Analysis of literature on accessibility of e-government websites with respect to Persons with Disabilities (PWDs)

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Abstract

E-Government is perceived to be a vehicle for transforming how governments deliver public services and interact with each other and with their citizens as well as businesses. It is therefore paramount that e-Government services are accessible and well-designed to allow all those who use the services the ability to use them. Yet, accessibility of e-Government websites continues to remain a challenge to people with disability (PWDs) worldwide and more so in low to middle income countries where the majority of PWDs reside. This descriptive study examines the current literature on the accessibility of e-Government services to PWDs using a literature synthesis approach. Four themes on the accessibility of E-Government literature are identified through the analysis: successful factors for adopting e-government, designing for accessibility, assistive technologies, and the evaluation of the accessibility and usability of websites. These findings can guide future work and practitioners in the provision of online services for PWDs.

Keywords: E-Government, Accessibility, Assistive Technology, Universal Design, Person with Disability (PWDs)

1. Introduction

Investment and growth within the information communication and technology (ICT) sector in South Africa is increasing and technology plays an important role in improving the standards of living of its citizens (Naidoo, 2012). ICT is now being used in government, in what is termed as e-Government, as a catalyst in enabling government to offer more efficient ways of delivering information and making services accessible to both citizens as well as to businesses, and the process transparent (Kariuki et al., 2019). The ability to access e-Government services ‘promotes democracy through inclusive participation’ and this is ultimately what e-Government is trying to achieve (Agangiba et al., 2018, p2). Despite these benefits, e-Government has the potential to exclude persons with disability (PWDs) – these are the 15% of the world’s population that lives with a physical, sensory, intellectual, or mental health impairment significant enough to affect their daily activities (Groce, 2018). These forms of disability make it difficult to participate fully in consuming e-Government services. PWDs usually receive limited support from the community, and consequently live “without equal access to health care and rehabilitation, education, and employment, and marginalised or excluded from the socioeconomic, religious, and political lives of their communities (Groce 2018, e724). This is concerning especially for lower to middle income countries that have higher populations of PWD’s than developed economies (Flaxman et al., 2017); and have a low level of digital literacy required to navigate and use technological systems, such as e-Government systems. Adding to these challenges is the lack of clarity on the web content accessibility guidelines which fail to guide developers during implementation and the cost associated with meeting these guidelines (İşeri et al., 2017). Although several studies have documented how inaccessible online government services are to PWDs and how this alienates them from enjoying the e-Government benefits; there remains limited studies exploring how best to address the challenges PWDs face; specifically, the barriers within the context of lower to middle income countries where the majority of PWDs reside. Part of the problem is that
there remains limited studies done in low to middle income countries on this phenomenon; and when done, these studies take place in silos, thereby making it difficult to see the big picture. This study seeks to contribute towards addressing this challenge because “people with disabilities have routinely been overlooked by global health and international development efforts” Groce (2018, e724), despite the “strong correlation between digital exclusion and social exclusion” (Othman et al 2020, p2567). Specifically, this study provides a descriptive analysis of the literature on accessibility of e-Government websites with respect to PWDs.

2. Related work

2.1 Related work on e-government

E-Government can be conceptualized as the usage of information and communication technologies (ICT) to provide services, improve efficiencies, and improve the operations of government (Vidmar et al.,2019; Twizeyimana & Andrersson,2019). It is widely cited that e-Government emphasizes technology and how it can be harnessed to address issues relating to access to information as well as interaction between citizens, businesses, and government (Agangiba et al. 2018; Choi & Chandler, 2020; Harder and Begnum, 2016). Several benefits have been associated with e-Government, and yet e-Government, although developed with good intentions, can also act as a tool of exclusion for PWDs when not implemented with their needs in mind.

Although Web Content Accessibility Guidelines (WCAG 2.0) have been proposed to ensure that all online resources/services are accessible to PWDs; several researchers have noted that most remain inaccessible. For example, Salvio (2020) found at least 77% of the 12 e-Government websites in the Philippines were not accessible. In India, Paul and Das (2020) examined 65 Indian e-Government websites for their accessibility and usability. Their findings of the accessibility tests highlight the existence of accessibility issues and the usability tests also showed that e-Government websites give low priority to such aspects during website design and development. Similar findings are reported in Sub Saharan Africa (SSA) where most government websites remain inaccessible (Verkijika and De Wet 2017). Specific instances are noted, like Uganda which show that all the websites not do not satisfy the level AA accessibility guidelines (Nakatumba-Nabende et al, 2019); Ethiopia where the current status of e-Government websites are seen to violate most of usability heuristics rules (Zekeke, 2020); and Libya whose government websites had significant number of usability problems ranging from visibility of system status, user control and freedom, and the ability to recover from errors (Karaim and Inal 2019). According to Verkijika and De Wet (2017), factors influencing e-Government accessibility in SSA, include the Human Development Index (HDI), Corruption Perception Index (CPI), and percentage of the active population (15-64 years). They show that countries with high HDI levels and low CPI levels tend to have websites with fewer accessibility errors, while those for countries with high percentage of the active population have more accessibility errors.

2.2 Related work on Accessibility

The Web content accessibility guidelines (WCAG 2.1) define web accessibility to include tools as well as technology that are developed and designed so that people with disabilities can understand, interact as well as navigate and contribute with the website. WCAG 2.1 caters for all disabilities accessing the web including physical, cognitive, auditory, speech as well as neurology. Although the web accessibility guidelines are well established studies have shown the lack of compliance to these guidelines specifically relating to e-Government websites (Boussarhan and Daoudi 2014; Fuglerud & Sloan 2013). For e-Government websites to be
accessible they need to adhere to these guidelines to ensure equal access for all citizens. In addition to providing information and e-services that cannot be granted privately, government websites need to ensure compatibility with tools and technologies which may be required by persons with disabilities (Kamoun & Almourad, 2014). Kamoun and Almourad (2014) highlights reasons for placing emphasis on accessibility for e-Government services: Firstly, there are a significant number of citizens with disabilities, citizens globally with some forms of disability are thought to be the world’s greatest minority, and according to the world health organization 80% of those are living in developing countries (Bundoc et al., 2019). Secondly e-Government services have allowed citizens previously unable to access certain information to do so from the comfort of their own homes. Thirdly, the government needs to ensure that they provide equal access of services and information to all citizens and not to discriminate against a minority due to their disability as this is considered a human right. The WCAG guidelines on accessing e-Government websites remain the most respected standard for designing, developing, and assessing websites as mentioned by most research.

3. Methodology
This paper is descriptive in nature and followed a literature review synthesis approach. Research articles on the phenomenon of e-Government and accessibility were collected via desktop search published between 2010 and 2020. Specifically, keywords used were e-Government and accessibilities, e-Government and person with disabilities. These keywords are consistent with the goal of the study. The search on Google scholar using the keywords produced 9028 articles. This comprised of 8872 articles on e-Government and person with disability and 156 articles on e-Government and accessibilities. Given the high return value, these papers were firstly looked at and analyzed based on the title and in some cases the abstract. Papers that did not focus on PWD and or focused on another phenomenon other than e-Government were removed. For example, papers such as Ruijer et al. (2020) or Moon (2020) that focused solely on open government and services without consideration of e-Government services and PWDs were removed. This exercise significantly narrowed down the number of articles to 42. These remaining articles were then examined as follows: first, each article was read by the primary reviewer who wrote a synopsis on the article. The rationale of the synopsis was to provide a summary of the article as well as the points surrounding it validity to this study. The analysis of the articles began by reading each one to understand the relevance to the study as well as the objective the article aimed to achieve. Articles which included e-Government accessibility as well as e-Government focusing on persons with disabilities were then included for the next phase of analysis.

Once all the articles that met the criteria were read, summarized sections of the text that were perceived to be relevant were highlighted and assigned to a theme which described the concept. The text was then collated and condensed into the main points. Patterns were identified and for example the economic, organisational, technological, and socio-cultural barriers to e-Government were highlighted by multiple authors as points for consideration for e-Government services to be more accessible. These were then grouped as success factors for e-Government. The aim of this was to create potential themes to create a useful collation of the data for the purpose of this research. The themes were then reviewed to ascertain whether these themes represented the articles analyzed as well as to ensure no potential important themes were missed. The naming of the themes was intended to create an understandable succinct name for each theme. For example, designing for accessibility as a major theme is simple and broad, but the theme encompasses the sub themes such as universal and inclusive design, design intention, design team demographics and co-operation of e-Government actors and reflective practices.
4. Findings and discussion

Four emergent themes as shown in Table 1, were identified during the analysis of the literature: successful factors for adopting e-government; designing for accessibility, assistive technologies, and the evaluation of the accessibility and usability of website. These are discussed below.

4.1 Success factors for adopting e-government

Most studies focused on identifying successful factors or barriers to e-Government adoption (see Table 2). Five factors were identified as key to successful adoption of e-Government. These factors are economic, technological, organizational, socio-cultural and end-user, as well as policy and strategy. Several studies have noted the need for readily available resources for the implementation of an accessible e-Government system (Zhenbin et al., 2019). Yet, many e-Government systems lack adequate resources. For example, although access to information technology experts as well as knowledge workers involved in the designing and implementation of e-Government services is important; this remains as one of the consistent organizational challenge most public institutions face (Kurt 2018). Another consistent organizational challenge is financial resource, mismanagement and inadequate financial and human resources contribute towards poor service delivery of government services (Antwerpen & Ferreira 2016). In South Africa, implementation of e-Government faces challenges due to the decentralization of e-Government funding (RSA Government gazette, 2017). Access to financial resources is seen to be limited for public actors (Wynen et al., 2014) and there is a perception that designing for accessibility is cost intensive and therefore not given a priority during design and implementation (Rossvoll & Fuglerud, 2013).

<table>
<thead>
<tr>
<th>Theme</th>
<th>Subthemes</th>
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</thead>
<tbody>
<tr>
<td>Success factors for adopting e-Government</td>
<td>Economic</td>
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<tr>
<td></td>
<td>Organizational</td>
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<tr>
<td></td>
<td>Technological</td>
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<td></td>
<td>Socio-cultural and End user</td>
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<td>Industry support</td>
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<td></td>
<td>Universal design principles</td>
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<td>Co-operation of E-government actors</td>
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<td>Design team demographics</td>
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<td>Design intentions</td>
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<td>Practitioners’ reflective practices</td>
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<td>Cost</td>
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<td>Accessibility automated tools</td>
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<td></td>
<td>Web content accessibility law and guidelines</td>
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<td>Periodically monitor sites for accessibility</td>
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Table 1: Emergent themes

<table>
<thead>
<tr>
<th>Success factor dimension (number of papers)</th>
<th>Examples of papers addressing the dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic (11)</td>
<td>(Agangiba et al., 2018; Almarabeh and Abu Ali, 2010; Ashaye &amp; Irani, 2019; Choi et al., 2016; Flaxman et al., 2017; Glyptis et al., 2020; Kariuki et al., 2019)</td>
</tr>
<tr>
<td>Organisational (11)</td>
<td>(Almarabeh and Abu Ali, 2010; Ashaye and Irani, 2019; Choi et al., 2016; Choi and Chandler, 2020; Glyptis et al., 2020; Naidoo, 2012)</td>
</tr>
<tr>
<td>Technological (10)</td>
<td>(Ashaye and Irani, 2019; Choi et al., 2016; Choi &amp; Chandler, 2020; Fogli and Provenza, 2012; Glyptis et al., 2020; Harder and Begnum, 2016; Kariuki et al., 2019)</td>
</tr>
<tr>
<td>Socio-cultural and end user (14)</td>
<td>(Agangiba et al., 2018; Almarabeh and Abu Ali, 2010; Choi &amp; Chandler, 2020; Dawar et al., 2017; Glyptis et al., 2020; Groce, 2018; Johnson et al., 2017)</td>
</tr>
<tr>
<td>Policy and strategy (14)</td>
<td>(Agangiba et al., 2018; Almarabeh and Abu Ali, 2010; Choi &amp; Chandler, 2020; Dawar et al., 2017; Glyptis et al., 2020; Groce, 2018; Johnson et al., 2017)</td>
</tr>
<tr>
<td>Industry support (6)</td>
<td>(Agangiba et al., 2018; Choi et al., 2016; Choi &amp; Chandler, 2020; Naidoo, 2012)</td>
</tr>
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Table 2: Success factors for adopting e-Government
4.2 Designing for accessibility

4.2.1 Universal and inclusive design

Buchdid et al (2015) asserted that for ICT products to be accessible and usable to all, researchers need to identify the barriers in the design of information systems. Several researchers now advocate for universal design (UD) and inclusive design (ID) as potential means of addressing accessibility challenges during design. This is based on the premise that UD begins with considering all users, to develop products that are accessible to and usable by all people regardless of their abilities (Liu et al 2015); and ID focuses on providing the ‘full range of human diversity’ and intends to provide access to as many citizens as possible (Dosis, 2014, p8). Seen in this manner, UD and ID presents an approach for exploring the barriers in the design of e-Government systems, with the intent of understanding how these services can be made accessible and usable to PWDs.

Universal Design is guided by some key principles of equitability, flexibility, ease of use, access, and tolerance of error. With these principles, it is envisaged that designers and developers as practitioners would be well guided in developing inclusive solutions for consumers regardless of any impairment. For example, with equitability, UD seeks to avoid disadvantaging and stigmatizing users and ensuring that one provides the same means of use, privacy, security, and safety for all users (Skuse 2020). The design should accommodate a wide range of individual preferences and abilities; and also make it easier to understand and use. These principles are echoed by Dosis (2014) who calls designers to meet two additional requirements when creating online solutions that meet the wide range of human diversity: sociability and hospitality. According to Dosis (2014) inclusive design begins when designers understand that online users are social beings who engage in social actions. As social beings, engaged in online activities, designers should develop online solutions that give users a social space of belonging, instead of a space that makes it difficult for them to participate and feel included. User experience becomes optimal when applications are designed with sociability and with people-oriented focus (Dawar et al (2017). People-oriented focus speaks to the aspect of hospitality that requires designers to “consider what the needs and desired outcomes of the users are and mirror those in the design” (Dosis 2014, 19).

4.2.2 Co-operation of E-government actors

E-Government systems are very complex and require participation of several agents to arrive at a successfully implemented accessible system. Rowley (2011) proposed a typology of e-Government stakeholder agents which compromises of, among others: e-Government project managers, technology practitioners (software designers, developers and human–computer interaction specialists (Fogli & Provenza, 2012); the people as service users and as citizens; businesses and trading partners; public administrators (employees) and other government agencies, non-profit organizations. Close co-ordination and collaboration between these agents are important for having a successful e-Government implementation project (Choi et al., 2016) because user’s voices become incorporated and taken on board.

However, Al-Rawahna et al. (2019) notes that this collaboration is very minimal during the initial design and implementation process of an e-Government project and could be the source for projects not meeting their intended goals and objectives. Gunawong and Gao (2017, p168) sees the key challenge in e-Government system implementation as the lack of top management as “focal actors to support the other actors in the network in their efforts both to play their roles properly”. Harder and Begnum (2016) calls for top level management to collaborate with all stakeholders, specifically the design team and the PWD interest groups to ensure focus is on developing systems that are accessible to all users. Agbozo (2019) also calls for e-Government
authorities to create the necessary environment for the private sector to support government in achieving a formidable e-Government system. Ashaye and Irani (2019, p253) have “recommended that public organisations would need to strategise their relationships with stakeholders in order to achieve a collective interest for successful e-Government implementation”. The number of people involved in decision-making could potentially lead to the achievement of a successful implementation of an accessible e-Government and ultimately achieve the sustainable development goals (Othman et al. 2020).

4.2.3 Design team demographics

Part of developing systems which have successful inclusive design (ID) requires having the ability to be sensitive to different user capabilities and needs (Lim, 2010). To reduce the exclusion nature of e-Government service, it becomes important for designers and developers to be able to understand user’s limitations in interacting with technology. Olbrich et al. (2015) pointed out that it is important to note the demographics of the design team as this may have an influence on the usability and accessibility of products and services created. A diverse group of people will generally have more members who are sensitive to at least some design accessibility issues. As stated by Olbrich et al. (2015) there is a likelihood that there will be an improvement in providing inclusivity in design if a wider array of design team members are working together. For example, it is reported that from a gender perspective, men and women assess web-based interfaces differently (Watling, 2011). Keeping gender in mind when designing a user interface is important, as the outcome of the solution may affect the user’s ability in engaging on the online platform (Reinecke and Gajos, 2014).

Designers of web interfaces can create an engagement between the interface and users. Far too often the design decisions taken have negatively impacted on PWD in their use of web and mobile interfaces (Watling, 2011). Biased design of interfaces negatively affects users of lower socio-economic backgrounds (Johnson et al, 2017). To avoid exclusion therefore, when designing for accessibility, diversity must be assumed to be the norm (Rieber & Estes, 2017) because without diversity there may be ‘knowledge redundancy’ within the team (Mahr et al., 2014). Knowledge and information diversity amongst information systems project team members can contribute towards to the success of the project (Liang et al., 2012).

4.2.4 Design intentions

Design intent “is the reflection of the design idea in designers’ brain. …is the reflection of product function in design process, and designers can express design intent by expressing target function” (Wang et al 2016,p1758). It is important that design intentions of the team are communicated throughout the team to ensure a shared vision. Without this shared vision, there could be a “fragmented understanding of the different elements of the design requirements and how they are connected”, across the design team (Laursen and Mriller 2016,p3). Given the multifaceted nature of the design intentions Otey et al (2018), and the need for inclusivity, it is important that the design team includes the voice of PWDs who will champion accessibility and inclusivity issues.

4.2.5 Practitioners’ reflective practices

Scholars such as Samuels (2018) have indicated the need for practitioners to be reflective of their work for them to be aware of their potential biases and inequitable practices. Highlighted benefits of reflection include “better education, improved design processes, and increased self-knowledge” (Baumer et al 2014,p99). These benefits of reflective practices are significant when designing for inclusion lest practitioners adopt certain values and norms unconsciously that could lead to PWD barriers (Stumpf et al 2020). Thus, simply following universal design
principles is inadequate without reflective practices. Yet, most scholars agree that reflection is a challenge because reflective practices are usually seen as “uncomfortable... as it may reveal characteristics” practitioners do not want to see (Samuels 2018,p26). Further, there have been few studies exploring what reflection should be about in systems design; and this has created some sense of vagueness to what reflection involves (Baumer et al 2014). To ensure the focus remains on inclusive design, practitioners need to establish a working definition of reflection in the context of systems design, development, and testing; and most importantly, actively involve PWDs participants in the entire process of design, development and testing to evaluate barriers.

4.3 Assistive technologies
The Third theme pointed to the need for readily available, cost effective assistive technologies that are easy to use and compatible to the activities PWDs engage in. Assistive technologies such as screen readers that read web pages aloud for the blind, screen magnifiers for people with low vision, and selection switches for people who cannot use a keyboard or mouse (Moreno et al., 2018), should be accessible to PWD as a support mechanism when performing tasks. The challenge as Agangiba et al (2018) points, is the cost associated with acquiring assistive technologies. Most PWDs in developing countries see the cost to be high and this hinders them to utilize online services. The findings of Rohwerder (2018,p2) show that the ‘assistive technology industry is limited and mostly serves the requirements of high-income settings.... and the small scale local assistive technology producers and providers in low-income countries cannot meet the needs of all those who need assistive devices.

Assistive technology services are also often in short supply and available, PWDs may require third party assistance when navigating and using technological systems; such as e-Government systems and in some cases, use these assistive technologies (Almarabeh and Abu Ali, 2010) that tend to be developed not within the context of lower to middle income country users. Adding to these challenges is the lack of clarity on the web content accessibility guidelines which fail to guide developers during implementation and the cost associated with meeting these guidelines (İşeri et al. 2017). Along with affordability there are several researchers who have raised the lack of awareness of the different types of assistive technologies available and the benefits thereof as a barrier to accessibility (Dollie et al. 2017, Agangiba et al. 2017, Borg and Östergren 2015, Oliveira et al., 2017, Rohwerder, 2018). Another aspect surrounding accessibility was a lack of training and intervention from government surrounding the usage of e-Government (Agangiba et al, 2018). Whilst some e-Government websites might integrate assistive technologies during design, the challenge remains, that most websites are not adapted to or compatible with the assistive technologies used by PWDs (Boussarhan and Daoudi 2014). To combat this challenge, periodic expert and end user testing is recommended to allow for assessment for compatibility with a wide range of assistive technologies and verify programming flaws in the interface that can cause confusion to assistive technology users.

4.4 Evaluation of the accessibility and usability of website
The final theme was on the evaluation of the accessibility and usability websites. The findings show that both usability as well as accessibility is a quality assurance regarding development of information systems (Quintal & Macías, 2018). However, the quality regarding user-centered processes is less emphasized than that of the quality of the usability and accessibility of the product itself (Lacerda & von Wangenheim, 2018). According to Quintal & Macías (2018) there is a lack of proposals which focus on identifying way to improve usability as well as accessibility, as this may lead to reduced errors, and implementation time. Some organizations have adopted the accessibility maturity model (AMM) which serves as a tool to
guide the planning accessibility in the workplace. However, this approach to assess accessibility uses online automatic tools such as Achecker, Taw, Wave, SortSite; but does not have the sufficient methods and techniques in place to execute an assessment that relates to both usability and accessibility (Lacerda & von Wangenheim, 2018; Quintal & Macías, 2018). Other tools and resources available for ensuring accessibility include the developed web content accessibility guidelines (WCAG). However, several studies have noted that these guidelines lack clarity and they only accommodate for the remediation of around thirty-five to fifty percent of PWD accessibility issues (Power et al, 2012; Romen & Svanaes, 2011). Focusing purely on the WCAG 2.0 compliance guidelines can cause developed solutions that are not holistically accessible and may lead to missed opportunities to include certain PWD (Fuglerud & Sloan 2013). To address this missed opportunity, one solution is to have periodic monitoring of e-Government websites for accessibility.

5. Conclusion

The purpose of this study was to document the current literature on accessibility of e-government website with respect to PWDs. The study followed a descriptive literature synthesis on the phenomenon. From the analysis, four themes were identified. Firstly, a significant number of studies focused on identifying the successful factors influencing e-Government adoption. These studies paid attention to user’s access to e-Government services from the following front: economic, organizational, technological, socio-cultural and end user, policy and strategy, and industry support. Whilst these studies present the foundational basis of what to consider when implementing e-Government services; these studies fail to engage and consider PWDs specific needs of accessibility. Studies in the second theme, sought to address this gap by putting the focus on the design process. It is envisaged that when all stakeholders are engaged during the design and work collaboratively in the design and implementation process, whilst being reflective of their practices to identify their biases in their design; the product would be accessible and meet PWDs needs. The third strand of research had a focus on the readily availability of cost-effective assistive technologies that are easy to use and compatible to the activities PWDs engage in. The final theme was on research that focuses on developing evaluation tools for evaluating websites to assess their accessibility and usability for PWDs. Although these studies help practitioners identify accessibility issues in several websites, the evaluation in most cases, tend to be after the fact, with most not involving end users’ (PWDs) in the evaluation process. These findings show that the design and implementation of accessible e-Government websites are done in a fragmented manner with limited co-operation amongst researchers and the numerous stakeholders involved. By tackling issues around the design of e-government systems collectively, we can contribute towards a better understanding of how these systems can be better designed and implemented for inclusivity purposes.

The study has a limitation on the sampling. Keywords that were used for data collection can be expanded on beyond the keywords e-Government and accessibilities, e-Government and person with disabilities, which might not reveal all papers related to people with disabilities. Further, focusing on a specific disability because each disability has its own specificity, and should be studied individually.

References


