TECHNO Review | Vol. 10, No. 1, 2021
International Technology Science and Society Review / Revista Internacional de Tecnología Ciencia y Sociedad
https://doi.org/10.37467/gka-revtechno.v10.2779

HOW THE ACCESSIBILITY IN E-COMMERCE AFFECTS THE INCLUSION OF THE VISUALLY IMPAIRED?

Visually impaired internet users in developing countries

EMILIO SOSA [1], ALLAN VILLEGAS-MATEOS [2]

[1] Centro, México
[2] HEC Paris, Qatar

KEY WORDS

Website accessibility
Inclusion
Design
Public policies
Visual impairment
E-commerce
WCAG

ABSTRACT

This study reviews the public policy effectiveness of website accessibility in Mexico and explains how these regulations may affect the visually impaired. The authors did n=6 semi-structured interviews with key players of the visually disabled community and then evaluated n=366 websites with a web scraping tool, using principal components analysis and non-parametric statistics to compare their accessibility by type of website. The authors found that even if there is a regulation for providing equal access to websites, the state of the law is insufficient and non enforced for private and public institutions, affecting the basic human right for visually impaired internet users.

Received: 20/ 01 / 2021
Accepted: 09/ 06 / 2021

GLOBAL KNOWLEDGE ACADEMICS

1. Introduction

Information and Communication Technologies (ICT) have given rise to a new type of firm, the ibusiness firm, which offers a platform that allows users to interact with each other and generate value through user co-creation of content (Brouthers et al. 2016). The internet has increased the offer of this type of value proposition that underlies the ibusiness. The emergence of the Internet has created a dynamic electronic marketplace, where a new species of e-commerce corporations are taking root (Singh and Kundu 2002). Internet and e-commerce are in fact being adapted by firms to reinforce their existing relationships with customers, suppliers, and business partners (Kraemer et al. 2006). Given the tremendous success of the Internet and e-commerce in developed countries, emerging economies are quickly embracing information technology as well (Agarwal and Wu 2015). In general terms, ICT can have a leveling effect, giving poor countries and poor people access to markets, information, and other resources that would otherwise have been inaccessible (Goldstein and O'Connor 2000). Gibbs et al. (2002) suggest that enabling policies such as trade and telecommunications liberalization are likely to have the biggest impact on e-commerce, by making ICT and Internet access more affordable to firms and consumers, increasing pressure on firms to adopt e-commerce to compete. In today's world, the COVID-19 pandemic has accelerated the e-commerce trends and information management knowledge that would remain after the lockdown (Stewart 2020; Barnes 2020). The problem is that each country has its own legislation that can affect ibusiness firms. Although, specific e-commerce legislation appears not to have as big an impact, although inadequate protection for both buyers and sellers in some countries suggests that mechanisms need to be developed to ensure greater confidence in doing business on-line (Gibbs et al. 2002). Nevertheless, in terms of potential consumers, there is a market of 2.2 billion people that firms are not paying attention to and the legislations are not protecting them at all in some cases, those potential consumers are the visually impaired or blind people (WHO, 2019). Despite it being an e-commerce website able to process money transactions or an informative website, millions of blind users around the world are iterating with websites and web applications which can be a challenging task, because of websites' lack of accessibility and usability (Nogueira et al. 2019).

In accordance with the Global Inclusivity Report (2020), the COVID-19 pandemic has been a bleak reminder of the chasmic divide between socioeconomic groups and how the threat of disease, financial status, and occupation are inseparably linked. During this period, families who typically struggle with food provision, internet connectivity, and poor housing are facing even greater adversity. The Internet is for instance a key factor for social and occupational integration for users with disabilities, it is imperative that new forms of information, services, entertainment, learning, work, and social interaction are achieved by all indiscriminately (Nogueira et al. 2019). Therefore, it is relevant to analyze the public policy's effectiveness around the regulation for the inclusivity of people with disabilities, specifically visually impaired, to increase their accessibility and usability to websites. This study aims to review the public policy regarding websites using a mixed-method approach to understand the implications of how accessibility is affecting the basic rights of visually impaired internet users. To review the public policy's effectiveness, the authors interviewed experts' members of the visually impaired community and analyzed the websites' accessibility of three types of webs from Mexico: government, e-commerce, and organizations. Studying the website accessibility is accurate to contrast the public policy's effectiveness since it's their primary goal rather than the usability. Website accessibility can be defined as the ability to perceive, understand, navigate, and interact with the information contained on the web, whether the user has special needs or not. Usability, in turn, can be seen as the degree of conformity between the interface and the perceptions of the user to perform a system task (Nogueira et al. 2019). Previous evidence has recognized the importance associated with e-commerce website

accessibility and usability and evaluated them with automatic and manual procedures tested with blind people (Goncalves et al. 2018).

In some way, the regulatory framework for websites tries to increase the adoption of e-commerce in general, but it has not been inclusive with people visually impaired or blind. Even though more developed countries have greater access to the Internet they are supposed to be more advanced on its legislations that can explain its growth in e-commerce, for developing countries the obstacles to affordable access remain formidable, but e-commerce does present real opportunities to small entrepreneurs (Goldstein and O'Connor 2000). For Morris and Mueller (2014), successfully serving this large and growing population has become a market imperative as well as a legislative mandate for the wireless industry in the USA. In consequence, the inclusion of visually impaired people in the design of websites has an impact on the potential sales of the market they represent. Finally, considering the above-mentioned arguments the authors formulated the following research question to address with this study:

> RQ1. What is the state of accessibility of e-commerce in comparison with other public and private websites?
>
> RQ2. How does accessibility in private websites affect visually impaired people in developing countries?

The rest of the article is as follows. Section 2 discusses the concept of inclusive design from a public policy perspective, the evidence of inclusive web design in the USA and Mexico in regulatory terms, and the inclusion of the visually impaired in e-commerce. Section 3 describes the mixed methodology, the interview process, and the empirical exercise, respectively. Section 4 presents the results of the qualitative and quantitative exercises. Finally, Section 5 presents the discussion and conclusions about the implications of the study and some research limitations identified.

2. Theoretical framework

2.1. Inclusive design and accessibility

Before creating a frame of reference regarding how a visually impaired person uses the web, it's important to understand what is inclusive design and what are the differences between having a product or service that is inclusive, and one that is accessible. In accordance with the University of Cambridge (2017), the products and services design that is accessible and usable by many people without a special adaptation are examples of inclusive design that were first explored by the British Standards Institute. Cambridge University presents this definition as one of the main concepts that are the fundamentals of their methodology. Observing other examples like the inclusive design guide of Microsoft (Microsoft 2019), we can observe both methodological approaches towards inclusivity. For the University of Cambridge (2017), there are several evaluation criteria, appointing the importance of reviewing them and discussing which are the most important.

This makes the inclusive design a path to go for creating products for a wider spectrum of people, but it makes it difficult to compare what it would take different industries to comply with these parameters, even when observing these methodologies in the web context. This is where accessibility is playing a role. For defining accessibility, we are using the definition provided by the World Wide Web Consortium (W3C); a group of 423 organizations that aim to create a basis for web standards, including accessibility (Web Accessibility Initiative 2018). The guide the W3C created is called Web Content Accessibility Guidelines 2.0 is the standard that governments like the European Union, Mexico, Canada, and the USA have established, at least for government and state institutions, to comply with AA accessibility (Web Accessibility Initiative 2018).

The objective of the WCAG is to have a list of recommendations for creating more accessible web content for people with different disabilities including blindness, low vision, deafness, hearing loss, learning disabilities, cognitive limitations, limited movement, speech disabilities, or

photosensitivity (Web Accessibility Initiative 2018). As this is the frame of reference that applies to Mexico and the USA, we will use the approach of website accessibility provided by the W3C, defining it as an equivalent form of user experience that enables people with disabilities to perceive, understand, interact and contribute equally with a website.

2.2. Accessibility in the USA

In 2019, Guillermo Robles, an American citizen with visual impairment, sued Domino's Pizza LLC for not complying with the ADA (Department of Justice 2010). He stated that Dominos failed to build a website and mobile application that wasn't fully accessible to him (United States Court of Appeals for the Ninth Court 2018). In 2018, according to the Writ Certiorari generated by the Supreme Court of the United States for the Robles vs Dominos Pizza LLC case, 2,550 other demands regarding LLC´s not complying with the ADA in terms of their web services and applications were filed in the Country (United States District Court 2019).

As the ADA was created in the 1990s (American Disabilities Act 1990), there is indeed no specific regulations or frame of reference in the responsibilities of LLCs regarding web accessibility or inclusive design, but the supreme court has the capabilities to rule in favor of the plaintiffs even if the law is not specific. The regulation of accessibility, in terms of specificity, is oriented to the government. The 508 Rehabilitation Act (508 Rehabilitation Act 2017) establishes that government entities, public and private schools, and NGOs (Non-Governmental Organizations) must comply with at least AA certification of the WCAG 2.0. Private businesses are not legally mandated to comply with the WCAG 2.0 at any level but, as the ADA established, they are responsible to offer an equally accessible service for people with any disability but there are no specifications for it.

If we compare the regulatory context of website accessibility compared to the facility guidelines in the ADA, we can see that the manuals and specifications for construction are more extensive and also depend on other government regulations (American Disabilities Act 1990). In terms of construction, compliance with the ADA is necessary for practically any public building with some exceptions regarding the structural capabilities of buildings and other specific scenarios stated in the law.

Regarding the use of web technology for the blind in terms of access to hardware, software, and how to use them, there is another public policy that is fundamental to understand the landscape of the legal conditions for the disabled in the USA. The Individuals with Disabilities Education Act (IDEA) is a public policy created with the purposes of ensuring public education for children with disabilities at a federal state and helping localities and states government to fulfill this first purpose. Ensuring tools and technology, as well as personnel preparation and technical assistance is paramount for the law and for understanding the rights a disabled student is entitled to (Individuals with Disabilities Education Act 2015). For the disabled individual this guarantees that public school is, if not designed especially for them, has enough resources to guarantee education for individuals between 3 and 21 years old.

2.3. Accessibility in México

On the other side of the border, in Mexican law, there are two initiatives that promote the inclusion of the disabled in the country. The first one is the General Law for the Inclusion of People with Disabilities that was published in the Oficial Diary of the Federation in 2011 (Ley General para la Inclusión de las Personas con Discapacidad 2011). Similarly, as the ADA in the United States, this law lacks specificity in terms of web accessibility and the use of technology for people with disabilities for private organizations. As for governmental entities, in Mexico, there is an equivalent of the 508 Rehabilitation Act. This disposition is an agreement (Secretaría de Gobernación, 2015) that establishes the guidelines of accessibility that the federal government and states owned companies' websites should address to comply with the international agreements Mexico has pleaded. As in the United States, this law mandates AA compliance of the WCAG 2.0 most recent version, as an accessibility statement on each page informing the general public of the status of the compliance itself. There is no sanction that enforces this law and the law itself establishes that reaching the accessibility level should be

gradual and should not imply a disproportionate workload to the governmental entities.

Regarding education, besides the general law of public education, there is no specific law for detailing the implications of education for people with disabilities besides that it is obligatory and should be promoted. In comparison with the IDEA, there are no details about school funding or technology acquisition. On average, an impaired person in Mexico has 4.5 schooling years compared to the national average that is 9 years (Zúñiga et al. 2012). This fact puts on a clear disadvantage the people with disabilities to the use and access to information technologies.

The most recent evaluation in terms of website accessibility at a governmental level was conducted by the National Commission of Human Rights (CNDH) in 2018. The report concluded that most state governments were working in terms of infrastructure, leaving behind the accessibility of information. Also, all the governments were establishing that they were complying with the law, raising the concerns that the general law of inclusion for the impaired people was not very detailed in terms of accessibility, creating opportunities for governments to comply without guaranteeing the basic rights of access to information for people with disabilities, especially the visually impaired (CNDH 2018). This evaluation showed that only 8 of the 32 States in Mexico are actively working to assure visually impaired people can access the information on their websites.

Regarding the literature, there have been some studies regarding accessibility in México, most of them focusing on a specific industry. The biggest research in terms of sample is the one of Ochoa-Urrego (2019), measuring over 1,500 websites of digital media platforms finding proficient accessibility in this type of websites. Regarding the government, Stable Et. Al. evaluated 20 governmental platforms of the region, finding low compliance in the sample in the case of Mexico in terms of WCAG 2.0 guidelines. Other studies like the one presented by Figueroa (2008) analyzed specific websites regarding public healthcare information. No study has presented a more meaningful sample of governmental or e-commerce Mexican websites.

2.4. Inclusion of visually impaired to e-commerce and private websites

Often, interactive web design is created for users with no special needs, and some adaptations can be incorporated to adapt the necessities of some specific categories of users, such as blind users (Nogueira et al. 2019). Nowadays, accessibility and usability are of major importance in today's information society in order to improve people's quality of life (Tânia et al. 2015; Goncalves et al. 2018). Goncalves et al. (2018) tested both accessibility and usability on blind users to analyze Portuguese e-commerce websites and found that when tested manually both show bad marks regarding efficiency, effectiveness, and satisfaction. This means that the automatic evaluation tools are not completely reliable to generalize the results, but also means that if a website is badly scored in one of these tools it will be even worse when tested with visually impaired users, and if it is well scored it is at least accomplishing regulations and is closer of been adequate for the usage of this groups of people. As argued before, this study focuses on measuring website accessibility only because website accessibility is a problem that affects millions of people with disabilities, and it will prove the point of public policy's effectiveness. In general, most of the current accessibility initiatives target government or commercial sites, and a growing segment of online content is being created by non-professionals which are often inaccessible to users with disabilities (Kane 2007). Consequently, considering the current growth of e-commerce driven by the COVID-19 pandemic that puts a lot of restrictions to physical contact and many countries under quarantine, there is a real necessity to purchase products of first necessity like food, healthcare, and cleaning, despite the socioeconomic status and more importantly despite if the person has or doesn't have any disability. The problem is that in developing countries like Mexico only 52.9% have access to an Internet connection and even less know how to use ICTs (INEGI 2019). Therefore, the inclusion of the visually impaired population is urgent in terms of social impact and as ibusiness owners that are trying to grow their market shares.

3. Methodology

This study has followed a mixed methodology to conduct exploratory research. Mixed methods research is in general terms, an approach to knowledge that attempts to consider multiple viewpoints, perspectives, positions, and standpoints (Johnson et al. 2007). It involves collecting, analyzing, and interpreting quantitative and qualitative data in a single study or in a series of studies that investigate the same underlying phenomenon (Leech and Onwuegbuzie 2009). The authors consider that mixed methods with quantitative and qualitative research paradigms are better to solve complex gaps in the literature (Johnson and Onwuegbuzie 2004; Johnson et al. 2007), plus, the combination of both, qualitative and quantitative approaches, has become more used in recent years (Bryman 2007). To answer the research questions, the authors identified key issues related to accessibility policies for inclusion through the qualitative approach and drew strengths and weaknesses that later served to discuss the findings on the quantitative approach to confirm the relevance of this study. Therefore, this study was framed within the mixed-method perspective as the most appropriate technique.

3.1. Data collection and samples characteristics

To conduct the qualitative data gathering, the authors did 6 semi-structured phone interviews that were recorded by computer software. The chosen participants were selected for being key players of the visually impaired community in Mexico through the snowball method (Naderifar et al. 2017). This sampling method was utilized because of the difficulty to find the participants. Three interviews were addressed to NGO's founders and government employees for understanding the state of law experienced by the visually impaired, and three interviews were addressed to educators in order to inquire about the daily technical and social challenges of using web technology and e-commerce sites. As the quantitative method is addressing the more technical aspect of website accessibility, the qualitative method is focusing on the social environment regarding internet access (Iwarsson and Stahl 2003). The questions were divided into two main topics: education and literacy challenges for web access, and state of law related to technology availability and internet consumption.

Table 1. Data sample and sample characteristics for the semi-structured interview.

Name	Role in the visually impaired community
Erasmo Ramos	Founder of Visual Diseases and Retina Studies Mexican Association (AMEVER) and Head of Inclusion in Coahuila´s Human Rights Commission
Conchita Hernández	Head of Blind Children Education in the State of Maryland and founder of the Non-Governmental organization METAS.
José Ignacio Suárez	Founder of the Retinitis Pigmentosa and Retina Diseases Mexican Association (AMRP) in the State of Nuevo León
Manuel Cortéz	Web accessibility professor at the Non-Governmental Organization Destellos de Luz
Andrés García	Web accessibility professor and typhlotechnology expert at AMEVER
Lumi Ramos	Mobility professor at AMEVER

Source(s): Own elaboration.

For the quantitative analysis, the authors did an empirical study measuring the accessibility to compare the different types of websites in three groups. Three types of websites were selected based on traffic and awareness criteria. In total, 107 government websites were identified as the most relevant in Mexico with the domain ".gob.mx", 158 e-commerce websites came out from the list of the Mexican Association of Online Sales (AMVO), and 103 organizations' websites were selected among the companies in the Great Place to Work in Mexico 2020. Hence, this study evaluated the web accessibility of N=366 web sites that operate in Mexico. The complete list of

websites is available upon request to the corresponding author.

3.2. Qualitative Method

For the qualitative method, the semi-structured interviews were processed using the thematic analysis methodology proposed by Braun for generating and analyzing the main themes around the data set (Braun and Clarke 2006). All the interviews were transcribed to text documents from the recording of the telephonic interviews accordingly. Afterward, the authors did multiple readings and familiarization of data prior to the coding process. The coding approximation the authors used is open coding to establish the initial categorization of different segments of the texts (Williams 2019). The initial codes were arranged in themes, revised, and compared with each other for assuring the relevance and correct categorization. The themes are described in Table 2.

Table 2. Description of the revised themes after the open coding process.

Theme	Description
Social challenges for accessing web technology and e-commerce	Findings regarding how Public education, access to hardware, payment methods and specialized software literacy affects access to web technology and e-commerce websites. This theme is formed by the pedagogic experiences of the professors and the issues the NGO directors are trying to solve through their organizations.
State of law regarding policies for the visually impaired	How effectively public policies are being executed by the Mexican government regarding the visually impaired. The construction of the theme is based on the legal knowledge and the life experiences of the participants and the community they represent.
The relevance of web accessibility	The relevance of web accessibility in terms of independence and consumption of online products and services for the visually impaired community in Mexico.

Source(s): Own elaboration.

Table 3. Description of the principal component analysis

		Total Errors	Contrast Errors	Alerts	Features	ARIA final	Structural Elements
Total Errors	Pearsons' Correlation	1	1.000	.519	.266	.479	.627
	Sig. (bilateral)		.000	.000	.000	.000	.000
	N	366	366	366	366	366	366
ContrastErrors	Pearsons' Correlatio	1.000	1	.519	.266	.479	.627

	n						
	Sig. (bilateral)	.000		.000	.000	.000	.000
	N	366	366	366	366	366	366
Alerts	Pearsons' Correlation	.519	.519	1	.418	.483	.491
	Sig. (bilateral)	.000	.000		.000	.000	.000
	N	366	366	366	366	366	366
Features	Pearsons' Correlation	.266	.266	.418	1	.400	.329
	Sig. (bilateral)	.000	.000	.000		.000	.000
	N	366	366	366	366	366	366
ARIAfinal	Pearsons' Correlation	.479	.479	.483	.400	1	.461
	Sig. (bilateral)	.000	.000	.000	.000		.000
	N	366	366	366	366	366	366
StructuralElements	Pearsons' Correlation	.627	.627	.491	.329	.461	1
	Sig. (bilateral)	.000	.000	.000	.000	.000	
	N	366	366	366	366	366	366

Source(s): Own elaboration.

After categorizing and naming the themes, a detailed analysis was conducted to find the relationship between themselves and how they contribute to the resolution of the research question. Extracts of the interviews were generated in order to represent the voice of the participants in the findings of the method and establish a direct relationship between the analysis and the data (Braun and Clarke 2006).

3.3. Quantitative Method

To evaluate website' accessibility, the authors used the open-source tool Web Accessibility Versatile Evaluator (WAVE), which has been used by web developers to the needs of users with cognitive disabilities (Andersen and Rowland 2007). WAVE is an online automatic evaluation tool that helps web developers to make their web content more accessible, although real accessible websites can be only determined by humans (Akgül and Vatansever 2016). WAVE is also based on the WCAG 2.0 criterion and it detects HTML5 and Accessible Rich Internet Applications (ARIA) features, such as header, footer, ARIA landmarks, and roles, etc. Basically, it categorizes the number of errors in each of the 104 features it measures reviewing code and metadata descriptions that are part of 5 different constructs: (1) Contrast errors, (2) Alerts, (3) Features, (4) ARIA, and (5) Structural elements. Hence, the home page of each website was analyzed with WAVE because it is the first contact a user makes and if the home page shows problems or is not accessible, it would be very difficult that an impaired user can access other pages of the website (Akgül and Vatansever 2016). Usually, the accessibility level is based on the total errors among all the features that the WAVE tool measures, but this study conducts a variables reduction procedure to recalculate the 5 constructs that compose the accessibility level into one summarized variable, and then it compares the new variable among the different

types of websites (government, e-commerce, and organizations websites).

In total, the pool of data had N= 366 websites analyzed, 105 from government, 158 from e-commerce, and 103 from organizations. E-commerce represented the websites with cart and payments enabled, while organizations and government websites were more informative not able to process money transactions. The WAVE tool counted the number of errors among the different features that measure the 5 constructs on which it is based. The authors sum the number of errors of all the features included by each of the different constructs and calculated the correlations matrix in Table 2. Then, the authors checked the internal consistency using Cronbach's alpha test because it helps to indicate how much a set of items measure a single unidimensional latent construct (Cronbach 1951). The result of this test shows a 0.739 Cronbach's alpha coefficient. Nunnally (1978) recommends a level of 0.7 or above for this coefficient. Consequently, with Cronbach's alpha test result, procedures like principal component analysis or factor analysis are possible to be used as variable reduction procedures to recalculate the set of constructs as one variable that was defined as web accessibility.

Once the reliability test was conducted and the Alpha coefficient reflected as appropriate to follow a variables reduction procedure, the authors selected the Principal Component Analysis (PCA) to recalculate the 5 constructs measured with the WAVE tool into one summarized variable. The PCA is well known as a powerful multivariate tool that is useful to analyze complex data and reduce dimensionality by using a linear combination of optimally weighted observed variables (Hotelling, 1933; Stevens, 1992; Dunteman, 1994; Lagona and Padovano 2007; Shlens 2009). The procedure provided one summarized variable that measures web accessibility that contains most of the variation within the data (Jolliffe, 2002) and it can be used to compare the differences between the three types of websites in the sample (government, e-commerce, and organizations). Before the PCA, the Bartlett and Kaiser-Meyer-Olkin (KMO) test was conducted in a prior internal consistency validation process and the KMO statistic was 0.802 which is acceptable above 0.5, indicating that the PCA was viable with our sample (Dziuban and Shirkey 1974); in addition, it showed a high level of significance (p-value=0.000) from the Bartlett test (Tobias and Carlson 1969). Then, the PCA was conducted (see Table 3), and after it, the comparisons of web accessibility between the types of websites were possible. Consequently, the authors needed to choose the best test for mean comparison which depended directly on the data distribution. Therefore, normality tests were conducted (Kolmogorov–Smirnov, and Shapiro–Wilk) and the results of these tests revealed that government nor e-commerce nor organizations' website accessibility was not normally distributed. Thus, the Mann–Whitney U non-parametric test for means comparisons was selected as the most appropriate method to compare between groups of websites because it has been reported as considerably more efficient and robust than the t-test when sample distributions are not normal (Conover 1998, p. 16).

Table 4. Description of the principal component analysis.

Web accessibility		
Statement	**Communalities extraction**	**Component matrix**
Contrast Errors	0.624	0.790
Alerts	0.616	0.785
Features	0.371	0.609
ARIA final	0.571	0.756
Structural Elements	0.626	0.791

Source(s): Own elaboration.

Table 5. Total variance explained

Component	Initial eigenvalues			Extraction sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	2.807	56.146	56.146	2.807	56.146	56.146
2	0.803	16.065	72.210			
3	0.535	10.709	82.920			
4	0.494	9.879	92.799			
5	0.360	7.201	100.000			

Source(s): Own elaboration.

4. Results

4.1. Qualitative findings

4.1.1. Social challenges for accessing web technology and e-commerce

All the participants in the interview agreed on the fact that education is one of the most challenging aspects regarding access to the internet. As only 2% of the public schools have access to specialized tutors for the impaired, ONGs are a crucial part of education as it is one of the main channels for finding relevant and updated information. The participants agreed that, even if braille language is usually associated with the main way the visually disabled learn, that is only true for their first years of learning for blind born children (Erasmo Ramos 2019). As the children enter high school, the understanding of screen readers is paramount to continue their education for successfully achieving incorporation in the workplace, higher education, and daily life activities. As the educator Lumi Ramos stated, even when the streets and maps in their class are in braille, accessibility in mobile app services are fundamental for orientation and mobility in the city (Ramos, L. 2020). The common concerns of the public and private education for the community were the lack of coverage for inclusive educational programs, the lack of knowledge of the use of technology in special and regular educators, and the lack of empathy when visually impaired learning is introduced to an inadequate educational environment. Another element that was fundamental in the education process is the family environment. The awareness of tiflotechnology and the level of independence that the family allows and is willing to encourage is also crucial for the visually impaired person to start pursuing technological literacy, that is the only way for becoming independent and potentially becoming an independent consumer. The family concerns are especially emphasized when young adults or seniors approach the ONGs looking for technological education with no prior knowledge. According to the educator Andres García, some of them are afraid even to touch the computer as they are not allowed to use them at home (Garcia 2019).

4.1.2. State of law regarding policies of the visually impaired

All the professors and NGO's directors are aware that, at least at a governmental level, all the websites and mobile apps should be accessible and comply with the WCAG 2.0 AA accreditation. There are different examples between the participants regarding good and bad experiences using governmental sites. While passport expeditions and tax payments are presented as governmental accessible websites, other institutions like the national institute of social development are presented as non-accessible experiences. Regarding the private sector, two of the six participants were very pleased in general with the purchasing process at e-commerce sites, and even if the site has minor flaws in accessibility, an experienced user is able to go around them. It should be noted that the vast majority of examples of accessible pages they provided were American businesses operating in Mexico, with the exception of the Mexican businesses Coppel and Elektra. The majority of participants agree that there is no way in Mexico to actually force a business to have an accessible website. The regular response of the majority of participants regarding a non-accessible website is a bad reputation in the visually impaired community. A common example was the consumption of financial services, a specific industry that is presented as very variable in terms of accessibility by half of the participants. In an example presented by Andrés García, he explains that every month after he receives his paycheck, he asks for a transfer to another bank that is more accessible. He describes the visually impaired consumer community as a very loyal and grateful community that appreciates the accessibility efforts the companies are doing with recommendations and even thank-you notes. Conchita Hernández established a concrete distinction in law enforcement between Mexico and the USA. While both countries have outdated and non-specific laws regarding web accessibility, the court resolutions of civil lawsuits presented in the USA are enforcing the right of the visually impaired community by commanding companies to have accessible web pages (Hernández, C. 2019). In response to the inability of the government to enforce accessibility in web pages and mobile applications, our participants

Also, the lack of results in the education policies regarding access to inclusive education is a paramount element for website accessibility according to the majority of the participants. If the educational programs are outdated in terms of technology, even if the visually disabled children were able to attend school, they are probably going to be segregated by not having technological literacy making it very hard to find a job and become a functional part of society (E. Ramos 2020).

4.1.3. State of law regarding policies of the visually impaired

One of the key results we gathered from the interviews is the relevance of website accessibility in the visually impaired community. As stated by the majority of participants, the direct implication of a non-accessible website or mobile app is losing autonomy in their daily lives. As stated in an example from Erasmo Ramos, when a web page or app is inaccessible, like in video conferencing web pages or any other kind, he asks his coworkers for help. This makes Erasmo more dependent on other people around them, his family, friends, or coworkers. All the ONG's and educators are creating opportunities for the community to encourage them to be independent, make a living, and access to educational opportunities, so facing exclusion scenarios is considered for them as an act of discrimination and an information barrier. As previously stated, braille is not a feasible way to access updated and relevant information, making web accessibility a fundamental tool for education, employability, and social development.

4.2. Quantitative findings

The results of the Mann-Whitney U tests are reported in Table 4. Comparing government websites against e-commerce website accessibility the result was higher and statistically significant for e-commerce ($z=-7.190$, $p= 0.000$). This means that e-commerce websites have more errors based on the WCAG 2.0 criterion which at the same time reflects

lower web accessibility between these two types of websites. Then when the authors compared government websites against organizations' website accessibility the result was not significant and the difference was slightly higher for government websites (z= -0.005, p= 0.996), meaning that organizations' websites are probably more accessible, but we can not generalize with these results. On the other hand, when comparing lastly the organizations websites against e-commerce websites accessibility the result of the Mann-Whitney U test shows that e-commerce websites are higher (lower accessible) and statistically significant (z=-6.766, p= 0.000).

Table 6. Mann-Whitney-U test results.

Scale	Type of websites	Valid cases	Mean ranges	Mann-Withney U	Z	p-value
Website Accessibility	Government	105	90.63	3951.5	-7.19	0.000
	e-commerce	158	159.49			
	Government	105	104.52	5405.5	-0.005	0.996
	Organization	103	104.48			
	e-commerce	158	156.53	4104.0	-6.766	0.000
	Organization	103	91.84			

Source(s): Own elaboration.

5. Discussion and conclusions

In our qualitative study, the main finding was that the general status of the accessibility of all categories in the sample is deficient and the majority of the websites present several errors, especially the e-commerce category, answering the RQ1. When we cross the data with the testimonies of the interviewees, we can conclude that the perception of accessibility is also considered deficient for the visually impaired community. The main issue regarding this evaluation is that in Mexico the private companies are not enforced to comply with any kind of regulation in terms of accessibility. Even if government sites should be obliged to comply, thorough enforcement of these guidelines should be revised as many of the web pages are far from doing so.

The results for the RQ1 are more relevant as we see the finding regarding the RQ2. We found that the implications of website accessibility in e-commerce sites or any other sites are very meaningful for the visually impaired community. As stated by Erasmo Ramos (2020), the disability, besides the disease that affects the vision, is created by the environment. Finding an inaccessible website is a barrier to information and makes an unequal opportunity to buy, learn, and work. The authors note it since the study

considers only home pages because they are the first contact to people and most of them are not passing the accessibility minimum requirements (Akgül and Vatansever 2016). This lack of accessibility doesn't represent only a different amount of information that is available for them, but also it forces them to ask for assistance in completing a certain task, decreasing independence in daily activities. The inability to use a website despite technological literacy is considered an act of discrimination and is an upside in the search for autonomy for the visually impaired. Even if the experienced users are more capable of going through an inaccessible website, accessibility is paramount for basic human rights and equality for the visually impaired. The results are confirming how the role of access to web information is a vital part of the integration of disabled users (Nogueiras et al. 2019).

The authors considered that there may be two main factors affecting the current accessibility issues in the Mexican e-commerce sites: law enforcement and private sector responsibility. Even if the law requires that at least all governmental websites are compliant with WCAG 2.0, we found out that not even these sites have the minimum requirements. This is a general problem because the policies by themselves are not enabling trade and telecommunications (Gibbs et al. 2002). If the government is unable or unwilling to comply, it seems complicated that private institutions will when they are not obligated. The government should enforce compliance for themselves and then start with the private sector. If the private sector has a better and more empathic understanding of what are the minimum requirements of accessibility and what are the implications of achieving them, they may be able to increase their market share. As there is a leveling effect in terms of socio-economical access to new markets (Goldwell and O'Connor 2000), there may be a potential gap increase for the market segments that are still not on board the ibusiness hype.

5.1. Limitations

For future research, having the opinions and problem perspective of the policymakers and enforcers could be interesting to see if there are other systemic conditions that affect accessibility compliance in the private sector. Also, the number of interviews could have been bigger for providing perspectives equally represented to visually impaired communities nationwide to see if there are different states of law between States. For the qualitative analysis, running usability tests to evaluate the site in terms of a more qualitative can be helpful to understand how these variables affect directly in the navigation. As stated, accessibility is only a technical element for inclusive web design, so approaching the sample with different research techniques could enrich the literature. For the quantitative on the other hand, the sample considered the most promising websites from the different associations, but the sample could be bigger as well and it could be interesting to compare with similar analysis websites from other hosting countries like the USA. As the authors mentioned one of the most relevant limitations is that with this research design they are evaluating the part of accessibility as the departing point that if the websites do not accomplish they won't be user friendly neither so there isn't a point in evaluating usability. In the qualitative analysis, this research considered people visually impaired, but the quantitative analysis was conducted with the WAVE automatic tool for web scraping. It could be explained because of websites' lack of accessibility and usability found testing other samples of websites on blind users (Nogueira et al. 2019).

5.2. Implications

The authors found different perspectives regarding the state of education from the participants that resided in the state of Nuevo León, México. There may be differences in terms of educational policy between States within a country, so having a deeper understanding of the educational context locally and what is the level of technological literacy can help to understand the potential market that these communities

represent. This data could make a more attractive case for the firms to invest in accessibility for increasing sales and market share in a loyal and unattended market. For governments, the inclusion of disabled people is supposed to be a priority in many countries and of course in Mexico with a specific law, but the findings of this study suggest that not even government dependencies are following accessibility requirements to increase penetration and inclusion of Internet users. Recently, the COVID-19 pandemic accelerated in a positive sense the transformation to digital economies in many countries, but with this case of Mexico, it helps to show how the developing countries face even greater challenges before prioritizing the inclusion of visually impaired to e-commerce activities starting with education in the usage of ICT's.

6. Acknowledgments

We want to thank Institute for Disability Research, Policy, and Practice for providing the software that made the web scrapping possible. We would also like to recognize AMEVER, Destellos de Luz and METAS for accepting our invitation to participate in this research.

References

Agarwal, J., & Wu, T. (2015). Factors influencing growth potential of e-commerce in emerging economies: An institution-based N-OLI framework and research propositions. *Thunderbird International Business Review, 57*(3), 197-215.

Akgül, Y., & Vatansever, K. (2016). Web Accessibility Evaluation of Government Websites for People with Disabilities in Turkey. *Journal of Advanced Management Science, 4*(3), 201-210. https://doi.org/10.12720/joams.4.3.201-210

Aquino, S., García V., & Izquierdo, J. (n.d.). *La Inclusión Educativa de Ciegos y Baja Visión En El Nivel Superior: Un Estudio de Caso.* Available at: http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1665-109X2012000200007 [Accessed June 2, 2020]

Architectural and Transportation Barriers Compliance. (2017). *Information and Communication Technology*. (ICT). Standards and Guidelines.

Barnes, S. J. (2020). Information management research and practice in the post-COVID-19 world. *International Journal of Information Management*, In Press. https://doi.org/10.1016/j.ijinfomgt.2020.102175

Braun, V., & Clarke, V. (2006). Using Thematic Analysis in Psychology. *Qualitative Research In Psychology*, 3, 77–101.

Brouthers, K.D., Geisser, K.D., & Rothlauf, F. (2016). Explaining the internationalization of ibusiness firms. *Journal of International Business Studies, 47*(5), 513-534.

Bryman, A. (2007). Barriers to Integrating Quantitative and Qualitative Research. *Journal of Mixed Methods Research, 1*(1), 8–8. https://doi.org/10.1177/1558689806290531

Cambridge University. (2017). *Inclusive Design Toolkit*. Available at: http://www.inclusivedesigntoolkit.com/ [Accessed June 13, 2020]

Comisión Nacional de Derechos Humanos CNDH. (2018). *Informe especial de la Comisión Nacional de los Derechos Humanos sobre el estado que guarda los Derechos Humanos de las personas con discapacidad en las entidades federativas del país*. Comisión Nacional de los Derechos Humanos.

Congreso de la Unión. 2011. "Ley General para la Inclusión de las Personas con Discapacidad." *Diario Oficial de la Federación*, 29.

Conover, W. J. (1998). *Practical nonparametric statistics*. John Wiley and Sons.

Cortéz, M. (2020). Telephonic Interview with Audio Recording.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*(3), 297-334. http://dx.doi.org/10.1007/BF02310555

Department of Justice. (n.d.). *2010 ADA Standards for Accessible Design*. Available at: https://www.ada.gov/regs2010/2010ADAStandards/2010ADAstandards.htm#c1[Accessed August 2, 2020]

Dunteman, G. H. (1994). Principal component analysis. In Lewis-Beck M. S. (Ed.), *Factor analysis and related techniques*. Sage, 157–245.

Dziuban, C. D., & Shirkey, E. C. (1974). When a correlation matrix is appropriate for factor analysis? Some decision rules. *Psychological Bulletin, 81*(6), 358-361. http://dx.doi.org/10.1037/h0036316

Figueroa, M. (2008). Accesibilidad a la información digital para las personas con discapacidad en los servicios de información de ámbito federal en salud de México. *Altepepaktli : Salud de La Comunidad, 4*(8), 3-13.

García, A. (2020). Telephonic Interview with Audio Recording.

Gibbs, J., Kraemer, K.L., & Dedrick, J. (2002). Environment and Policy Factors Shaping E-commerce Diffusion: A Cross-Country Comparison. *The Information Society*.

Goldstein, A., and O'Connor, D. (2000). E-Commerce for development: prospects and policy issues. *OECD Development Centre*. Working paper No. 164.

Goncalves, R., Rocha, T., Martins, J., Branco, F., & Au-Yong-Oliveira, M. (2018). Evaluation of e-commerce websites accessibility and usability: an e-commerce platform analysis with the inclusion of blind users. *Universal Access in the Information Society*, 17, 567-583. https://doi.org/10.1007/s10209-017-0557-5

Hernández, C. (2020). Telephonic Interview with Audio Recording.

Hotelling, H. (1933). Analysis of a complex of statistical variables into principal components. Journal of *Educational Psychology, 24* (6), 417-441.

INEGI. (2019). Encuesta sobre Disponibilidad y Uso de Tecnologías de la Información y la Comunicación en los Hogares. Instituto Nacional de Estadística y Geografía. Available at: https://www.gob.mx/sct/prensa/en-mexico-hay-74-3-millones-de-usuarios-de-internet-y-18-3-millones-de-hogares-con-conexion-a-este-servicio-endutih-2018-196013?idiom=es#:~:text=En%20M%C3%A9xico%20hay%2018.3%20millones,hogares%20conectados%20fue%20de%2050.9%25. [Accessed August 25th, 2020]

Iwarsson, S., & Ståhl, A. (2003). Accessibility, Usability and Universal Design—Positioning and Definition of Concepts Describing Person-Environment Relationships. *Disability and Rehabilitation, 25*(2), 57–66.

Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational researcher, 33*(7), 14-26.

Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of mixed methods research, 1*(2), 112-133. https://doi.org/10.1177/1558689806298224

Jolliffe, I. T. (2002). *Principal component analysis* (2nd ed.). Springer.

Kane, S. K. (2007). Everyday inclusive Web design: an activity perspective. *Information Research, 12*(3).

Kreamer, K.L., Dedrick, J., Melville, N.P., & Zhu, K. (2006). *Global E-Commerce Impacts of National Environment and Policy*. Cambridge University Press.

Lagona, F., & Padovano, F. (2007). A nonlinear principal component analysis of the relationship between budget rules and fiscal performance in the European Union. *Public Choice*, 130, 401–436. https://doi.org/10.1007/s11127-006-9095-z

Leech, N. L., & Onwuegbuzie, A. J. (2009). A typology of mixed methods research designs. *Quality & quantity, 43*(2), 265-275. https://doi.org/10.1007/s11135-007-9105-3

Microsoft. (2018). Microsoft Design. Available at: https://www.microsoft.com/design/inclusive/. [Accessed May 9, 2020]

Morris, J., & Mueller, J. (2014). Blind and Deaf Consumer Preferences for Android and iOS Smartphones. In: Langdon P., Lazar J., Heylighen A., Dong H. (eds) *Inclusive Designing*. Springer. https://doi.org/10.1007/978-3-319-05095-9_7

Naderifar, M., Hamideh G., & Fereshteh, G.. (2017). Snowball Sampling: A Purposeful Method of Sampling in Qualitative Research. *Strides in Development of Medical Education*.

Nogueira, T.C., James Ferreira, D., Teixeira de Carvalho, S., Oliveira Berretta, L, & Guntijo, M. R. (2019). Comparing sighted and blind users' task performance in responsive and non-responsive web design. *Knowledge and Information Systems*, 58, 319-339. https://doi.org/10.1007/s10115-018-1188-8

Nunnally, J. (1978). *Psychometric theory* (2nd ed.). McGraw–Hill.

Ochoa-Urrego, R. (2019). Índice de accesibilidad para cibermedios mexicanos. *Revista Española de Documentación Científica, 42*(3), e244-e244. https://doi.org/10.3989/redc.2019.3.1541

Ramos, E. (2020). Telephonic Interview with Audio Recording.

Ramos, L. (2020). Telephonic Interview with Audio Recording.

Schu, M., Morschett, D., & Swoboda, B. (2016). Internationalization Speed of Online Retailers: A Resource-Based Perspective on the Influence Factors. *Management International Review*, 56, 733-757. https://doi.org/10.1007/s11575-016-0279-6

Secretaría de Gobernación. (2015). Acuerdo por el que se establecen las Disposiciones generales de accesibilidad Web que deben observar las dependencias y entidades de la Administración Pública Federal y las empresas productivas del Estado. [Accessed July 15, 2020] [Accessed May 2, 2020] Available at: https://dof.gob.mx/nota_detalle.php?codigo=5418749&fecha=03/12/2015.

Shlens, J. (2009). *A tutorial on principal component analysis. Version 3.01 Systems Neurobiology Laboratory*. Salk Institute for Biological Studies online.

Singh, N., & Kundu, S. (2002). Explaining the growth of e-commerce corporations: An extension and application of the eclectic paradigm. *Journal of International Business Studies*, 33, 679-697.

Stable, Y., Alvarez Calderon, E., Pérez, L., & Antonio, C. (2020). *State of web accessibility of e-government portals in Latin America*, 16, 7-22.

Stevens, J. (1992). *Applied multivariate statistics for the social sciences*. Lawrence Erlbaum Associates.

Stewart, R. (2020). Stores may be reopening, but brands shouldn't put e-commerce back on the simmer. *The drum*. Available online at: https://www.thedrum.com/news/2020/06/11/stores-may-be-reopening-brands-shouldn-t-put-e-commerce-back-the-simmer [Accessed August 24th, 2020]

Suárez, J. (2020). Telephonic Interview with Audio Recording.

Supreme Court of the United States. (2019). Petition for a Writ Certiorari to the United States Court Of Appeals of the Ninth Circuit. [Accessed June 10, 2020]

Tânia, R., Diana, C., Ramiro, G., José, M., Frederico, B., Maximino, B. (2015). Usability Evaluation of the Touch Screen and Mouse as Input Devices by People with Intellectual Disabilities. *Conference paper*. WWW/Internet 2015.

Tobias, S., and Carlson, J.E. (1969). Brief report: Bartlett's test of sphericity and chance findings in factor analysis. *Multivariate Behavioral Research, 4*(3), 375-377. https://doi.org/10.1207/s15327906mbr0403_8

United States Code. (2008). *Americans with disabilities act of 1990*. Retrieved August 2, 2020 (https://www.ada.gov/pubs/adastatute08.pdf).

United States Code. (2015). *[Usc02] 20 usc ch. 33: education of individuals with disabilities*. Retrieved August 2, 2020, https://uscode.house.gov/view.xhtml?path=/prelim@title20/chapter33&edition=prelim.

United States District Court. 2019. "Appeal from the United States District Court for the Central District of California S. James Otero, District Judge, Presiding." 25.

Web Accessibility Initiative. (2018). Web Content Accessibility Guidelines. Available at: https://www.w3.org/WAI/standards-guidelines/wcag/. [Accessed March 10, 2020]

WHO. (2019). Blindness and vision impairment. World Health Organization. Available online at: https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment [Accessed August 25th, 2020]

Williams, M., & Tami Moser. (2019). The Art of Coding and Thematic Exploration in Qualitative Research. *International Management Review*, 15, 45–55.

Williams, M., and Tami M.. (2019). The Art of Coding and Thematic Exploration in Qualitative Research. *International Management Review*, 15:45–55.

Zúñiga, S., García, V., & Izquierdo, J. (2012). La inclusión educativa de ciegos y baja visión en el nivel superior: Un estudio de caso. *Sinéctica*, 39, 01–21.