastructure, the accessibility of ICT to the general citizen and business organization population, and the effect of the legal and regulatory framework on ICT use in, for example, an e-government strategy [18]. The concept of e-readiness has been further extended to measure the ability and readiness of nations or entities (e.g., organizations) to utilize ICT to sustain welfare and growth [19]. The technology readiness (TR) index aims to better understand people's propensity to embrace and use cutting-edge technologies [20]. Moreover, the metric is used to develop the economy, foster welfare, and ensure better participation in the global socioeconomic value chains [21]. It further refers to the degree of preparedness of a country for implementing e-governance models and to the ability of all parties to participate in the digital world (for example, e-commerce and e-government) [22,23].

In the context of this paper, e-readiness can be explained as the nations' readiness or the ability of organizations to provide access to inclusive and accessible ICT digital platforms suitable for use by persons with disabilities. This definition of e-readiness can be categorized to impact both social welfare and economic factors. Persons with disabilities face various barriers that prevent them from economic autonomy, joining the labor market,

and receiving equitable services, which erodes their dignity and rights and significantly contributes to a state's welfare burden. The provision of accessible ICT can effectively alleviate this problem by providing access to skills, education, and employment facilitated by digital platforms, thus positively impacting social welfare factors. Subsequently, having adequate access to ICT-based platforms and services will enable members of the disability community to be active participants and contributors in the digital economy by being empowered to utilize e-commerce and related services, thus positively impacting economic factors.

2.2. E-Readiness Assessment Initiatives and Tools

The rapid progression of ICT over the past two decades has made it essential for governments and policymakers to understand the state of ICT infrastructure, access, and services within a country. Since the concept of e-readiness, various e-readiness assessment initiatives have been conducted to measure various aspects of ICT, society, and the economy. E-readiness assessments are meant to guide development efforts by providing suitable tools for comparison and gauging the relational progress of aspects that are relevant to ICT accessibility [24]. Countries enabling their population by offering inclusive access to information and consequently allowing them to attain social, cultural, economic, and political advancement aspire to achieve a certain measure of e-readiness. E-readiness assessments can offer governments and policymakers vital information to develop impactful national ICT strategies and improve specific aspects of e-readiness [25]. Leveraging the rapidly evolving scope of ICTs can empower governments and organizations to seek innovative solutions to socioeconomic challenges regarding poverty reduction, education, health, and social justice [26].

The maximum potential of ICT usage can be achieved by acquiring a high degree of e-readiness. The potential reflects the country's ability to provide accessible ICTs to the population, the effectiveness of the implemented legal and regulatory ICT framework (if any), and progress related to ICT-driven projects and initiatives. E-readiness assessments allow governments and organizations to identify and optimize the development of ICT-based opportunities. Furthermore, e-readiness assessment results provide governments with crucial data to measure the current state and progress of ICT-related social and economic targets and develop national ICT strategies and targets to create a knowledge and information-based economy and society. Ultimately, e-readiness assessments allow policymakers to decide on the best approaches to utilize national resources to achieve the ICT-based goals of the country. It is critical to conduct periodic e-readiness assessments to develop and keep track of ICT-related objectives contributing toward short- and long-term national vision.

Many e-readiness assessment tools have been designed to measure ICT utilization and penetration among communities, organizations, and populations on a macro and micro level. Depending on the objectives, these tools are very diverse in their goals, strategies, and results [26]. Similar to the perception of e-readiness definitions, e-readiness assessment tools can primarily be classified into e-society and e-economy. E-society e-readiness assessment tools focus on ICT usage relating to social welfare, such as social inclusion, education, health, individual property rights, and population density. In contrast, e-economy e-readiness assessment tools focus on ICT usage relating to e-business, e-commerce, and ICT infrastructure associated with supporting business and economic growth.

2.3. E-Readiness Assessment Models and Tools: The Qatari Context

The World Health Organization developed the Model Disability Survey (MDS). It is a general population survey that allows for a direct comparison between the needs of and barriers faced by groups with differing levels of disability, including people without disability. Mada Center is a private institution for public benefit, which was founded in 2010 as an initiative that aims at promoting digital inclusion and building a technology-based community that meets the needs of persons with functional limitations: persons

with disabilities and older adults in the State of Qatar. This naturally positioned Mada to develop and implement a tool to identify gaps and opportunities to improve the state of ICT accessibility in the country and influence policies related to empowering persons with disabilities.

Furthermore, Mada conducted the Digital Accessibility Rights Evaluation Index (DARE Index) study in Qatar, which, similar to the MDS, identified gaps in digital access among persons with disabilities within the domains of education, community, and culture. Table 1 contains the scores for the level of implementation of policy and program outcomes by areas of ICT accessibility reflected in the DARE Index 2018 study in Qatar. The results of the MDS and DARE Index reflected the need to measure the ICT adoption rate among various institutions in Qatar and develop recommendations to improve the state of digital inclusion of persons with disabilities and older adults within the domains of education, culture, and community through the implementation of applicable policies and legislations.

Table 1. Scores from the DARE Index 2018 study in Qatar for the category indicators of the level of implementation of policy and program outcomes by areas of information and communication technology (ICT) accessibility [9].

| Indicators | | | Points | Domain |
|--|---------------------|----------------|--------|---------------------|
| Area | Existence of Policy | Implementation | | |
| Web | Yes | Yes | 4/5 | Community/Culture |
| TV and multimedia | Yes | Yes | 2/5 | Community/Culture |
| Mobile telephony | Yes | Yes | 5/5 | Community/Culture |
| E-books and digital contents | Yes | Yes | 2/5 | Education/Community |
| Internet Availability and Usage among Persons with Disabilities | Yes | Yes | 3/5 | Community/Culture |
| Inclusive ICTs for all in education | Yes | Yes | 4/5 | Education |
| Enabling ICTs for all in employment | Yes | No | 1/5 | N/A |
| E-government and Smart Cities for all | Yes | Yes | 4/5 | Community/Culture |
| Enabling Assistive Technologies and ICTs for independent living | Yes | Yes | 5/5 | Community/Culture |
| Procurement of accessible public goods and services for all citizens | No | No | 0/5 | Community/Culture |
| Total points | | | 30/50 | |

A myriad of evaluation models for e-readiness tools, which can be used by organizations, individuals, and governments to conduct the assessment, exist in the modern world of ICT [27]. Global companies have devised e-readiness in a way that can be easily used in grading exercises. E-readiness procedures allow for comprehensive feedback on the prowess of the ICT to be accessed whenever they are published by the concerned companies [28]. An example of an e-readiness assessment framework is the UN e-government publication and its grading by the Economic Intelligence Unit (EIU) [29]. Other e-readiness examples include the Centre for International Development (CID), designed to study the

preparedness of developing countries, and Asia-Pacific Economic Cooperation (APEC) e-readiness results, which have been used as the reference for crafting digital electronics in Asia Pacific states. The central e-society and e-economy tools are shown in Table 2.

Table 2. Comparison of e-economy and e-society tools based on target populations and sectors.

| E-Economy Readiness Tools | | E-Society Readiness Tools | |
|---|---|--|-------------------------------------|
| Tool | Target | Tool | Target |
| E-readiness Ranking Tool [30] | Large economies | CID e-readiness tool | Communities in developing countries |
| APEC e-commerce Readiness Assessment Guide [15] | General communities and businesses. Policy-oriented | “Readiness Guide for Living in the NetworkedWorld” | General communities and businesses |
| Risk e-business Tool [31] | Nations | World Bank KAM | Dynamic communities |
| Index of ICT Diffusion [32] | Economic policymakers | “Mosaic’s Global Internet Diffusion Framework” | Digital communities |
| Global Technology Index (GTI) [15] | Economic policymakers | The Information Society Index (ISI) | Digital communities |

E-readiness assessment is widely used, and the world’s most trusted institution which performs e-readiness activities is the EIU; it has successfully produced the most extensive global e-readiness grading since its inception [33]. The EIU grading model was based on the country’s infrastructural capacity and the number of telecommunication and computer devices present. The World Bank’s Knowledge Assessment Methodology is another e-society tool that targets migration to knowledge-based communities [34,35]. Risk E-business Tool assesses the nation’s capacities to delve into digital economic activities, while Mosaic’s Global Internet Diffusion Framework assesses the Internet’s pervasiveness. The main principle of e-readiness is to ensure that all the factors are well managed and that the planned activity will be successful [36]. The principle is enhanced via training on the effective running of e-commerce and other e-business. The Information Society Index, Global Technology Index, and Index of ICT Diffusion all assess the capacity of communities to remain digital despite the dynamicity of the global social and economic systems.

While the highlighted frameworks or assessment tools provide data regarding the readiness for ICT use, none of the models underscore the difficulties of persons with disabilities. The e-readiness ranking tool from EIU is critical in examining the adoption and application of technology by developed nations to various divisions that would guarantee economic growth. E-economy readiness assessment models also evaluate citizens’ technology prowess and how it can be transformed into economic growth [37,38]. The model fails to explore how these largest economies consider the needs of persons with disabilities when developing their technology policies. Similarly, the APEC E-Commerce Readiness Assessment Guide targets major businesses that drive the rising Asian economies. The framework entails full details on the technology infrastructure possessed by nations that could allow their businesses to thrive. The other three e-economy readiness assessment tools focus on exploring the critical infrastructure in the countries and the state implementations of the latest technologies to ensure economic prosperity.

2.4. Lack of Inclusion in E-Readiness Assessment Tools: The Need for Accessibility Standards in Digital Platforms

The central variation between the e-economic and e-society readiness is their target bases. The community remains a central audience or focus group for the latter category of readiness evaluation approaches, as shown in Table 2. The focus of e-economy e-readiness is businesses that contribute directly to the gross domestic and national products. However, Table 2 revealed a lack of specificity in the types of economies targeted by the tools and frameworks. Most importantly, none of the e-readiness tools target communities with vari-

ous disabilities or functional limitations. Furthermore, most e-readiness assessment tools in the e-economy and e-society categories assess the capacities of nations and communities to implement ICT and develop relevant policies while ignoring the aspect of equality.

The emergence of ICT has led to economic expansion, especially in developing countries [39]. ICT has provided access to all materials available globally regardless of their purpose. Scholars have since attempted to broadly discuss the e-readiness impacts of ICT adoption in developing countries [40] to reduce the gap through assessment toward capturing the loopholes regarding challenges related to ICT accessibility. Since then, authors have discussed virtual services extensively through the e-readiness of developed countries [41]. Table 3 summarizes e-readiness assessment tools that impact society and the economy and the relevant measures.

Table 3. E-readiness group categories and measures.

| | Group | Measure |
|---|--|--|
| 1 | Available infrastructure, level of technology, level of ICT services, number of connected households, Internet level adjustments | The measure is determined by the following factors: speed, reliability, readiness, associated cost, and transmission capacity, among others. |
| 2 | How people use ICT, how people use the Internet, universality, and amalgamation of ICT | Is the available infrastructure used in a residential institution of learning, companies, bolstering the economy, running government services, performing everyday life activities, and the number of Internet users? |
| 3 | The available legal work, the proximity of network, ease of ICT penetration, the global ranking of the digital economy | How is the present ICT policy in place? What are the industry standards? How does credit card regulation work? What are the industry-led standards? What are government regulations? Does intellectual property govern them? |
| 4 | Competence, workforce, consumers | What is the level of ICT comprehension? How are the training levels? What are the competency level and present workforce? |
| 5 | Others | The diversity of the company's ideal online content, the competitiveness of market commodities, political issues, population level, etc. |

Despite the vast array of e-readiness tools and approaches that can be utilized to assess various business aspects, most of these tools are meant to measure aspects such as policy making and national ICT development strategy impacts. However, none of these tools specifically focus on indicators related to the usage of ICT by persons with disabilities and the provision of accessible digital infrastructure. Therefore, policymakers must be at the forefront of formulating guidelines to increase the magnitude of e-readiness measures to address the needs of persons with disabilities.

In summary, e-readiness assessments provide policymakers with a complete model of the economy's competitiveness concerning ICT performance at the local and international levels. The comparisons in Tables 2 and 3 illustrate the e-readiness assessment tools currently focused on various economic and social aspects of ICT usage. However, they have yet to emphasize social inclusion factors, such as the challenges facing people with disabilities in accessing information and communication technologies.

Many persons with disabilities cannot use computer technologies and ICT-based services without the help of assistive technologies, such as customizable interfaces, alternate input devices, and screen readers. According to the WHO, nearly 15% of the world's

population comprises people with disabilities [42]; this translates to more than 1 billion people. This statistic attests to the significant number of people whose needs should be considered when developing digital platforms. The development of digital platforms must be based on principles and processes which allow the support of devices, options, and customizations geared toward meeting the needs of people with different disabilities [43]. Such accessibility allows people with disabilities to effectively use the Internet and other media technologies. Hence, when considering the disability population, the realm of accessible ICT includes the availability of an ICT infrastructure that incorporates the relevant accessibility standards. Nations need to acquire optimal e-readiness to accommodate the adequate availability of ICT and related services for persons with disabilities. The adoption will ensure growth over the next decades due to increased life expectancy and rapid growth of the older-adult population worldwide and in the State of Qatar [44,45].

3. The Novel E-Readiness Assessment Framework “MARSAD”

Policymakers need to understand the status of ICT usage and its impact on organizations and population sectors from a policy and infrastructural level. Effective policy implementation results in adequate ICT infrastructural provision to meet the market and social needs of the population. Moreover, the implementation ensures a higher level of digital inclusion and e-readiness. The MARSAD e-readiness assessment framework, proposed by the authors of this study (Figure 1), is grounded in factors related to implementing ICT infrastructure and policies. The framework identifies 13 critical components of the E-Readiness Assessment related to implementing an accessible ICT ecosystem based on the research outcome of Averweg in 2009 [18]. All the indicators will be described in detail. Furthermore, derived from principles of the DARE Index, the framework identifies policies, processes, and standards necessary to implement these e-readiness assessment components effectively. Finally, ten outcome indicator areas that will be impacted because of adequate provision of accessible ICT have been included in the framework. These outcome indicators are the following: web, TV and multimedia, mobile telephony, e-books, and digital contents, Internet availability and usage among persons with disabilities, inclusive ICTs for all in education, enabling ICTs for all in employment, e-government, and smart cities for all, enabling assistive technologies and ICTs for independent living, and procurement of accessible public goods and services for all citizens.

3.1. Government

Governments play a significant role in contributing to successful ICT adoption in a country. The adoption is primarily because government support is critical in funding the development, maintenance, and improvement of national ICT infrastructure, which dictates the country's e-readiness. National ICT policy and regulatory frameworks developed by governments define the vision and roadmap of ICT infrastructure and services that are to be implemented and are overseen by the public and private sectors. Progressive governments develop roadmaps and policies offering a clear vision toward ICT adoption by defining the roles of all stakeholders, including companies, citizens, and organizations. Pro-active government investments in the implementation and regulation of ICT infrastructure and services can lead to early adoption of ICT on a nationwide scale driving the demand for ICT-based services across all domains and thus paving the path toward attaining high levels of e-readiness.

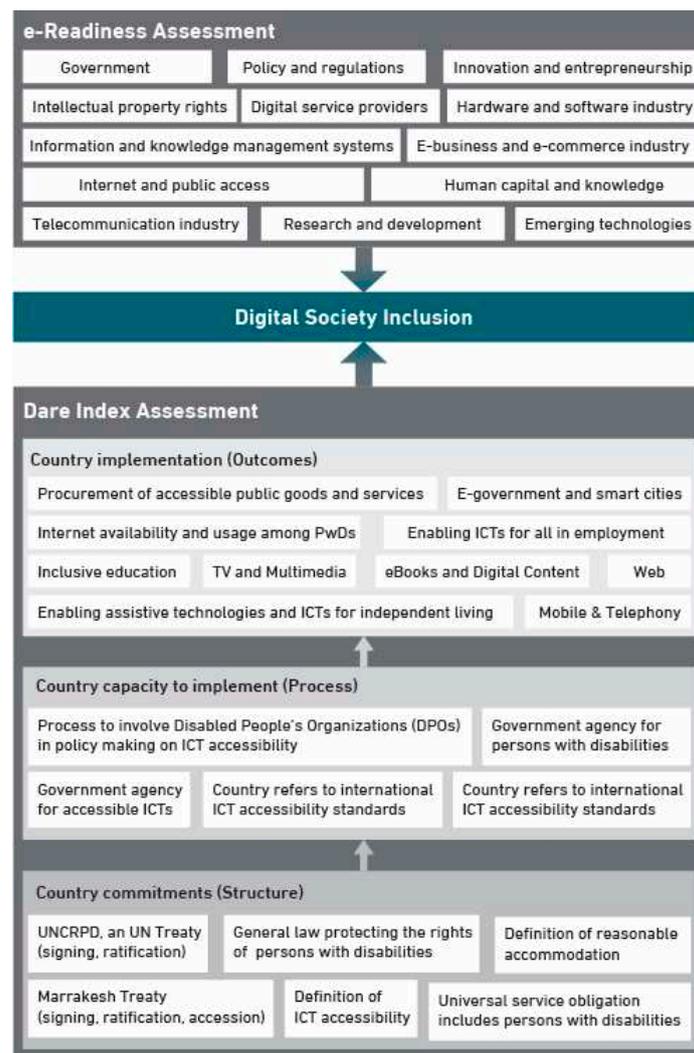


Figure 1. Overview of the e-readiness assessment framework proposed by the authors.

3.2. Policy and Regulations

ICT policy and regulatory frameworks are critical to achieving a thriving digital economy. Implementing a national ICT policy and regulatory framework can improve the economy by offering diversified business opportunities.

The convergence and changing role of ICT in the economy and society and its involvement in all aspects of the public sector, private sector, and communities, such as employment, education, and health, have a significant potential impact on social and economic development. The reduction of barriers, such as cost, access, and capacity, through ICT can help achieve goals, such as increased access to education. The national ICT vision should be stated and a roadmap provided to achieve its goals, objectives, and strategies. An overarching policy is necessary to coordinate and harmonize the ICT direction across all sectors.

For businesses to prosper and benefit from ICTs, a favorable business climate is required. It necessitates a transparent, open, and competitive business environment; explicit, independent legal norms that apply to all enterprises; procedures for the quick formation and dissolution of organizations; and transparent, straightforward, and accessible corporate governance. Furthermore, the International Telecommunications Union expands the realm of accessible ICT to signify the importance of ICT accessibility by stating that “to extend the benefits of ICTs to all, ICTs have to be made accessible to persons living with disabilities, so these technologies constitute an opportunity and not a barrier” [46].

3.3. Internet and Public Access

The Internet is an integral aspect of ICT, facilitating data flow across networks, platforms, and devices. It has evolved into an essential tool for accessing information and communication services along with e-commerce services that allow the purchase of goods and services. Public Internet access enables more significant ICT usage by facilitating the usage of population segments for whom affordability may be an issue, such as students and lower income groups [47]. Equitable access to information, communication, and government services is a significant characteristic of digital economies as it contributes to social and economic inclusion. The Internet must be affordable and widely available in public areas such as cafes, parks, and libraries, as providing Internet access is fundamental to allow everyone to benefit from it and accelerate the growth of digital economies.

3.4. Hardware and Software Industries

Hardware and software industries are vital components in building a robust ICT infrastructure. Cutting-edge hardware and software technologies are at the forefront of the rapidly evolving ICT sector. Various types of hardware, including microprocessor technology, parallel processors, neural networks, client/server technology, disk storage, open systems, user technologies, artificial intelligence systems, and virtual reality systems, interoperate within an advanced ICT infrastructure. Successful digital economies consist of hardware technologies such as wireless and mobile communication technologies, which enable consumers to place orders online through their mobile devices. The software industry offers products and services consumed by small and medium enterprises (SMEs) in the digital economy. Such products and services include enterprise resource planning, customer relationship management systems, SQL servers, Oracle, system applications, data processing, computer programming services, prepackaged software, computer integrated systems design, computer processing, data preparation, information retrieval services, and computer services management. National ICT policy and regulation frameworks need to provide an incentivized business ecosystem for the hardware and software sectors to achieve high levels of e-readiness.

3.5. Telecommunications Industry

The telecommunication industry provides several significant services fundamentals to an ICT-based society and economy. These services include landline and mobile telephony communications, Internet service provision, radio broadcasting, television broadcasting, and videoconferencing facilities/services. Furthermore, the telecommunications sector is core to the global information infrastructure. It can be defined as a seamless web of interactive communications being deployed worldwide to provide the infrastructure for new services and activities based on the strategic use of all types of information.

3.6. Digital Service Providers

Digital service providers comprise services offered over the Internet, such as online shopping, websites or applications, and multimedia (e.g., music and movies) streaming services. These services may support e-commerce features allowing consumers to conduct financial transactions to avail of the services. Digital service providers may include content providers for information-based services such as online portals and e-government. Revenue generation from digital services is key to a thriving digital economy. It can also serve as a primary e-readiness component when measuring the contribution of ICT-based factors toward economic growth.

3.7. Information and Knowledge Management Systems

Access to appropriate information and knowledge is crucial for traditional businesses to transition to e-businesses. Many SMEs may be interested in moving into e-business but require additional information on critical issues to take the next step [48]. Societies with a developed digital economy tend to have a knowledge-based economy in which

information and knowledge management systems are vital for businesses to operate successfully. The efficiency in acquiring, interpreting, synthesizing, evaluating, and managing related information channels that support organizational processes dictates the potential of organizations to achieve their business goals. The presence of adequate information and knowledge management channels adds value to businesses and impacts their return on investments making it essential to manage them well [49]. Businesses operate in an increasingly knowledge-intensive environment where intra- and inter-organizational knowledge sharing is highly valued. Goods and services are also increasingly produced in intangible capital, making knowledge an essential element in competitions between public bodies within knowledge-based economies.

3.8. E-Business and E-Commerce Industry

The ability of companies to conduct financial transactions utilizing electronic platforms can significantly impact how they conduct business. E-business and e-commerce facilities allow organizations to communicate cost-effectively and transact with local and international clients transparently. E-business channels allow businesses to streamline communications and enhance customer response time using digital services, such as the Internet, email, and digital applications. E-commerce can be interpreted as buying and selling goods and services electronically with computerized business transactions using the Internet, networks, and other digital technologies [50].

3.9. Intellectual Property Rights

Intellectual property rights are an essential element of achieving strong e-readiness and the development of stable digital economies. SMEs need to protect their ICT innovations and digital products by being able to afford the obtainment and maintenance of intellectual patents. It is vital to implement balanced intellectual property rights regulatory frameworks that safeguard the interests of suppliers and users and protect and manage intellectual property and digital rights without disadvantaging innovative e-business and content distribution models.

3.10. Human Capital and Knowledge

Human capital and knowledge skills of a firm's workforce related to rapidly evolving ICTs are critical for organizations to realize their full growth potential. SMEs intending to compete in international markets demand the presence of an ICT-skilled workforce. The presence of expertise in the field of IT and web-based platforms are critical in determining an organization's e-readiness. Knowledge-based digital economies rely highly on human capital investment in knowledge workers, such as architects, bank workers, fashion designers, pharmaceutical researchers, teachers, and policy analysts. A knowledge worker works primarily with information or one who develops and uses knowledge in the workplace to develop new designs, ideas, and innovations [51]. The knowledge workers' levels of education, research and development, communication, and access to information services form the scope of a knowledge-based economy.

3.11. Research and Development

Research and development are an essential aspect of maintaining a leading position and being at the forefront of implementing and adopting new ICTs and related services. The rapidly evolving nature of the ICT sector makes it vital for governments and economies to offer a business environment that promotes innovation resulting in the creation of new products and services. A successful research and development element within the economy requires adequate networking mechanisms and knowledge exchange among various sectors, such as business entities, research bodies (e.g., universities and research institutions), customers, suppliers, government regulators, financial institutions, and the public. The research and development sector is further strengthened by providing ICT

business incubation centers and support services that often foster the creation of new technology-based start-ups, which are crucial contributors to economic growth.

3.12. Emerging Technologies

Emerging technologies play a role in the evolving digital economy. It is critical for nations to be involved in developing emerging technologies or their early adoption. The research and development element of a digital economy often helps develop impactful solutions, which eventually evolve into emerging technologies. Early adoption of emerging technologies can place nations in a relatively advantageous position by improving their efficiency or quality of products and services within a given area. Recent emerging technologies such as artificial intelligence and machine learning, virtual and augmented reality, blockchain, and robotic process automation are widely used [52]. The rapid progression of ICTs means nations will be required to integrate emerging technologies into their ICT infrastructures and ecosystems readily.

3.13. Innovation and Entrepreneurship

Harnessing the full potential of innovation and entrepreneurship is at the core of a growing digital economy. The ability for businesses and SMEs to innovate enables the development of new solutions and localization of existing solutions to meet the needs of local market sectors. The provision of a nationwide innovation ecosystem to support innovation and entrepreneurship within the private sector through establishing ICT business incubation centers and dedicated innovation programs can significantly catalyze the development of new digital solutions.

The success of the ICT industry relies on several key factors, including funding streams for innovation, community and market access, support for solution providers, effective policy and best practices, collaborations and networking opportunities, innovation and design capabilities, a strong private sector, informed decision-making through evidence and research, and improved delivery and capacity. All of these elements work together to enable a more inclusive digital society [53].

4. Methodology

4.1. Research Questions

The methodology aims to investigate the factors that influence the adoption of ICT accessibility measures by government institutions and the impact of these factors on the overall accessibility of government-provided services for individuals with disabilities. In order to achieve this objective, the study will be structured around two specific research questions: “What factors influence the adoption of ICT accessibility measures by government institutions?” and “How do these factors impact the overall accessibility of government-provided services for individuals with disabilities?”.

4.2. Theoretical Model

Based on research questions on how to identify factors influencing the readiness of ICT accessibility in the country, we conducted a survey on a sample of organizations. The MARSAD e-readiness tool measured the state’s ability of institutions in Qatar to provide accessible digital platforms for persons with disabilities. These digital platforms ranged from websites providing access to information and communication channels to complex web portals offering e-services with e-commerce features. In 2018, the MDS conducted in Qatar established that the primary focus areas of ICT usage by persons with disabilities are within the domains of education, culture, and community. As part of its mandate, the Mada Center through strategic partnerships, works to enable the education, culture, and community sectors through ICT to achieve an inclusive community and educational system. The Center achieves its goals by building partners’ capabilities and supporting the development and accreditation of digital platforms per international standards of digital access. The initial step of the tool implementation involved identifying and selecting

partnering institutions within the domains of education, culture, and community to achieve an optimal and direct impact on the lives of persons with disabilities.

For this study, we followed the socio-technical system (STS) theoretical framework that provides a comprehensive understanding of the interactions between technology and society and could be used to analyze the results of the e-readiness assessment tool in this paper [54]. The STS framework considers both technical and social aspects in the design and implementation of ICT systems and their impact on users. It would be relevant to apply the STS framework to understand the factors influencing the adoption of ICT accessibility by the participating institutions in Qatar and to develop recommendations for improving digital access for persons with disabilities and providing recommendations for creating an inclusive and sustainable digital environment. As a first step, several focus groups were conducted. The areas of disabilities of the participants were visual, hearing, learning, and physical impairments, and they were all from different demographics (e.g., student, employed). The focus group participants were engaged in discussions to provide information about the institution's digital platforms and relevant e-government services most accessed/used by them and rate the impact of its access/usage availability on their quality of life. Similarly, information was gathered about the most desired government institution digital platforms and relevant e-government services (currently partially or entirely inaccessible) that the participants would want to access. The participants also rated the perceived impact of having access to these digital platforms on the quality of their lives.

In this development of a theoretical narrative to identify organizations subject to the survey [55], we draw on the literature that relates to direct impact on persons with disabilities to guide our research model development. In this study, we explore how a person with disability uses or will use digital platforms of the organization or/and use the available e-government services. We commence with the broadly recognized notion that digital platforms and e-government services may always be fit for purpose. Whether digital accessibility policy is badly implemented or not followed properly to map onto the readiness of the organization, persons with disabilities have provided the existence of inadequate condition. Further, these inadequate condition of adopting digital accessibility policy may cause accessibility problems for persons with disabilities who find it hard to get information or to complete a request online.

First, persons with disabilities evaluate how inadequate implementation of digital accessibility policy will eventually bring negative consequences to them [56]. We suggest that two of the possible and immediate consequence of inadequate implementation of digital accessibility policy are the ignorance about the policy [57], and the loss of control over how they develop and update their digital platforms [58]. These two consequences are linked to the possibility that some organization may be inclined to engage in performance. We identify two additional factors that may influence the engagement. The first relates to the public relations and IT policy restrictions enacted as part of corporate governance [59]. The second involves the inclination of individual employees to engage in implementing digital accessibility guidelines that transcend normative job-role requirements [60]. The abilities and capabilities of employees to engage in discretionary work activities will depend on the resources and time available to them [61]. We present the adapted theoretical model in Figure 2.

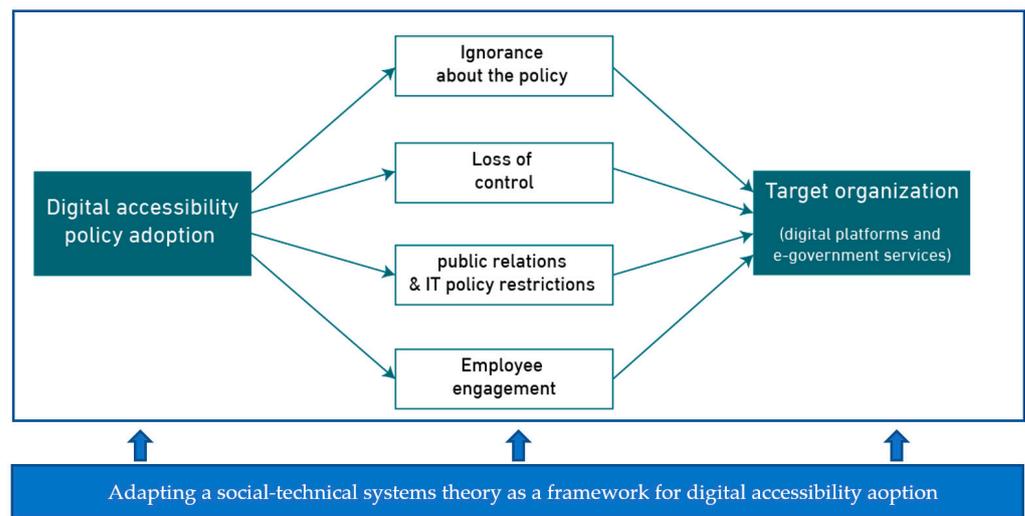


Figure 2. Adapted theoretical model based on socio-technical theory.

4.3. Data Collection

The next step involved plotting a bubble chart based on the data collected during the focus groups to identify the most relevant organizations and administer the MARSAD survey to them (Figure 3). Based on the conclusion of the focus group and following the theoretical model (Figure 1), fourteen partnering organizations within the education, culture, and community domains were identified for implementation of the MARSAD (Tables 4 and 5). For each organization, we estimate the rate of relevance to the digital accessibility policy (axis X) and the link to the persons with disabilities (bubble size). We limited our study to the organizations that are under the education and culture sector as per the Mada Center mission and vision. For that, we added a new metric linked to the relevance on the target sector (axis Y).

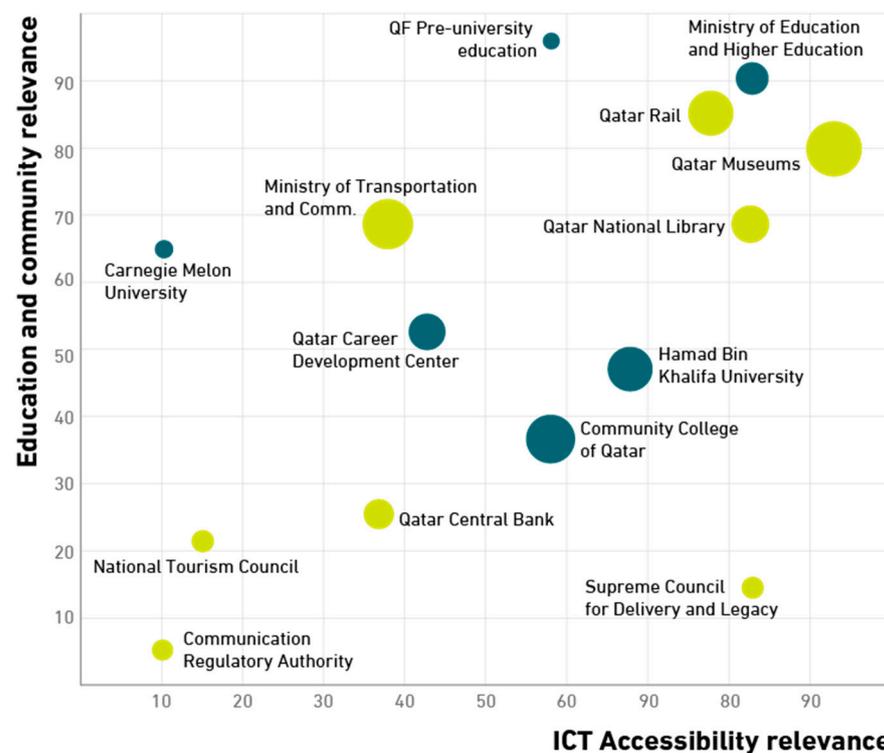


Figure 3. Relevance of organizations to the ICT Accessibility based on the ICT Accessibility adoption relevance and the education and culture relevance through the outcome of focus groups.

Table 4. Organizations within the education domain.

| | Partner Organization |
|---|--|
| 1 | Qatar Foundation: Pre-university Education |
| 2 | Carnegie Mellon University–Qatar (CMU-Q) |
| 3 | Ministry of Education & Higher Education |
| 4 | Qatar Career Development Center (QCDC) |
| 5 | Hamad Bin Khalifa University (HBKU) |
| 6 | Community College of Qatar (CCQ) |

Table 5. Organizations within culture and community sectors.

| | Partner Organizations |
|---|---|
| 1 | Supreme Committee for Delivery & Legacy (SC) |
| 2 | Ministry of Transportation and Communication (MOTC) |
| 3 | Qatar Rail |
| 4 | Communications Regulatory Authority (CRA) |
| 5 | National Tourism Council (NTC) |
| 6 | Qatar Central Bank (QCB) |
| 7 | Qatar National Library (QNL) |
| 8 | Qatar Museums |

Each of the selected organizations was asked to complete the survey twice. The first was conducted in Q2 of 2019 ($N_1 = 14$) and again in Q2 of 2021 ($N_2 = 14$). Generally, the public relation manager was the main person to answer all the questions and for some questions, other department managers were involved to justify. The method would allow for tracking if there were any improvements in the accessibility of their digital platforms. As such, the survey was to be completed by one person within the organization(s) who can provide an assessment of policies and practices at the organizational level. All participating organizations were informed about the state of accessibility of their digital platforms after they completed the survey each time. Based on the outcomes of the first survey, participating organizations were provided with consultancy and training on ways to improve the accessibility of their digital platforms. The training was provided mainly to the IT department responsible on digital platforms (websites and mobile apps).

4.4. MARSAD Survey

The MARSAD survey leverages the building blocks of the G3ict DARE Index Survey, a global resource for advocates and policymakers to benchmark progress in making ICTs accessible in compliance with the UNCRPD [9]. The survey aims to collect data in order to understand how organizations implement policies related to digital accessibility. The result of the survey is meant to provide strategic visibility at the executive level of the current status of organizational digital accessibility and work toward improving digital accessibility to staff, students, educators, and a wider community. The survey is built upon three building blocks related to achieving an accessible ICT or digital environment: regulations and policies, mechanisms, and implementation that covers factors influencing the landscape of ICT accessibility within the country. It is essential to realize that these core components are often dependent on each other, and the accomplishment in one area leads to the initiation of the next. Ideally, to attain an effective digitally accessible environment, an organization must begin developing regulations and policies related to digital accessibility. Then, based on these regulations and policies, the organization employs mechanisms to

execute and sustain digital accessibility-related initiatives. Finally, these mechanisms are applied to implement digitally accessible ICT platforms.

Appendix A presented the survey questions used in this study. The initial part of the survey seeks to gain information about the participating organization regarding its services offered to the customers and its digital presence in developing and maintaining organizational mobile apps and e-kiosks. Further on, according to the mentioned components, the survey is divided into three sections. The first section, "Regulations and Policies," focuses on the presence of organizational policies to promote and foster an inclusive digital environment by providing accessible digital platforms. The next section of the survey focuses on mechanisms employed to implement digital platforms that are accessible. This section investigates the organizational capacity to develop and maintain accessible digital platforms by exploring the existence of internal and external resources. The last section of the survey examines the implementation aspects of digital accessibility within the organization. It primarily focuses on the presence of implemented accessible digital platforms and the associated standards practiced in implementing them. The incorporation of assistive technologies and the introduction of innovations to facilitate digital access are also considered, along with organizational publications related to digital access.

The total scores allocated to the Regulation and Policies, Mechanisms, and Implementation sections are 15 (3 points per question), 15 (3 points per question), and 70 (7 points per question), respectively. Questions answered as "Yes" followed by the relevant explanation (if applicable) received their associated scores; otherwise, they were scored as zero.

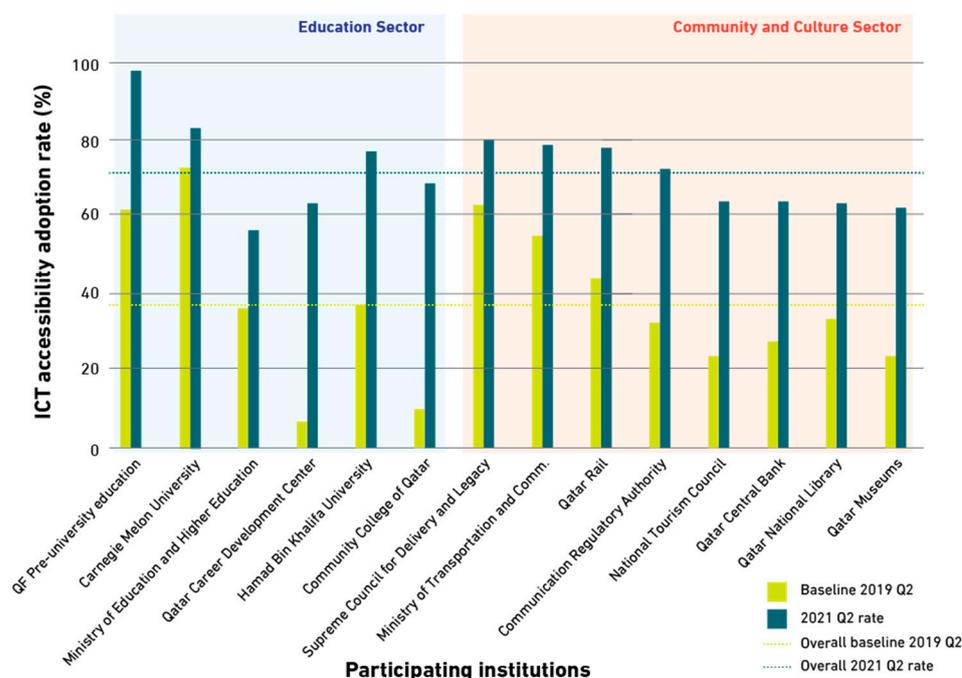
5. Results

The responses from the participating organizations tended to be similar within each domain. The first survey conducted in 2019 Q2 indicated that 5 out of 6 organizations in the education domain attained a score of 3 for the Regulation and Policies section in the survey. It indicated that at the time of the survey, there was an absence of policy governing the digital accessibility of their platforms, of framework to measure against and improve on e-accessibility, and any defined procurement requirements in these organizations. The survey scores acquired for the Mechanism section widely varied among these organizations with the highest score of 12 and the lowest of 0. It indicated that some organizations considered implementing e-accessibility standards within their digital platforms, whereas some were yet to begin the process; however, none of the organizations had a dedicated resource for implementing or monitoring the accessibility of their digital platforms. The scores for the Implementation section of the survey reflected a similar scenario with the highest attained score of 49 and the lowest of 0. It suggested raising awareness, capacity-building, and staff training concerning digital accessibility in these organizations. For the culture and community domain, the participating organizations scored between 0 and 9 for the Regulation and Policies section of the survey with only one organization scoring 15. The scores for the Mechanisms section varied between 3 and 12, with two organizations scoring 0. The scores for the Implementation section were between 14 and 28.

The second round of the survey conducted in Q2 of 2021 reflected better e-readiness among all participating organizations (Table 6). It could be attributed to the fact that based on the first survey results, Mada Center had provided all the organizations with relevant e-accessibility training, website audit reports, and strategies to improve their digital accessibility. Figure 4 illustrates the progress of the ICT Accessibility Adoption Rate from Q2 2019 to Q2 2021 by the organization.

Table 6. ICT accessibility adoption rate by an organization from Q2 2019 to Q2 2021.

| Domain | Organization | Baseline 2019 Q2 | 2021 Q2 | % Progress |
|---------------------------------|--|------------------|---------|------------|
| Domain 1: Education | 01# Qatar Foundation: Pre-University Education | 61% | 97% | 59% |
| | 02# Carnegie Mellon University | 73% | 83% | 14% |
| | 03# Ministry of Education & Higher Education | 36% | 56% | 56% |
| | 04# Qatar Career Development Center | 6% | 63% | 950% |
| | 05# Hamad Bin Khalifa University | 37% | 77% | 108% |
| | 06# Community College of Qatar | 10% | 69% | 590% |
| | Education average rate | 37.16% | 74.16% | |
| Domain 2: Community and Culture | 07# Supreme Committee for Delivery & Legacy | 62% | 80% | 29% |
| | 08# Ministry of Transportation and Communication | 55% | 79% | 44% |
| | 09# Qatar Rail | 43% | 77% | 79% |
| | 10# Communications Regulatory Authority | 32% | 73% | 128% |
| | 11# National Tourism Council | 24% | 64% | 137% |
| | 12# Qatar Central Bank | 27% | 64% | 137% |
| | 13# Qatar National Library | 33% | 63% | 91% |
| | 14# Qatar Museums | 23% | 62% | 170% |
| | Culture average rate | 37.37% | 70.25% | |
| | Overall average | 37% | 72% | |

**Figure 4.** ICT accessibility adoption rate progress from Q2 2019 to Q2 2021 by organization compared to the domain results (“education sector” and “community & culture sector”).

6. Discussion

The results of implementing MARSAD in 2019 Q2 and 2021 Q2 within participating institutions highlighted an improved state of ICT accessibility by reflecting higher scores during the second round of the survey implementation. The participating institutions can

be distinguished into two groups. The first group consists of institutions that scored equal to or above the overall baseline during 2019 Q2 (Figure 5). Their scores reflected that they were already committed to providing accessible ICT by implementing some related policies and procedures. Participating institutions belonging to this group attained considerably higher scores while implementing the tool in 2021 Q2 and thus, offering an excellent quality of ICT accessibility services within the institution.

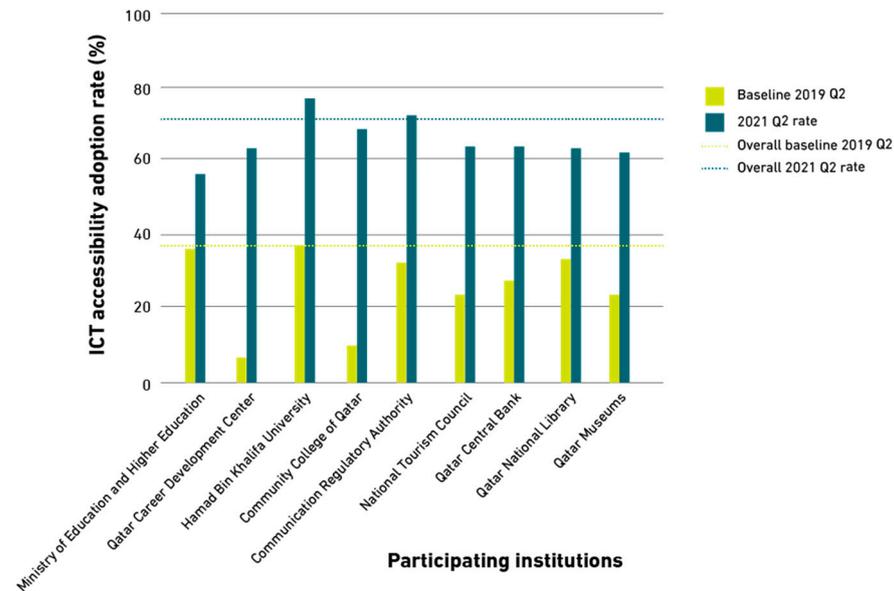


Figure 5. Group 1—participating institutions that scored above the overall baseline in 2019 Q2 and already had current policies and procedures in place to provide accessible ICT.

The second group comprises institutions that scored significantly below the overall baseline in 2019 Q2 (Figure 6), and the scores achieved by them indicated that they did not have any current policies or procedures for providing inclusive ICT access. However, these institutions also attained comparatively higher scores during the second round of implementation in 2021 Q2. They improved the provision of accessible ICT platforms and services within the institutions. After implementing the first round during 2019 Q2, all participating institutions were provided with recommendations and staff training to offer accessible ICT platforms and services. These activities have received positive feedback from all the institutions. It was observed that the primary factors influencing the provision of institutional accessible ICT services were gaining awareness, receiving appropriate ICT accessibility advice, and technical knowledge among relevant staff members to implement inclusive ICT services.

It was noticed that many of the participating institutions in Group 2 were vaguely aware of the concept of ICT accessibility. These institutions gained awareness about the concept while working to implement the tool, which initiated their interest in providing accessible ICT for all users. It was complemented by the advice and training offered to them after the initial round in 2019 Q2, which led them to have an improved capacity to deliver accessible ICT services.

The proposed model in Figure 7 identifies raising awareness as a foundational factor for institutions to work toward providing ICT accessibility, which is in line with earlier research that highlights the importance of awareness in promoting digital accessibility [57]. Furthermore, this is followed by the need to receive advice and advocacy for implementing such digital infrastructures, which has also been emphasized by previous studies [60]. Lastly, the most impactful factor in successfully providing ICT accessibility is building procedural and technical capacity to develop and sustain accessible ICT platforms and services, which is consistent with the findings of previous research (Reference).

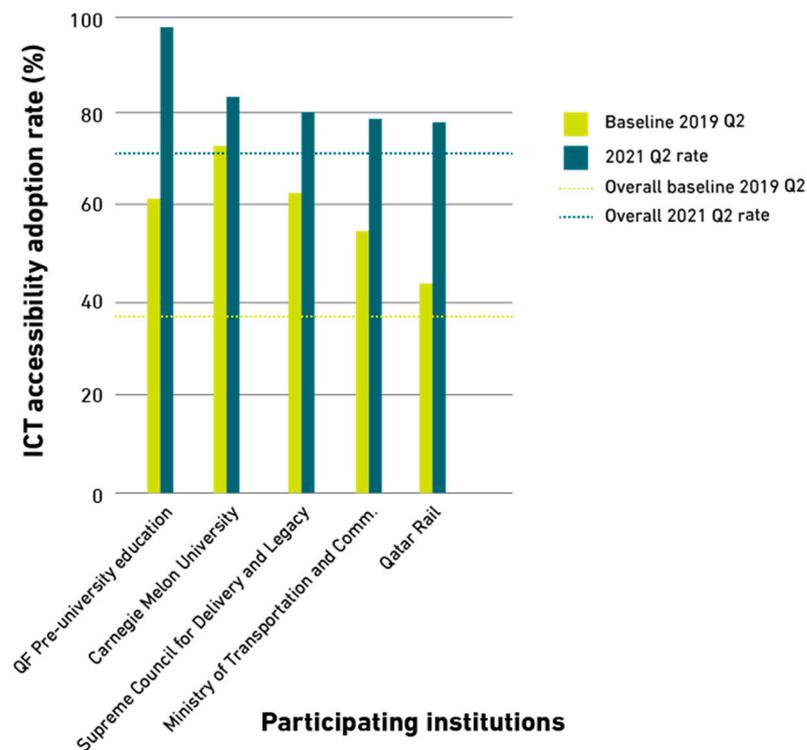


Figure 6. Group 2—participating institutions that scored below the overall baseline in 2019 Q2 and did not have policies and procedures in place to provide accessible ICT.

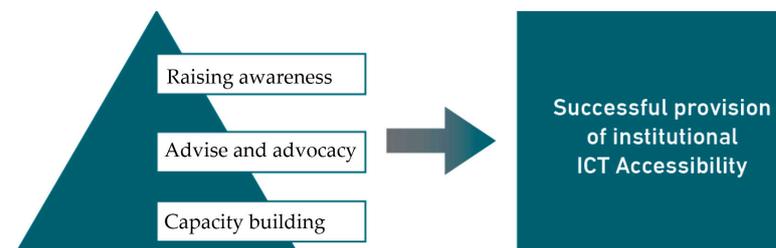


Figure 7. Model for achieving the successful provision of accessible ICT.

The followed model is outlined in Figure 7 to help its partners improve ICT accessibility within their institutions. MARSAD has been demonstrated to be an effective tool for measuring the impact of such initiatives. A comparison of existing e-readiness assessment tools indicates that they primarily look into aspects related to e-society and e-economy. However, they lack focus on acquiring details specific to ICT access for persons with disabilities and older adults (Tables 2 and 3). MARSAD is an initiative that can be considered a starting point for developing e-readiness assessment tools that evaluate ICT accessibility and focus on providing equal ICT access for persons with disabilities. Therefore, further studies must be conducted to develop more comprehensive e-readiness assessment tools for gauging ICT accessibility.

Based on this study, there are several key elements that are necessary for achieving the successful provision of accessible ICT. These elements include:

- (1) A clear understanding of the needs and requirements of users with disabilities: In order to provide accessible ICT, it is essential to have a deep understanding of the specific needs and requirements of users with disabilities. This could include understanding the different types of disabilities and how they impact a person's ability to access and use ICT, as well as consulting with users with disabilities to gather input and feedback on their experiences and needs;

- (2) Adoption of accessibility standards and guidelines: To ensure that ICT is accessible to users with disabilities, it is important to adopt and adhere to relevant accessibility standards and guidelines. These standards and guidelines provide a framework for designing and developing accessible ICT, and can help ensure that the technology is usable and accessible to all users;
- (3) Training and support for users with disabilities: Providing accessible ICT is not just about the technology itself, but also about ensuring that users with disabilities have the necessary training and support to use the technology effectively. This could include providing training on how to use the technology, as well as ongoing support and assistance to help users with disabilities to overcome any barriers or challenges they may encounter;
- (4) Ongoing evaluation and improvement: Providing accessible ICT is an ongoing process, and it is important to regularly evaluate and improve the technology to ensure that it continues to meet the needs of users with disabilities. This could include conducting user testing and feedback sessions, as well as staying up-to-date on the latest accessibility standards and guidelines, to ensure that the technology remains accessible and usable for all users.

7. Conclusions

In conclusion, this study highlights the importance of implementing accessible ICT to improve the lives of persons with disabilities and the alignment of such implementation with the principles of sustainability such as intergenerational equity and the principle of sustainable development. The study presents an e-readiness assessment tool (MARSAD) that measures the utilization of accessible ICT in various domains and identifies gaps in the ICT infrastructure of government and semi-government institutions in Qatar. The results of the assessment show a genuine willingness to invest in implementing the required changes based on the results acquired by conducting MARSAD. Furthermore, the e-readiness assessment tool aligns with the DARE Index components for an inclusive digital society and economy and contributes to achieving SDG 11 of making cities and human settlements inclusive, safe, resilient, and sustainable. Moreover, the tool can be used within organizations related to women and children and older persons.

The e-readiness tool MARSAD was effective in capturing data about the overall state of ICT accessibility in the participating organizations and provided the decision-makers with the necessary information to take action to improve the accessibility of ICT platforms and services offered by the organizations. It was reflected by the fact that the participating organizations had higher scores in the survey during its second round conducted in Q2, 2021. It was noticed that institutions in the State of Qatar are interested in providing equal access to information and services for persons with disabilities by learning about ICT accessibility and investing in implementing it accordingly. Some organizations required clarifications about the concept of assistive technology and ICT accessibility prior to filling out the survey for the first time, which was a challenge as this impacted the expected timeline of specific tasks of the project. Some participating organizations indicated that they could have implemented other ICT accessibility features within their platforms if they had not been affected by the COVID pandemic, which can be considered a limitation in measuring the effectiveness of MARSAD in particular in the education sector.

Moreover, the tool is designed to be used within an environment where the ICT accessibility ecosystem is in its infancy. It might not be effective in regions that are already advanced in digital accessibility, as in such cases, capturing more detailed information is necessary. Furthermore, it must be noted that the tool was implemented only on 6 and 8 organizations within the education, and culture and community domains respectively. The study results may vary if more organizations from the exact or additional domains are included to take the survey.

One of the limitations of the absence of an ICT accessibility readiness tool is that it can be difficult for organizations to assess and evaluate their current level of accessibility.

Without a tool, organizations may have to rely on manual assessments and evaluations, which can be time-consuming and may not provide as comprehensive or accurate results as a dedicated tool. Additionally, the absence of an ICT accessibility readiness tool can make it difficult for organizations to identify areas where they may need to improve their accessibility, and to prioritize and plan their accessibility efforts. This can lead to a lack of progress in making ICT accessible, and may result in a suboptimal user experience for individuals with disabilities.

Making a transformational change in e-accessibility requires an effort that combines quick wins and long-term goals. It must be grounded in an identifiable policy framework that is transparent and accessible. Lack of digital accessibility awareness and knowledge of implementing accessibility standards often hinder achieving a conducive environment for persons with disabilities. For its part, Mada Center will be available to provide the necessary support to empower organizations in Qatar and the Arab region to make the shift toward a digital ecosystem accessible to all.

Extending the study to additional domains could offer new perspectives on the results of our research. By expanding the scope of our study to include other domains, we can gain a deeper understanding of the implications and applications of our findings. For example, our study may have focused on education and culture, but by exploring the results in other domains, we can identify common trends and patterns that may not have been apparent in our original sample. Additionally, expanding the study to other domains can provide opportunities to compare and contrast the findings, and to identify potential areas for further research and investigation.

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Appendix A

The MARSAD survey is composed by 4 parts.

About the Organization:

1. Name of the organization
2. Activity type
3. About the organization
4. Key services provided
5. The main point of contact for this survey
6. What is your organization's web address?
7. What are the names of your organization's apps as it appears they appear in the mobile app stores?
8. Does your organization operate digital kiosks to provide public services? If yes, please provide details.
9. Does your organization provide direct customer services to the public? If yes, please provide details.
10. Does your organization offer services specifically designed for people with disabilities? If yes, please provide details.

Regulations and Policies:

The survey questions for the section are as follows:

1. Does your organization apply an internal law, policy, or regulation that explicitly addresses the digital access of persons with disabilities? Yes/No
2. Does your organization apply international digital accessibility standards such as WCAG 2.0, WCAG 2.1, Section 508 of the ADA, or others? Yes/No. If yes, please state the standards implemented in your organization.
3. When procuring ICT devices or software or requesting IT support services from external suppliers, does your organization require that these services or products meet accessibility standards? Yes/No
4. Does your organization have a mechanism for complaints, accommodation requests, and recommendations related to digital access? Yes/No
5. Does your organization conduct an internal assessment or periodic review regarding implementing digital access standards? Yes/No. If yes, how often is this audit conducted, and which digital platforms does it cover?

Mechanisms:

1. Does your organization have a person or department responsible for evaluating and monitoring the application of digital accessibility standards? Yes/No. If yes, which department or employee is responsible for this?
2. Have any of your organization's members attended any training on digital access, e-accessibility, or the National e-Accessibility Policy? Yes/No
3. Is there an internal mechanism in your organization to evaluate and report on digital accessibility? Yes/No
4. Does your organization work with any external experts or consultants to provide support in the field of digital accessibility? Yes/No
5. Is your organization raising awareness about digital accessibility and its importance among employees and internal stakeholders? Yes/No

Implementation:

1. Are digital accessibility standards currently applied on your organization's websites? Yes/No/Not applicable. If yes, which standards are applied?
2. Are digital accessibility standards currently applied in your organization's mobile apps? Yes/No/Not applicable. If yes, which standard is applied?
3. Are digital accessibility standards applied in your digital kiosks, such as ticketing machines or ATMs? Yes/No/Not applicable. If yes, which standards are applied?
4. Does your organization's video content include digital access features, such as closed captioning, audio description, or sign language translation? Yes/No/Not applicable.
5. Does your organization provide telephones to its employees that meet accessibility standards? Yes/No/Not applicable. If yes, which accessibility features do your telephones include?
6. Has your organization introduced any technology to improve digital access for people with disabilities? Yes/No. If yes, please provide details.
7. Does your organization have mechanisms to provide assistive technology devices and solutions to internal stakeholders with disabilities, such as employees or members? Yes/No. If yes, please provide details.
8. Has your organization published any resources for internal use to raise awareness of the importance of digital accessibility? Yes/No.
9. Has your organization published any public resources to raise awareness about the importance of digital accessibility? Yes/No.
10. Does your organization apply any internationally recognized standards to digital documents? Yes/No. If yes, please mention which standards are implemented and in what format your organization publishes digital documents.

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