USING A MULTI-CRITERIA DECISION-MAKING MODEL TO EVALUATE AND SELECT AN E-COMMERCE PLATFORM

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ABSTRACT

The COVID-19 pandemic has led to disruptions in consumers' lifestyles and purchases, as well as businesses' online business models. Online platforms are increasingly used for shopping purposes. To evaluate and choose an e-commerce platform requires using many criteria and decision makers. Therefore, the process of evaluating and selecting an e-commerce platform is viewed as a multi-criteria decision-making problem. The objective of this study is to develop a multi-criteria decision-making model to help consumers evaluating the e-commerce platforms. In the proposed model, the ratings of alternatives and the weights of the criteria are evaluated using the linguistic variable. Simulation examples are used to show the effectiveness of the model in practice.
Keywords: Fuzzy TOPSIS, E-Commerce Platform, Mcdm, Fuzzy Sets.

INTRODUCTION

According to Muhmin (2010), shopping intention on e-commerce sites is an important predictor of actual buying behavior, referring to a result of evaluating consumer criteria about website quality, information search and product reviews. Online shopping has changed a lot the way businesses operate and consumers' purchasing decisions. Therefore, customer participation in online purchases has become an important trend that contributes to the development of online commerce between businesses and consumers (Sharma, 2016). E-commerce platforms have an important role in facilitating virtual interactions and include insightful and information-rich product information (Chandna and Salimath, 2018; Li et al., 2020), especially is during the Covid 19 pandemic (Nielsen, 2020).

Kidane (2016) pointed out that at the present time, e-commerce is being challenged by the reality of complex consumer behavior. Therefore, it is important to identify the factors that influence consumer purchasing decisions through e-commerce in respective cultures and societies. Research has shown that the factors affecting consumers' purchasing decisions through e-commerce are trust, satisfaction, return policy, cash on delivery, after-sales service, insurance. refund practices, business reputation, social and personal attitudes. Lee et al (2011) pointed out a number of factors such as perceived value, ease of use, perceived usefulness, company reputation, privacy, trust, and reliability. Reliability and functionality have a significant linear relationship with online repurchase intention. Promoting purchase intention, consumer orientation towards quality, customer orientation towards brand, online trust and online purchase experience are positively related to customer prior purchase intention online shopping (Werk et al., 2010). Sanyal (2019) analyzed the important factors affecting customer satisfaction for e-commerce, websites and online purchases in Oman. Research indicated that price standards and ease of use standards and the availability of multiple payment options are important factors that positively influence customer satisfaction. Shergill and Chen (2005) suggested that website design, website reliability, customer service sites and website safety are the four dominant factors affecting consumer perception. about online shopping. Liang et al (2017) used 04 factors to evaluate e-commerce websites, including efficiency, completion, system usability, and privacy. Therefore, e-commerce website evaluation is considered a complex multi-criteria decision-making (MCDM) problem involving large amounts of inaccurate and inconsistent review data.

Wilson and Christella (2018) also suggested that delivery performance is an important aspect in an online store. Delivering the right products without defects, packing the product safely, the product must meet the promised delivery schedule or should be called on time, will make the customer satisfied with the service (Ziaullah, 2014). Anshu and Gaus (2019) used a combination of AHP and TOPSIS methods to rank 3 e-commerce sites Bigbasket, Amazon and Grofers through 10 delivery and after-sales service criteria, including: price attractiveness and results, customer service, website design, convenience of the process, attractiveness of the product, payment options, site information, login convenience , product information. Ishak et al. (2021) used fuzzy AHP method to evaluate e-commerce sites, including Elevenia, Shopee, Tokopedia, Bukalapak. The criteria for choosing quality e-commerce are reliability, responsiveness, assurance, empathy and tangibles.

LITERATURE REVIEW

The literature review shows that there are 06 commonly used criteria to choose e-commerce platforms by consumers, including: Price (C1), product quality (C2), support policy (C3), website design (C4), ease of use (C5), safety (C6).

a. Price

Engel et al. (1968) and Howard and Sheth (1969) mentioned that consumer purchases are mainly influenced by environmental factors such as quality, price, family and personal factors. such as motivation, finance, knowledge, attitude, personality, lifestyle. Price is the amount of money exchanged for a product or service (Kotler and Armstrong, 2006). Furthermore, price is the amount of value that consumers exchange for the quantity of benefit by owning or using a good or service. Price is something that is always in the attention of modern economic consumers today, cheap price does not guarantee the product will be sold but too expensive price will make consumers feel cheated if it is not suitable for the price. available cognitive value (Arif, 2010). Price perception goes a long way to assessing whether a product is reasonably priced, expensive or cheap (Scihiffman and Kanuk, 2005). Competitive price perception is understood as the buyer's perception of the price of a particular website compared to other websites (Sullivan et al., 2018). Online buyers may view price as an important cost component and compare prices with different alternatives (Chen and Dubinsky, 2003). Consumers can use various online information sources such as online sales websites, etc. to collect information and compare product prices (Choudhury and Karahanna, 2008). They will find it more attractive to a website that offers a product whose price is within an acceptable range, leading to a heightened perception of perceived value. As a result, consumers are likely to search for a website that offers the lowest possible price (Anderson and Srinivasan, 2003). In such a case, a high level of competitive pricing perception can have a positive effect on perceived value (Sharma, 2016).

b. Product Quality

Philip and Gary (2006) pointed out a number of product quality criteria such as: performance; feature or characteristic; reliability; conformity to serviceability specifications; Beauty; determine perceived quality. Product quality is the distinction of features or characteristics inherent in a product or service that are distinct from competitive product or service offerings (Cronin, 1996). Consumers estimate the value of the product of choice by taking into account all the benefits and sacrifices involved (Kim et al., 2007). Snoj et al. (2004) suggested that perceived benefit is a combination of different product attributes, available in relation to a particular transaction and use situation. When perceived value is seen as a trade-off between a giver component and a receiver component as described, it is reasonable to assume that higher quality perceptions will lead to higher perceived value levels. higher value. Several empirical studies have confirmed the close relationship between perceived quality and perceived value (Sullivan and Kim, 2018).

c. Support Policy

Supporting policies related to e-commerce platforms include mechanisms, policies, rules and regulations of the seller or e-commerce service provider in order to commit and assure consumers of the services and their responsibilities to consumers who have been using and purchasing goods through the websites. Policy includes: policy on customer support, policy of compensation, refund or exchange of goods, settlement of complaints. Antonija and Scherling

(2019) showed that policy support comes from both aspects of trust and confidentiality. This shows that customer service and support policies contribute positively to building experience or increasing the rate of good perception from consumers about the seller's services. In a study by Loureiro and Umberger (2007), up to 91% of consumers interviewed said that the return policy of an online shopping service was an important factor in their payment decision. Unlike brick-and-mortar stores, online consumers don't get to see and feel any physical products before they buy. Therefore, e-commerce sites must ensure that return policies are fair and attractive to customers, especially when payment has been made prior to receipt of goods. A clear and appropriate compensation or return policy gives consumers a sense of security that what they are buying is guaranteed to be in their right. If a retailer fails to provide this assurance, consumers are more likely to become suspicious and avoid purchasing the product at that retailer (Antonija and Scherling, 2019).

d. Website Design

In the context of online purchases, the quality of the web is said to be the customer's perception of the overall quality of a web (Poddar et al., 2009). Website quality including: attractive appearance, clear layout, efficient navigation, balanced information arrangement, will influence the customer's first impression of the online retailer (Wakefield, 2004). This is best demonstrated as an important element of customer intention (Poddar et al., 2009). Previous studies have also shown that web quality has a positive effect on customer relationship and entices customers' intention to return to purchase online (Lee et al., 2010). Chen et al (2010) studied the elements of the website that stimulate, attract customers and increase purchase intention. Research results show that the essential elements to create a user-friendly and professional web interface must demonstrate ease of use, security, convenience, and attractive images. Parboteeah (2009) mentioned that if a website can create visual appeal to consumers, such as displaying products visually, vividly, and attractively, such as creating attractive images, interactive videos, etc. … will make them feel more comfortable when using it. According to Liu (2013), when a consumer uses an e-commerce website and finds it attractive to their eyes, they will have a better assessment of their purchase decision. Al-Maghrabi et al. (2011) pointed out a number of factors that motivate customers to intend to continue shopping online or return to buy online in Saudi Arabia such as: enjoyment, receiving usefulness, and social pressure have an impact on customers' intention to return to purchase online. Research results showed that 03 factors, including: perceived usefulness, interest and social pressure have a positive impact on customers' intention to continue shopping or purchase online again. In addition, the two factors web quality and trust also have a positive impact on perceived usefulness and impact on customers' intention to continue buying through perceived usefulness. Web quality also has a positive effect on customer enjoyment and trust when shopping online, and social pressure factor also has a positive effect on customer enjoyment.

e. Ease of Use

Ease of use on an e-commerce platform is performing operations on a website or App in a simple, easy and convenient way. Perceived ease of use of technology model TAM by Davis and Arboer (1989) refers to users who believe that using information technology products and systems will not require much effort and they will feel comfortable using the product. They found that ease of use has a positive effect on trust because it helps customers in deciding which e-commerce platform to use and experience. As the online shopping market expands, the design

of the website becomes a decisive factor for success (Kim et al., 2003). Website is the main bridge between businesses and shoppers, so website design becomes essential (Kim et al., 2003). Factors to evaluate the design quality of a website such as attractiveness, useful content and ease of navigation (Qeisi et al., 2014). The decision to purchase on which e-commerce platform will be influenced by the buyer's perception of website quality, so businesses should create a website with attractive design and useful content to attract customers. attract more customers (Aladwani, 2006). Providing an online shopping application that promotes the ability of customers to shop is an important criterion to attract consumers (Ainscough and Luckett, 1996). Even a slow response to any interaction in an electronic payment result in a delay in service delivery and tends to leave consumers feeling uncertain about the completion of the transaction. become or not. Thus, Abramovich (2001) concluded that the successful design of an electronic payment system from the user's point of view plays an important role in attracting customers' acceptance of electronic payments. Ease of use refers to the ease of understanding of the electronic payment system, the simplicity of the electronic payment and the ease of manipulating the navigation system, the degree of controllability by the consumer. (Flavian et al., 2006). Duong Thi Hai Phuong (2012) also showed that ease of use not only has a direct and direct influence on online purchase intention, but also is the most important influencing factor on online purchase intention.

f. Safety

Fianyi and Zia (2019) showed that the security issue in participating in buying and selling on e-commerce platforms is quite complicated because the risks are divided among both sellers, buyers and real intermediaries. currently support the payment or shipping process, vv. The rise of cybercrime and the development of personal data penetration tools have affected e-commerce security and increasing user identity theft, privacy and financial intrusions (Fianyi and Zia, 2019). Fang et al. (2015) described that security is the degree to which users believe that using a particular application will not be risky. Ashra and Ng (2009) suggested that taking steps to authenticate the account holder identity in online transactions should take place through a non-reusable password system to ensure control. financial information of buyers as well as sharing information with sellers or electronic payment service providers (Quan et al., 2020). However, Hartono et al (2014) argued that aspects such as confidentiality, integrity, availability and non-repudiation play an important role in the concept of security. Research by Raja et al. (2008) suggested that in order to enhance safety and security, it is necessary to increase the participation rate of issuers or related payment service providers to reduce relationships. threaten.

Based on a literature review, to evaluate and select e-commerce platforms, there are 06 criteria presented in Table 1 as belows:

Table 1
Criteria for Evaluating and Selecting E-Commerce Platforms

Criteria	References
Price (C1)	Arif, (2010), Teoh et al. (2013), Fortes
Product quality (C2)	and Rita, (2016), Sullivan et al., (2018);
Support Policy (C3)	Bucko, (2018), Anshu and Gaus (2019),
Website Design (C4)	Fianyi and Zia (2019), Sanyal (2019),
Ease of use (C5)	Quan et al. (2020)
Safety (C6)	

Table 2

Triangular Fuzzy Numbers and Linguistic Variables for Ratings of Alternatives and Weights of Criteria

Ratings		Weights of criteria	
Linguistic variables	Triangular fuzzy numbers	Linguistic variables	Triangular fuzzy numbers
Very Low (VL)	(0.1, 0.2, 0.3)	Unimportant (UI)	(0.1, 0.2, 0.3)
Low (L)	(0.3, 0.4, 0.5)	Less Important (LI)	(0.2, 0.3, 0.4)
Medium (M)	(0.4, 0.5, 0.6)	Important (I)	(0.4, 0.5, 0.6)
Hight (H)	(0.6, 0.7, 0.8)	Very Important (VI)	(0.6, 0.7, 0.8)
Very Hight (VH)	(0.7, 0.8, 0.9)	Absolutely Important (AI)	(0.8, 0.9, 1.0)

Multi - criteria decision making model for evaluating and selecting e-commerce platforms

Assume that a committee of k decision makers ($D_t, t = 1, ..., h$) is responsible for evaluating k e-commerce platforms ($A_i, i = 1, ..., k$) based on h standard ($C_j, j = 1, ..., n$).

Determine the ratings of alternatives

Let $x_{ijt} = (e_{ijt}, f_{ijt}, g_{ijt})$,$i = 1, ..., k, j = 1, ..., n, t = 1, ..., h$, is the appropriate rate determined for e-commerce platform A_i by decision makers D_t for each criterion C_j. The average of the ratios, $x_{ij} = (e_{ij}, f_{ij}, g_{ij})$, can be calculated as follows:

$$x_{ij} = \frac{1}{h} \otimes (x_{ij1} \oplus x_{ij2} \oplus ... \oplus x_{ijt} \oplus ... \oplus x_{ijh}),$$

(1)

in which, $e_{ij} = \frac{1}{h}\sum_{t=1}^{k} e_{ijt}, f_{ij} = \frac{1}{h}\sum_{t=1}^{k} f_{ijt}$, và $g_{ij} = \frac{1}{h}\sum_{t=1}^{k} g_{ijt}$.

Determine the weights of the criteria

Let $w_{jt} = (o_{jt}, p_{jt}, q_{jt}), w_{jt} \in R^*, j = 1, ..., n, t = 1, ..., h$ is the weight determined by the decision maker D_t for each criterion C_j. The averaged weight, $w_j = (o_j, p_j, q_j)$, of each criterion C_j evaluated by h decision makers can be calculated as follows:

$$w_j = (1/h) \otimes (w_{j1} \oplus w_{j2} \oplus ... \oplus w_{jh})$$

(2)

in which, $o_j = (1/h)\sum_{t=1}^{h} o_{jt}, p_j = (1/h)\sum_{t=1}^{h} p_{jt}, q_j = (1/h)\sum_{t=1}^{h} q_{jt}$.

Normalization

The evaluation criteria for e-commerce platforms often have different characteristics, properties and units of measurement. To ensure the evaluation value of options for each criterion with the same scale, the study uses a normalized method. The normalized value r_{ij} can be calculated as follows:

$$r_{ij} = \left(\frac{a_{ij}}{c_j^*}, \frac{b_{ij}}{c_j^*}, \frac{c_{ij}}{c_j^*}\right), j \in B$$

(3)

$$r_{ij} = \left(\frac{a_j^-}{c_{ij}}, \frac{a_j^-}{b_{ij}}, \frac{a_j^-}{a_{ij}}\right), j \in C$$

(4)

where $a_j^- = min\, a_{ij}, c_j^* = max\, c_{ij}, i = 1, ..., m; j = 1, ..., n.$

Final values of e-commerce platforms

Final values of e-commerce platforms can be evaluated by $T_i = \left(\frac{1}{n}\right) \sum_{j=1}^{n} x_{ij} \otimes w_j$, $i = 1, \ldots, k; j = 1, \ldots, n$

Calculation of A^+, A^-, d_i^+ and d_i^-

The fuzzy positive-ideal solution (FPIS, A^+) and fuzzy negative ideal solution (FNIS, A^-) are obtained as:

$$A^+ = \max_i \{u_T^\alpha(i)\} \tag{5}$$

$$A^- = \min_i \{u_T^\alpha(i)\} \tag{6}$$

The distance of each e-commerce platform $A_i, i = 1, \ldots, m$ from A^+ and A^- is calculated as:

$$d_i^+ = \sqrt{\sum_{j=1}^{n} (u_T^\alpha(i) - A^+)^2} \tag{7}$$

$$d_i^- = \sqrt{\sum_{j=1}^{n} (u_T^\alpha(i) - A^-)^2} \tag{8}$$

where d_i^+ represents the shortest distance of e-commerce platform A_i, and d_i^- represents the farthest distance of e-commerce platform A_i.

Obtain the closeness coefficient

The closeness coefficient of each e-commerce platform, which is usually defined to determine the ranking order of all e-commerce platforms, is calculated as:

$$CC_i = \frac{d_i^-}{d_i^+ + d_i^-} \tag{9}$$

A higher value of the closeness coefficient indicates that an e-commerce platform is closer to positive ideal solution and farther from negative ideal solution simultaneously. The closeness coefficient of each alternative is used to determine the ranking order of all e-commerce platforms and identify the best one among a set of given feasible e-commerce platforms.

Application of decision-making model to evaluate and select e-commerce platforms

On the basis of helping consumers choose suitable e-commerce platforms, as well as checking the applicability and effectiveness of the proposed model, this study applies the proposed model to evaluate and select choose 3 e-commerce platforms in Vietnam. The steps of the e-commerce platforms evaluation and selection process are as follows:

Determine the set of evaluation criteria

Based on a review of previous studies and discussion, 03 reputable e-commerce platforms in Vietnam (A1, A2, A3) were selected to conduct the assessment. The criteria used include: price (C1), product quality (C2), support policy (C3), website design (C4), ease of use (C5), and safety (C6).

Determine the average weight of the criteria

After defining a set of e-commerce platforms evaluation criteria, each expert on the panel determines the importance of the selected criteria through the use of a language variable. Table 3 presents the weights of the criteria determined by the decision makers (D1, D2, D3). Using Table 2 and Equation (2), the aggregated weight of each criterion is determined.

Table 3
Average weight of the Criteria

Criteria	Decision makers			w_{ij}
	D_1	D_2	D_3	
C_1	VI	AI	VI	(0.667, 0.767, 0.867)
C_2	AI	AI	VI	(0.733, 0.833, 0.933)
C_3	I	VI	VI	(0.533, 0.633, 0.733)
C_4	I	I	I	(0.400, 0.500, 0.600)
C_5	VI	I	I	(0.467, 0.567, 0.667)
C_6	VI	VI	VI	(0.600, 0.700, 0.800)

Determine the aggregated ratings of e-commerce platforms based on each criterion

In this step, each decision maker evaluates each e-commerce platform against the selected set of criteria. The aggregated rating of each e-commerce platform based on each criterion were evaluated by decision makers using Table 1 and equation (1) as follows (see Table 4):

Table 4
Aggregated Ratings of E-Commerce Platforms based on Criteria

Criteria	E -commerce platforms	Decision makers			Aggregated ratings (r_{ij})
		D_1	D_2	D_3	
C_1	A_1	H	VH	M	(0.567, 0.667, 0.767)
	A_2	H	M	VH	(0.567, 0.667, 0.767)
	A_3	M	VH	VH	(0.600, 0.700, 0.800)
	A_4	VH	H	H	(0.633, 0.733, 0.833)
C_2	A_1	VH	H	M	(0.567, 0.667, 0.767)
	A_2	H	H	H	(0.600, 0.700, 0.800)
	A_3	H	VH	M	(0.567, 0.667, 0.767)
	A_4	L	H	H	(0.500, 0.600, 0.700)
C_3	A_1	H	VH	M	(0.567, 0.667, 0.767)
	A_2	H	VH	M	(0.567, 0.667, 0.767)
	A_3	H	H	H	(0.600, 0.700, 0.800)
	A_4	VH	VH	H	(0.667, 0.767, 0.867)
C_4	A_1	VH	H	H	(0.633, 0.733, 0.833)
	A_2	M	H	H	(0.533, 0.633, 0.733)
	A_3	H	M	H	(0.533, 0.633, 0.733)
	A_4	M	H	H	(0.533, 0.633, 0.733)
C_5	A_1	H	VH	H	(0.633, 0.733, 0.833)
	A_2	VH	H	H	(0.633, 0.733, 0.833)
	A_3	VH	M	VH	(0.600, 0.700, 0.800)
	A_4	H	VH	M	(0.567, 0.667, 0.767)
C_6	A_1	H	H	VH	(0.633, 0.733, 0.833)

A_2	M	H	VH	(0.567, 0.667, 0.767)
A_3	H	H	H	(0.600, 0.700, 0.800)
A_4	M	H	VH	(0.567, 0.667, 0.767)

Ranking the e-commerce platforms

Using the Equations (3)-(9), the aggregated weighted ratings, fuzzy positive-ideal solution, fuzzy negative ideal solution, the distance of each e-commerce platform and the closeness coefficient are defined in Table 5.

Table 5

Ranking the E-Commerce Platforms

E-commerce platforms	T_i	di+	di-	CCi	Ranking
A_1	(0.506, 0.696, 0.916)	0.586	1.257	0.682	1
A_2	(0.492, 0.679, 0.896)	0.610	1.227	0.668	3
A_3	(0.497, 0.685, 0.902)	0.601	1.237	0.673	2
A_4	(0.491, 0.677, 0.894)	0.612	1.224	0.667	4

The obtained results show that the e-commerce platform A1 is the best choice. So, the order of selection of e-commerce platforms is $A_1 > A_3 > A_2 > A_4$.

CONCLUSION

This study presented a multi-criteria decision-making model for the evaluation and selection of consumer e-commerce platforms, including the following steps: (i) defining a set of evaluation criteria; (ii) determine the weight of the criteria; (iii) determination of the rate value of e-commerce platforms by a panel of experts based on standards; (iv) determine the value of integration between the rates and weights of the providers; (v) evaluate and rate e-commerce platforms. The proposed model has been applied to help consumers choose the best e-commerce platform. The ranking results show that the A1 e-commerce platform is the best rated and rated choice by consumers.

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