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# SaaS E-Commerce Platforms Web Accessibility Evaluation

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**Abstract** — Web accessibility related to cloud computing is more concerned at the application level where a human interacts with an application via a user interface. Although previous research has identified web accessibility influences on website effectiveness, the evaluation of the relative importance of web accessibility on software-as-a-service (SaaS) e-commerce platform has not been empirically determined. This study evaluates the web accessibility of SaaS e-commerce platform websites. The web accessibility features from the cloud accessibility taxonomy framework were evaluated for people with disabilities such as sensory (hearing and vision), motor (limited use of hands) and cognitive (language and learning disabilities) impairments. We conducted an expert evaluation using Fuzzy TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution). The results show Shopify cloud-based e-commerce platform has a high number of web accessibility features from the proposed cloud accessibility framework followed by 3dCart, BigCommerce, Volusion, and WooCommerce.

**Keywords**— *E-commerce, Ecommerce, Cloud computing, Cloud accessibility, People with disabilities, Software-as-a-service, SaaS, Web accessibility, user interface*

## I. INTRODUCTION

Cloud computing has brought a dramatic shift in the IT industry and has changed the way in which organizations plan their IT infrastructure due to its on-demand, highly scalable and affordable service offerings [1]. Cloud computing allows businesses to utilize computing resources from external service providers over the Internet rather than investing in their own IT infrastructure [2].

Cloud service models as per NIST (National Institute of Standards and Technology) [3] are IaaS (infrastructure as a service), PaaS (platform as a service), and SaaS (software as a service) describe how cloud services are made available to the clients. For instance, an e-commerce firm can use an IaaS model to purchase servers, storage, network and operating systems, etc. PaaS provides a pre-built application platform to the client; business requisition resources as they need them, rather than investing in underlying infrastructure for their applications. Alternatively, businesses can quickly launch e-commerce websites without worrying about server configurations and software updates. With the rapid advance and the widespread use of cloud services, Software-as-a-Service (SaaS) has become

a good fit for the majority of online businesses. SaaS platforms offer the ease of creating a website, featuring excellent scalability. Concerning the e-commerce, SaaS platforms allow businesses to develop their online store using readily available tools and easy to use drag and drop interfaces [1, 2].

Although cloud computing has changed the e-commerce industry, however, its unique web accessibility implications are often minimal [4]. Web accessibility is more concerned with the web user interface than the platform or infrastructure-as-a-service. Researchers have measure customer satisfaction, service quality and the user acceptance of SaaS [5-8]. However, in recent years, there is a growing concern regarding the web accessibility of cloud computing, in particular for people with disabilities [9-11]. SaaS helped to minimize costs and maximize customer satisfaction levels but neglected the accessibility of the e-commerce websites [12]. Businesses ignore the importance of web accessibility and in turn lose out on a large number of consumers who find it difficult to interact with their website [13].

Therefore, the purpose of this study is to evaluate the web accessibility of SaaS e-commerce websites. Following the main objective, the research question is: *what is the impact of web accessibility of e-commerce SaaS websites?* This study applied Bohn and Tobias [4] cloud accessibility framework to evaluate web accessibility of cloud-based e-commerce platforms websites using Fuzzy TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution), a popular multi-criteria decision making (MCDM) technique. The decision-maker as end-user evaluates the web accessibility features from the cloud accessibility taxonomy framework [4] for people with disabilities.

The study is organized as follows: Section II provides the background information about SaaS and e-commerce, web accessibility and cloud computing. Then it presents the cloud accessibility framework along with a MCDM approach. The research method is explained in Section III followed by case study results in Section IV. Finally, the study concludes in Section V.

## II. BACKGROUND AND LITERATURE REVIEW

This section discusses some background information and related studies about cloud and the e-commerce, cloud web accessibility, and MCDM.

### A. Cloud (SaaS) and the e-commerce

Software-as-a-Service (SaaS) also referred to as on-demand software, the provider hosts the software and provides access to the clients through leasing. SaaS is the best cloud service model to achieve full-service e-commerce, in particular for small-to-medium-sized enterprise [14]. Cloud elastic computing allows services to scale up and scale down on demand, depending on the volume of user traffic to an e-commerce application. The rapid advancement of cloud computing emerged in multi-tenant e-commerce. "Multi-tenancy is a business strategy in which a single instance of a software application serves multiple customers (tenants)." [15]. The multi-tenant SaaS model allows a single application instance to be used by multiple customers thus allowing service providers to support multiple B2C websites from a single software stack and database [15]. SaaS providers can also offer new features and carry out application updates on a single software stack instead of maintaining individual application instances for each tenant [8].

Due to a wide range of cloud services such as – on demand service access, lower expenses both in terms of maintenance and management, higher efficiency and many other valuable features, the e-commerce companies are able to expand their businesses without worrying of the upfront costs, scalability, maintainability and elasticity. While using SaaS, the e-commerce companies could earn a higher return on investment, greater flexibility, higher customer satisfaction by allowing them to select the provider according to their personalized choices [16].

However, for forming a long-term trusted relationship between the e-commerce service provider and a customer they should form a viable service level agreement (SLA) [17-19]. The compliance with SLA between both parties may be determined by gathering data for each HTTP/HTTPS request and response send to the e-commerce service provider [20]. Tang et al. [21] proposed a trustworthiness cloud service discovery framework to rank cloud services by combining customer feedback rating with the quality of service (QoS) data to assist the customer to choose appropriate cloud service provider. Sohaib and Naderpour [22] highlighted that SaaS is the optimal choice for the e-commerce business.

### B. Web Accessibility and Cloud Computing

The Web Accessibility Initiative (WAI), a working group of World Wide Web Consortium (W3C) deals with the web accessibility and significantly involved in the development of web content accessibility guideline (WCAG). The WAI define web accessibility as: "people with disabilities and older people can perceive, understand, navigate, and interact with the Web, and that they can contribute to the Web [23]. The WCAG version 2.0 is the latest version, which has four principles (perceivable, operable, understandable and robust). These

principles are further subdivided into 12 guidelines. For each guideline, testable success criteria are provided and for each of the success criteria, 3 levels (Level A, AA and AAA) are defined [24]. Sohaib and Kang [25-26] highlighted web accessibility in e-commerce for people with disabilities. However, according to [13] web accessibility should not only be addressed to a certain group of people involving disabilities but there should be one and equal access to all people.

Web accessibility related to cloud computing is more concerned at the application level where a human interacts with an application via a user interface [4]. Thus, many of the current web accessibility standards for software/web applications are also applicable to cloud computing applications such as SaaS websites. The most relevant are ISO 9241-151, ISO 9241-20:2008, Section 508 of the US rehabilitation Act and the WCAG 2.0 [4]. However, cloud computing also offers new cloud based accessibility opportunities such as Global Public Inclusive Infrastructure (GPII) and the Accessibility Application Programming Interfaces (A APIs) [4].

A number of researchers have evaluated website accessibility for people with disabilities. [25, 26]. Mulfar et al. [11] provided adaptive SaaS user interfaces via virtual machine for people with disabilities in order to enable them accessing assistive technology tools.

However, the Cloud Computing and Accessibility Public Working Group (CCA-PWG) identified a few issues that are unique to managing accessibility in the cloud [4]. These issues include software version control, reliance on the browser, platform quandary, the user of thin clients and rich data visualizations. Users with disabilities such as sensory (hearing and vision), motor (limited use of hands) and cognition (language and learning) have a process and technological barriers accessing electronic information. For example:

#### *Audio and alternatives.*

A deaf user or who have difficulty in the hearing will need text captioning for all audio content [19]. Sign language could also be a more effective form of communication [4].

#### *Control, Input and Operation.*

A user with motor impairments will have difficulty using a mouse or keyboard. For-example, interacting with product images as three-dimensional (3D) virtual models, 360° rotation view, which allows the manipulation of product images [19]. Such users may need an alternative input devices or speech recognition system [4].

#### *Reading, understanding, learning and managing.*

A user with cognitive disabilities (reading, thinking, remembering, navigating etc.) will find difficult to process information on a webpage [19].

#### *Speaking and communicating.*

A user with speech disabilities produces speech that is not recognizable by other people. Such users find it difficult to interact with the website, if the website services only offer a phone number as its contact information.

#### *Visual.*

Users with low vision, blindness and color-blindness struggle with many websites. Images without a text alternative, lack of sensitivity to certain colors can be a huge barrier for those people with visual disabilities. Such users may require usage of screen readers, magnification and high contrast web design [19].

### C. Cloud Accessibility

As discussed above, it is important to have a consistent taxonomical framework of cloud accessibility to create information resources that make sense to the users, in particular for people with disabilities. Bohn and Tobias [4] explained a series of use cases of how a user with disabilities interacts in different circumstances, which are useful in considering accessibility in cloud computing. Figure 1 shows the Cloud Accessibility taxonomy framework [4].

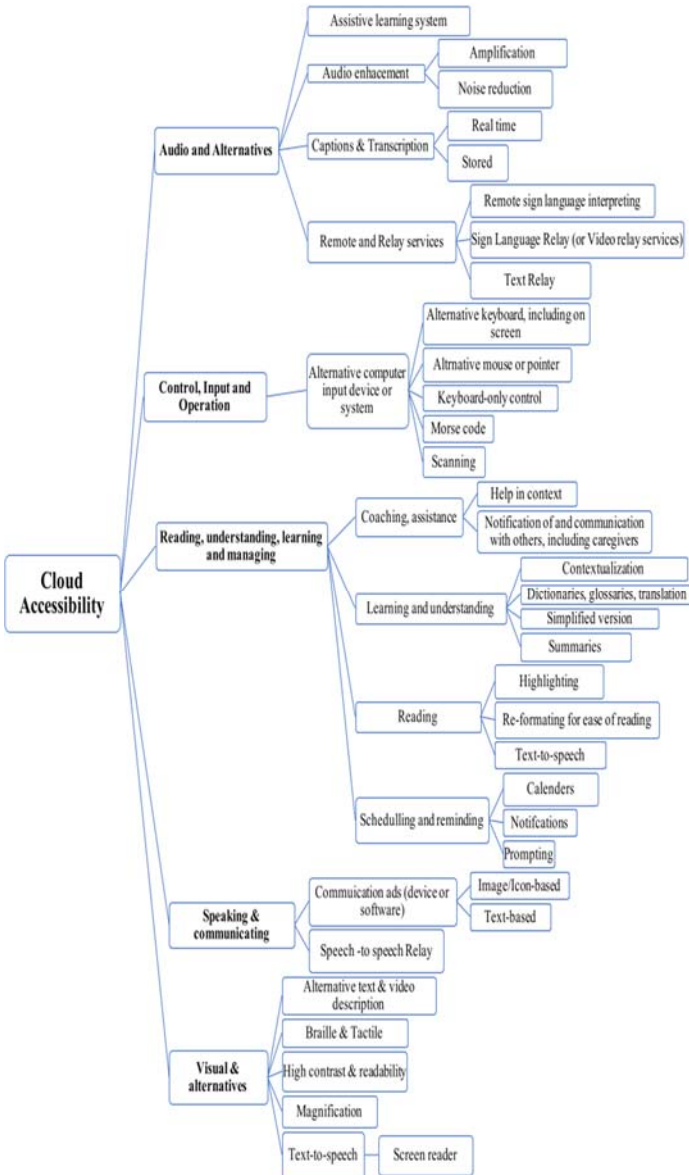


Fig 1: Cloud Accessibility [4].

### D. Multi-Criteria Decision Making

Multi-criteria decision-making refers to the decision making in the existence of multiple and conflicting criteria [27-28]. MCDM involves both quantitative and qualitative factors and there are numerous MCDM techniques for choosing the best feasible option. Due to fuzziness in criteria and decision makers' judgments, many real-world decision problems denote fuzzy multi-criteria decision making [31]. This paper uses the fuzzy technique for order preference by similarity to ideal solution (TOPSIS) [22] to deal with the decision-making problem. TOPSIS has been firstly developed by Hwang and Yoon [29] and has been an acceptable method in different application areas [30].

A typical MCDM problem based on  $m$  alternatives ( $A_1, A_2, \dots, A_m$ ) and  $n$  criteria ( $C_1, C_2, \dots, C_n$ ) is presented as:

$$X = [x_{ij}]_{m \times n}, W = [w_j]_n \quad (1)$$

where  $X$  is the decision matrix,  $x_{ij}$  is the performance of the  $i$ th alternative with respect to the  $j$ th criterion,  $W$  is the weight vector, and  $w_j$  is the weight of the  $j$ th criterion.

In fuzzy MCDM both  $X$  and  $W$  can be linguistic terms that are presented by fuzzy numbers and defining appropriate membership functions. Such functions can be determined in different ways, this paper assumes that parametric triangular ones are good enough to capture the vagueness of those linguistic assessments.

Assume,  $\tilde{X} = \{\tilde{x}_{ij}, i = 1, 2, \dots, m, j = 1, \dots, n\}$  is the linguistic decision matrix for alternatives with respect to criteria, and  $\tilde{W} = \{\tilde{w}_j, j = 1, \dots, n\}$  is the linguistic vector of criteria weights.

The fuzzy TOPSIS method is as follows:

**Step 1:** Normalized fuzzy decision matrix: The fuzzy linguistic rating  $\tilde{x}_{ij}$  preserves the property that the ranges of normalized triangular fuzzy numbers belong to  $[0, 1]$ ; thus, there is no need for normalization.

**Step 2:** Weighted normalized fuzzy decision matrix: Considering the different importance values of each criterion, the weighted normalized fuzzy decision matrix is constructed as:

$$\tilde{V} = [\tilde{v}_{ij}]_{m \times n} \quad i = 1, \dots, m, j = 1, 2, \dots, n \quad (2)$$

where  $\tilde{v}_{ij} = \tilde{x}_{ij} \otimes \tilde{w}_j$  is the standard multiplication of two triangular fuzzy numbers. Assume  $\tilde{a} = (a_1, b_1, c_1)$  and  $\tilde{b} = (a_2, b_2, c_2)$ , then

$$\tilde{a} \otimes \tilde{b} = (a_1 a_2, b_1 b_2, c_1 c_2) \quad (3)$$

**Step 3:** Identification of fuzzy positive ideal (FPI) and fuzzy negative ideal (FNI) solutions: The FPI and FNI solutions are determined as follows:

$$A^+ = \{\tilde{v}_1^+, \tilde{v}_2^+, \dots, \tilde{v}_n^+\} = \quad (4)$$

$$\{(\max_j \tilde{v}_{ij} | i \in I') \text{ or } (\min_j \tilde{v}_{ij} | i \in I'')\} \quad i = 1, \dots, m \quad j = 1, \dots, n$$

$$A^- = \{\tilde{v}_1^-, \tilde{v}_2^-, \dots, \tilde{v}_n^-\} = \quad (5)$$

$$\{(\min_j \tilde{v}_{ij} | i \in I') \text{ or } (\max_j \tilde{v}_{ij} | i \in I'')\} \quad i = 1, \dots, m \quad j = 1, \dots, n$$

where  $I'$  is associated with benefit criteria and  $I''$  is associated with cost criteria.

**Step 4:** Calculation of distances: The distance of each alternative from FPI and FNI is calculated as follows:

$$D_j^+ = \sum_{j=1}^n d(\tilde{v}_{ij}, \tilde{v}_i^+) \quad j = 1, 2, \dots, n \quad (6)$$

$$D_j^- = \sum_{j=1}^n d(\tilde{v}_{ij}, \tilde{v}_i^-) \quad j = 1, 2, \dots, n \quad (7)$$

where  $d(\tilde{a}, \tilde{b})$  is the vertex method that calculates the distance between two triangular fuzzy numbers  $\tilde{a}$  and  $\tilde{b}$ :

$$d(\tilde{a}, \tilde{b}) = \sqrt{\frac{1}{3}[(a_1 - a_2)^2 + (b_1 - b_2)^2 + (c_1 - c_2)^2]} \quad (8)$$

**Step 5:** Calculation of similarities: The similarities to FPI solution is measured as follows:

$$C_j = \frac{D_j^-}{D_j^+ + D_j^-} \quad j = 1, 2, \dots, n \quad (9)$$

**Step 6:** Ranking of alternatives: The alternatives are ordered based on  $C_j$  in descending. The alternative with highest  $C_j$  is the best choice.

### III. METHODOLOGY

Fig. 2 represents the proposed methodology for the decision-making problem. As can be seen, it consists of four steps that are explained in the following sub-sections.

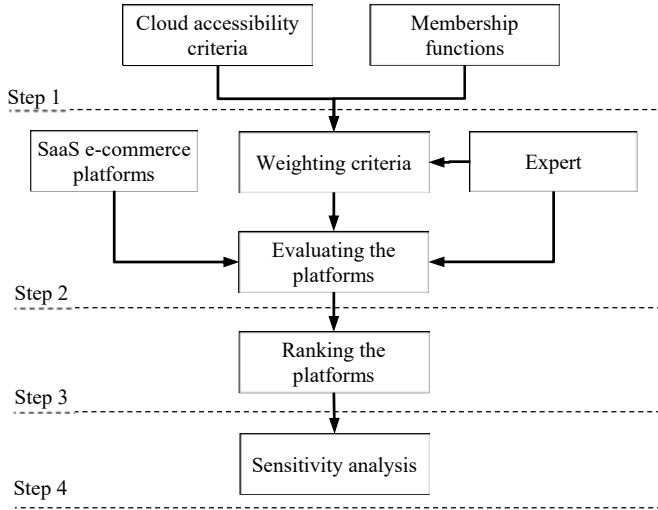


Fig 2. The proposed methodology.

#### A. Step 1

The cloud accessibility criteria are determined based on Bohn and Tobias [4] as explained in Section II.C. The paper uses triangular fuzzy numbers to express the importance of each

criteria. Triangular fuzzy numbers make the computations easy and they have shown their effectiveness in formulating decision problems where the information available is subjective and imprecise. The linguistic variables proposed by [31] as represented in Table I are used for weighting criteria.

TABLE I. FUZZY LINGUISTIC TERMS AND FUZZY NUMBERS FOR WEIGHTING CRITERIA

Linguistic term	Fuzzy number
Very low (VL)	(0, 0, 0.2)
Low (L)	(0.05, 0.2, 0.35)
Medium low (ML)	(0.2, 0.35, 0.5)
Medium (M)	(0.35, 0.5, 0.65)
Medium high (MH)	(0.5, 0.65, 0.8)
High (H)	(0.65, 0.8, 0.95)
Very high (VH)	(0.8, 1, 1)

Likewise, triangular fuzzy numbers are used to express evaluation of each alternative. Table II illustrates each fuzzy linguistic term to its correspondent fuzzy numbers.

TABLE II. FUZZY LINGUISTIC TERMS AND FUZZY NUMBERS FOR EVALUATING ALTERNATIVES

Linguistic term	Fuzzy number
Not exist (NE)	(0, 0, 0)
Very poor (VP)	(0, 0, 0.1)
Poor (P)	(0.05, 0.2, 0.3)
Medium poor (MP)	(0.2, 0.3, 0.5)
Fair (F)	(0.3, 0.5, 0.6)
Medium good (MG)	(0.5, 0.6, 0.8)
Good (G)	(0.6, 0.8, 1)
Very good (VG)	(0.8, 1, 1)

#### B. Step 2

A list of SaaS e-commerce platforms along with designed linguistic terms for weighting criteria and evaluating alternatives are presented for an expert. The expert is asked to firstly weight criteria and secondly access the platforms for evaluation.

#### C. Step 3

The fuzzy TOPSIS presented in Section II.D is relied upon in this step to rank the alternatives.

#### D. Step 4

If the platforms show close scores, it is required to do a sensitivity analysis. Sensitivity analysis addresses this question that how sensitive is the overall decision of small changes in the individual weights? This question is answered by varying slightly the values obtained during expert elicitation and observing the effects of the decision. This is useful in situations where uncertainties exist in the definition of the importance of different factors [32]. Here, sensitivity analysis is conducted in order to see the importance of criteria weights in selecting the best alternative among the SaaS e-commerce platforms.



## IV. CASE STUDY

This study intends to evaluate SaaS e-commerce platform websites for web accessibility based on Bohn and Tobias [4] cloud accessibility taxonomy framework. An expert was invited to survey five alternatives including:

- P1: Shopify
- P2: BigCommerce
- P3: Volusion
- P4: 3dCart
- P5: WooCommerce

These providers are considered as the top SaaS e-commerce platforms. One website from each provider in the electronics category is selected to evaluate the cloud web accessibility. The decision-maker is an expert in web content accessibility guidelines (WCAG). The proposed cloud accessibility evaluation criteria were explained to the expert. The goal was to evaluate the web accessibility features from the cloud accessibility taxonomy framework for people with disabilities.

## A. Implementation

There are 33 criteria as summarized in Table III. The expert assigned a linguistic term to represent the importance of each criteria as shown in the last column of Table III.

TABLE III: CRITERIA AND CORRESPONDING WEIGHTS

Criteria	Symbol	Weight
Assistive learning system	C1	MH
Audio enhancement: Amplification	C2	L
Audio enhancement: Noise reduction	C3	L
Caption and Transcription: Real-time	C4	H
Caption and Transcription: Stored	C5	VH
Remote and Relay Services: Remote sign language interpreting	C6	MH
Remote and Relay Services: Sign language relay	C7	MH
Remote and Relay Services: Text relay	C8	ML
The alternative keyboard on the screen	C9	H
Alternative mouse or pointer on the screen	C10	H
Keyboard only control	C11	M
Morse code	C12	M
Scanning	C13	M
Coaching assistance: Help in context	C14	H
Coaching assistance: Notification of and communication with others	C15	H
Learning and understanding: Contextualization	C16	H
Learning and understanding: Dictionaries, glossary, translation	C17	MH
Learning and understanding: Simplified version	C18	MH
Learning and understanding: Summaries	C19	M
Reading: Highlighting	C20	H
Reading: Re-formatting for ease of reading	C21	M
Reading: Text-to speech	C22	MH
Scheduling and reminding: Calendars	C23	M
Scheduling and reminding: Notification	C24	M
Scheduling and reminding: Prompting	C25	L
Communication device/software: Image or icon based	C26	VH
Communication device/software: Text-based	C27	VH

Speech-to-speech relay	C28	MH
Visual & alternatives: Alternative text and video description	C29	VH
Visual & alternatives: Braille and tactile	C30	H
Visual & alternatives: High contrast and readability	C31	VH
Visual & alternatives: Magnification	C32	VH
Text-to speech screen reader	C33	VH

The expert then evaluated the alternatives against each criterion. The fuzzy decision matrix is shown in Table IV.

TABLE IV: FUZZY DECISION MATRIX

Criteria	P1	P2	P3	P4	P5
C1	G	VP	VP	F	P
C2	NE	NE	NE	NE	NE
C3	NE	NE	NE	NE	NE
C4	NE	NE	NE	NE	NE
C5	F	NE	NE	NE	MP
C6	NE	NE	NE	NE	NE
C7	NE	NE	NE	NE	NE
C8	NE	NE	NE	NE	NE
C9	NE	NE	NE	NE	NE
C10	NE	NE	NE	NE	NE
C11	G	MG	MG	G	MG
C12	NE	NE	NE	NE	NE
C13	NE	NE	NE	NE	NE
C14	MG	MG	F	F	MP
C15	F	MP	P	F	P
C16	F	MP	P	P	P
C17	F	MP	P	P	P
C18	G	MP	P	F	MP
C19	F	P	VP	P	P
C20	MP	MP	P	MP	P
C21	P	P	VP	F	P
C22	NE	NE	NE	NE	NE
C23	P	NE	NE	NE	NE
C24	MP	P	P	F	VP
C25	F	P	P	F	P
C26	VG	G	F	G	P
C27	VG	G	F	G	P
C28	NE	NE	NE	NE	NE
C29	VG	G	MG	VG	MP
C30	NE	NE	NE	NE	NE
C31	VG	G	MG	VG	MP
C32	VP	P	MG	F	VP
C33	NE	NE	NE	NE	NE

## B. Results

According to Step 3 of the research methodology, fuzzy TOPSIS is applied for ranking of the platforms. Considering that all criteria are benefited, the FPI ( $A^+$ ) and the FNI ( $A^-$ ) solutions are determined. Fuzzy TOPSIS results are summarized in Table V, and earlier matrices are omitted due to space consideration.

TABLE V: FUZZY TOPSIS RESULTS.

	P1	P2	P3	P4	P5
$D_j^+$	25.47	27.68	28.83	26.66	29.91
$D_j^-$	8.65	6.25	4.79	7.3	3.71
$C_j$	0.25	0.18	0.14	0.21	0.11
Rank	1	3	4	2	5

As can be seen, according to  $C_j$ , P1 which is Shopify, is considered as the best choice followed by P4, P2, P3, and P5.

### C. Sensitivity Analysis

In Step 4, the sensitivity analysis is performed to investigate the impact of criteria weights on the decision-making problem. The experiment details are provided in Table VI. In the first seven experiments, the criteria weights are set equal to each linguistic variable, i.e. VL, L, ..., VH. In Experiments 8 to 26, the weight of one criterion is set as VH one by one and the rest is set to VL. The aim is to see which criteria have the most important influence on the decision-making process. It is worth noting that those criteria that do not exist (i.e. have the linguistic term "NE" in Table IV), do not have any influence on the decision-making process. Hence, they are excluded from the sensitivity analysis.

TABLE VI: SENSITIVITY ANALYSIS EXPERIMENTS.

Exp.		P1	P2	P3	P4	P5
E1	$W_{C1-C33} = VL$	0.04	0.03	0.03	0.04	0.02
E2	$W_{C1-C33} = L$	0.09	0.06	0.05	0.07	0.04
E3	$W_{C1-C33} = ML$	0.13	0.09	0.07	0.11	0.06
E4	$W_{C1-C33} = M$	0.18	0.13	0.1	0.15	0.08
E5	$W_{C1-C33} = MH$	0.23	0.16	0.12	0.19	0.1
E6	$W_{C1-C33} = H$	0.27	0.19	0.15	0.23	0.12
E7	$W_{C1-C33} = VH$	0.31	0.21	0.16	0.26	0.14
E8	$W_{C1}=VH, W_{C_i, i \neq 1}=VL$	0.06	0.03	0.03	0.05	0.03
E9	$W_{C5}=VH, W_{C_i, i \neq 5}=VL$	0.06	0.03	0.03	0.04	0.03
E10	$W_{C11}=VH, W_{C_i, i \neq 11}=VL$	0.06	0.05	0.04	0.06	0.04
E11	$W_{C14}=VH, W_{C_i, i \neq 14}=VL$	0.06	0.05	0.04	0.05	0.03
E12	$W_{C15}=VH, W_{C_i, i \neq 15}=VL$	0.06	0.04	0.03	0.05	0.03
E13	$W_{C16}=VH, W_{C_i, i \neq 16}=VL$	0.06	0.04	0.03	0.04	0.03
E14	$W_{C17}=VH, W_{C_i, i \neq 17}=VL$	0.06	0.04	0.03	0.04	0.03
E15	$W_{C18}=VH, W_{C_i, i \neq 18}=VL$	0.06	0.04	0.03	0.05	0.03
E16	$W_{C19}=VH, W_{C_i, i \neq 19}=VL$	0.06	0.04	0.03	0.04	0.03
E17	$W_{C20}=VH, W_{C_i, i \neq 20}=VL$	0.05	0.04	0.03	0.05	0.03
E18	$W_{C21}=VH, W_{C_i, i \neq 21}=VL$	0.05	0.04	0.03	0.05	0.03
E19	$W_{C23}=VH, W_{C_i, i \neq 23}=VL$	0.05	0.03	0.03	0.04	0.02
E20	$W_{C24}=VH, W_{C_i, i \neq 24}=VL$	0.05	0.04	0.03	0.05	0.02
E21	$W_{C25}=VH, W_{C_i, i \neq 25}=VL$	0.06	0.04	0.03	0.05	0.03
E22	$W_{C26}=VH, W_{C_i, i \neq 26}=VL$	0.07	0.05	0.04	0.06	0.03
E23	$W_{C27}=VH, W_{C_i, i \neq 27}=VL$	0.07	0.05	0.04	0.06	0.03
E24	$W_{C29}=VH, W_{C_i, i \neq 29}=VL$	0.07	0.05	0.04	0.06	0.03
E25	$W_{C31}=VH, W_{C_i, i \neq 31}=VL$	0.07	0.05	0.04	0.06	0.03
E26	$W_{C32}=VH, W_{C_i, i \neq 32}=VL$	0.05	0.04	0.04	0.05	0.02

Table VI shows that out of 26 experiments, the alternative P1 (i.e. Shopify) has the highest score in 21 experiments. In other five experiments, P4 (i.e. 3dCart) has a similar score to P1. Therefore, Shopify is recommended as the most sustainable alternative.

### V. CONCLUSION AND FUTURE WORK

Web accessibility related to cloud computing is more concerned at the application level where a human interacts with an application via a user interface, such as websites as a software-as-a-service. We evaluated the web accessibility of SaaS e-commerce platform websites using the cloud accessibility taxonomy framework [4] for people with disabilities. We conducted an expert evaluation using Fuzzy TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution). Sensitivity analysis is also conducted to see the importance of criteria weights in selecting the best alternative among the SaaS e-commerce platforms. Finally, the results show Shopify is ranked high followed by 3dCart, BigCommerce, Volusion, and WooCommerce. This means Shopify meets a high number of web accessibility features from the proposed cloud accessibility framework.

The use of accessibility APIs and the Global Public Inclusive Infrastructure (GPII) is the cloud-based approaches to accessibility. However, the current web content accessibility guidelines (WCAG 2.0) is also applicable to cloud-based SaaS websites. Methods for evaluating web accessibility include online accessibility evaluation tools and expert evaluation. Thus, the SaaS platform selected in this study may report different web accessibility errors by applying WCAG 2.0.

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