# Using Fuzzy Delphi and Generalized Fuzzy TOPSIS to Evaluate Technological Service Flexibility Dimensions of Internet Malls


## Abstract

The expanding development of technology and availability of the internet is leading a consumer shift from offline to online activity. This shifting behavior shows positive signs for the growth of the e-commerce market but also increases the challenges for the online service provider to provide satisfaction and loyalty to consumers when there is no personal interaction between buyer and seller. In these circumstances, quality, in terms of technology services i.e. web/transaction, can play a significant role for the service provider, especially for internet shopping malls. But there is little material available in current literature to build a theoretical model for web/transaction flexibility dimensions and to rank internet shopping malls on their provision of services to customers. The vagueness of the available information can be tackled by fuzzy theory by employing a Fuzzy Delphi method to finalize technological service dimensions and lead to development of a research model. The final ranking of internet malls has been achieved by utilizing Generalized Fuzzy TOPSIS. The findings of this study can be useful for internet shopping malls in devising strategies to provide a better quality of web/transaction service to customers.



**Keywords:** Evaluation; Fuzzy TOPSIS; Internet Malls; Transaction Dimensions; Technological Services; Web Dimensions


## 1. Introduction

In 1989, Piore defined flexibility as the ability of the system to respond effectively to changing circumstances. In today era of digitalization all types of business are influenced by information technology. With the advent of the internet and its increasing availability, the e-commerce market in India is growing with burgeoning speed and every business wants to capture this market by focusing on more consumer choices and better strategies; it is no longer enough to provide only services. Therefore, every organization wants to shift their business from offline to online. The change is having an impact not only on the service provider but also on the customer; customers are also embracing these new opportunities. Now both options, i.e. offline and online, are available for customers, thus increasing the challenges for service providers to achieve customer satisfaction and customer retention.

With the rapid growth of the internet and switching behavior of the consumer from offline to online, online marketing is attracting the attention of both researchers and online service providers. Online business depends entirely on the types of flexibility being provided to the online customers so that they can stay and are comfortable in the online portal. Therefore, it is necessary for the online service providers to focus more on this concept, especially for online shopping where a number of internet shopping malls are available for the customer with a number of flexible options (Jain et al. 2013; Singh and Shalender, 2014). Customers want more flexibility and to survive, service providers must make sure that they satisfy their customers by providing this flexibility (Gunasekaran et al., 2016; Sushil, 2016a). Consequently, online flexibility in the context of price comparison, transaction, etc. is developing a new paradigm for internet shopping malls. Finding out what type of flexibility a customer wants is also becoming a challenge for service providers (Jain et al. 2013; Singh and Shalender, 2014; Shalender et al. 2017).

To cope with the changing business environment and to provide more flexible options to the customer, are challenges being faced by service providers. Due to increasing competition in every field and sector, flexibility is not only restricted to a particular domain; it is now an issue in almost all management disciplines (Wadhwa et al., 2008; Liao et al., 2010; Singh and Shalender, 2014; Haldar et al. 2016; Yadav and Barve, 2016; Bamel and Stokes, 2016). However, in the context of online marketing, very little material is available in current literature (Sharma and Gupta, 2004). Customers now demand more flexibility in terms of services, product, price, etc. In the last few years, the concept of flexibility in marketing has therefore become a critical area for research (Jain et al. 2013; Singh and Shalender, 2014; Shalender et al., 2017); this important concept cannot be ignored. In existing literature there is a discussion gap between the concepts of flexibility and online marketing; this study tries to fill this gap by exploring flexibility in the concept of online marketing and its application based on internet malls. At the same time, to cover all kinds of online marketing flexibilities for a study is difficult; therefore, this study only focuses on the web and transaction flexibilities of internet shopping malls. Nonetheless, web and transaction flexibilities play a vital role for the customer in accessing the services of online providers. There is no available research where a fuzzy Delphi method is used to capture information and to finalize the web and transaction flexibility dimensions where generalized Fuzzy TOPSIS has been used to rank internet malls. To fill this literature gap, this study has been conducted. The objective of this study is firstly to find out web and transaction flexibility dimensions in the context of internet shopping malls then, to develop a model for the evaluation of five giant internet shopping malls.

The study is divided into six parts. The introduction forms the first part of the paper with a literature review in the second section. Basic required preliminaries are explained in part three. In part four, a research model is proposed for evaluation and in the fifth part, a research evaluation has been carried out by generalized Fuzzy TOPSIS. Managerial implications and conclusions form the last part of the study.

## 2. Literature Review

Tremendous challenges for markets have arisen due to the uncertainties that are present in today's world. The business scenario is changing in this era and developing rapidly; given the pace of change, traditional business approaches with their basic underpinnings is not a valid procedure. In this scenario, flexibility is something everyone is looking for to provide a competitive edge for an organization. In a chaotic business environment, flexible systems are a paradigm that helps to manage successfully (Jain et al., 2015). The concept of flexibility is a muti-dimensional aspect of looking at things.

There has been a major transition of the Indian retail market from the 1990s to the twenty first century. In earlier times, the market was very monopolistic in nature but these days the competition is increasing as companies are focusing on customer preferences and flexible strategies. Providing services has resulted in systems taking in a wider aspect. In the last two decades, business has evolved with a more flexible approach by embracing the management of change and transformations. Flexibility is a very strategic tool and is recognized in both the academic and industrial sectors. In marketing literature, flexibility has not been examined in depth although in other disciplines it has been discussed more fully leading to greater understanding and the evolution of more flexible business processes.

In today's competitive and changing business environment, there is a critical role played by flexibility to ensure the survival of businesses (Shalender and Singh, 2015; Haldar et al., 2016). Exploration of flexibility has been undertaken by Sharma et al. (2010) who emphasized that flexibility can play a role as the strategic driver to enhance performance of a company. In this digital environment we cannot ignore the increasing influence of information technology and internet penetration on the Indian retail market; this has changed the industry by becoming more competitive and dynamic in nature (Sushil, 2016b). As a gradual increase in competitive levels is transforming the e-commerce platform, the industry is crying out for more customer centric operations and flexible processes (Sharma et al., 2015). In spite of the fact that flexibility is an implicit application of the marketing concept (Sharma et al., 2015), no study has directly addressed online marketing flexibility. The key constructs adopted in this study related to online marketing flexibilities are as follow.

## 2.1 Web flexibilities

The benefit of evaluating e-service success has been recognized and embraced by customers. Evaluation is a challenging task for service providers given the difficulty of understanding customers' needs and their demanding flexibilities on time. If a service provider understands these web base flexibilities then they can implement appropriate services which directly impact on customer satisfaction and their re-purchase intention. Therefore, the success of e-business is achievable although it requires careful as well as timely evaluation of the flexibilities (Sushil, 2016b).Vast investments are continually being made by the managers of e-businesses to develop attractive websites. However they do not seem to have a clear picture of what are the key factors that contribute to making a high-quality website and how these factors can help in measuring the effects on the success of e-business. This has been a matter of concern for many researchers (Barnes and Vidgen, 2001; Agarwal and Venkatesh, 2002; Webb and Webb, 2004; Wells et al., 2011; Chou and Cheng, 2012; Shahin et al., 2014; Ziemba et al., 2015; Kumar and Dash, 2016; Orehovački et al., 2016; Sá et al., 2016). They have pointed out that although the companies are making huge investments in developing an application for an e-business, they still are not able to thoroughly evaluate the success of their e-business systems through web flexibilities. Managers have not identified which type of flexibilities customers want according to their differing needs and are therefore unable to provide the necessary services on their web portals. Work is needed on measuring the flexibilities to develop, test and apply successful e-business measures.

## 2.2 Transaction flexibilities

Transaction flexibilities refer to the overall support delivered by the online portals so that the trust of customers in a service provider will increase. Transaction flexibilities become very critical in e-business as online customers deliberate their transactions without seeing their retailers. In order to provide best services in the context of transaction flexibilities, the online retailers implement various service functions into the website such as online delivery tracking systems, 24*7 services and issue management systems which record all the complaints of customers. To increase customers' perception and expectations of the quality of service provided, transaction flexibilities have become a valuable instrument for service providers. This issue has been discussed by many authors (Lee et al., 2011; Wells et al., 2011; Ding et al., 2011; Chou and Cheng, 2012; Wu et al., 2014; Shahin et al., 2014; Ziemba et al., 2015; Orehovački et al., 2016; Sá et al., 2016; San Lim et al., 2016). They have noted how companies are making huge amounts of investments in developing online applications but are hard-pressed to evaluate the success of their online systems through transaction flexibilities; this means that the type of

transaction flexibilities that customers want are not being provided. Based on the reviews, Table 1 shows the dimensions and criteria of the study as the foundation for fuzzy Delphi and generalized Fuzzy TOPSIS.

**Table 1**: Dimension and criteria

| **Dimensions** | **Criteria** |
|---|---|
| Web Flexibility Dimensions | User Interface Design (UID) ($C_1$) |
| | Web Localization ($C_2$) |
| | Web Quality ($C_3$) |
| | Visual Appearance ($C_4$) |
| | Online Reputation Management ($C_5$) |
| | Navigation/Organization ($C_6$) |
| Transaction Flexibility Dimensions | Payment Options ($C_7$) |
| | Ease of Payment Procedure ($C_8$) |
| | Delivery Options ($C_9$) |
| | Reducing Delivery Time ($C_{10}$) |
| | Point of Sale Options ($C_{11}$) |
| | After-Sales ($C_{12}$) |

## 3. Preliminaries

The study proposes a concrete process integrating the Fuzzy Delphi method and generalized Fuzzy TOPSIS to rank internet shopping malls on transaction flexibility. To account for the vagueness of human thought and to handle ambiguities involved in the process of decision making, fuzzy set theory has been used (Zadeh, 1975). Some important definitions, notions about fuzzy sets and a brief introduction of Fuzzy Delphi method and generalized Fuzzy TOPSIS are set out as follow.

### 3.1 Fuzzy Sets

**Def. 1.** A fuzzy set $\widetilde{A}$ is a subset of the universal set X, with mapping $\mu_{\widetilde{A}}(x): X \to [0,1]$. For the fuzzy set $\widetilde{A}$ the function value of $\mu_{\widetilde{A}}(x)$ is called the 'membership value' of x in $\widetilde{A}$ representing the degree of truth that x is an element of the fuzzy set $\widetilde{A}$.

**Def. 2.** A triangular fuzzy numbers (TFN) $\widetilde{N}$ can be defined as a triplet (a, b, c) and its membership is defined as

$$\mu_{\widetilde{N}}(x) = \begin{cases} \dfrac{x-a}{b-a}, & a \le x \le b \\ \dfrac{c-x}{c-b}, & b \le x \le c \\ 0, & \text{otherwise} \end{cases}$$

, where a, b, and c are real numbers and a < b < c.

The graphical representation of TFNs

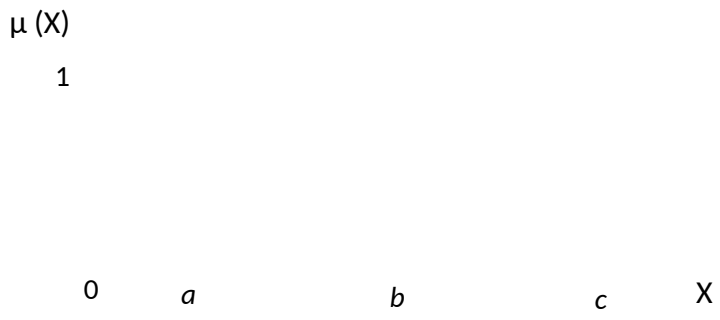


**Figure 1:** Graphical Representation of TFNs

It is a rigorous process to select any particular criteria when many options are available. A Delphi technique is an appropriate method to choose the best from given alternatives. By using personal interaction in this method, group decisions are recorded and relevant feedback about chosen criteria has been collected. Capturing the vagueness of data can be handled with this method. To address this problem, in 1993, Ishikawa et al. extended the method in a fuzzy environment. After introducing the new version of this method to handle vagueness of data, different studies have been conducted in different domains such as project selection (Büyüközkan, 2004), talent assessment (Huang and Wu, 2005) and the e-commerce marketplace (Chen et al., 2008). In this study the same method is used to determine web and transaction flexibility (Chang et al., 2000). The brief on this process is explained below:

### 2.2 Fuzzy Delphi Method

P, Q and R are the minimum, average and maximum ways of representing opinions; they are considered as a triangular fuzzy number and can be written as:

$$\widetilde{Y}_k = (P_k, Q_k, R_k), \quad (1)$$

Where $\widetilde{Y}_k$ represents the fuzzy number for the criteria k, for finalizing the criteria, the first centre-of-gravity method given by Klir and Folger (1988) is used with

$$L_k = (P_k + Q_k + R_k)/3 \quad (2)$$

If $L_k \geq \lambda$, accept the criteria, otherwise reject it. Once this part of using fuzzy technique is finished, the selected alternatives are to be measured against the set of defined criteria and five internet shopping malls. For this, generalized Fuzzy TOPSIS is utilized (Wang and Lee, 2007).

### 2.3 Generalized Fuzzy TOPSIS

The process to find a better alternative from all the available alternatives is defined as decision making. There is a problem associated with this technique known as MCDM (Hwang and Yoon, 1981). This occurs when various criteria are to be considered while decision making where there are many alternatives available; this is explained as follows:

$$G = \begin{array}{c} \\ A_1 \\ \vdots \\ A_m \end{array} \begin{array}{c} \begin{array}{cccc} C_1 & C_2 & \dots & C_n \end{array} \\ \begin{pmatrix} G_{11} & C_{12} & \dots & C_{1n} \\ \vdots & \vdots & \dots & \vdots \\ G_{m1} & G_{m2} & \dots & G_{mn} \end{pmatrix} \end{array} \quad (3)$$

$$W = \left[ W_1, W_2 \dots\dots W_n \right] \quad (4)$$

Here $A_1$, $A_2$, $A_3$,……, $A_m$ and $C_1$, $C_2$, $C_3$,……, $C_m$ are alterative and valuation criteria, and $G_{ij}$ for (i, j) is defined as the parameter of performance and $W_j$ represents weight. In the literature of MCDM, most of the traditional MCDM methods defuzzify fuzzy rating and increase the weight into crisp values while the defuzzification leads to the loss of information. Using these methods the risk of losing fuzzy information is reduced but there are obviously some problems associated with this as well (Chen, 1985). This generalization can be tackled with fuzzy mathematics (Chen, 1985; Raj and Kumar, 1999). In 2003, Wang et al. suggested a fuzzy multiple criteria group decision making (FMCCDM) method with two operators, MAX and MIN.

**FMCGDM Method**

Suggesting two operators Up and Lo, Wang and Lee (2007) established and normalized the TOPSIS method to FMCGDM and have helped to manage the positive and the negative ideal solution where the information is vague; this is normalized through TOPSIS in the fuzzy medium on the basis 2 operations Up and Lo and is explained as follows.

In the initial phase the weights and the ratings are assessed with the lingual/qualitative terms (Herrera and Herrera-Viedma, 1996). The various lingual ratings used can be categorized from Very Good (VG) to Very Poor (VP). These ratings are based on expert opinion. Let us presume that the lingual/qualitative terms defined above represent the range [0, 1].

Let $G_{ijk}$ be the experts' opinion with $E_k$ experts and $A_i$ alternative against criterion $C_j$, where $G_{ijk} = (g_{1ijk}, g_{2ijk}, g_{3ijk})$, $i = 1, 2, ....., m;\ j = 1, 2, ...., n;\ k = 1, 2, ....., p$. Then

$G_{ij} = (g_{1ij}, g_{2ij}, g_{3ij}) = (1/p) \otimes (G_{ij1} \oplus G_{ij2} \oplus G_{ij3} \oplus .... \oplus G_{ijp})$, $i = 1, 2, ....., m;\ j = 1, 2, ....., n.$ and can be extended by,

$$g_{1ij} = \sum_{k=1}^{p} g_{1ijk} / p \quad , \quad g_{2ij} = \sum_{k=1}^{p} g_{2ijk} / p \quad , \text{ and } \quad g_{3ij} = \sum_{k=1}^{p} g_{3ijk} / p \quad . \tag{5}$$

$G = [G_{ij}]_{m \times n}$, is a composite score for alternative $A_1, A_2, ..., A_m$. $A^-$ and $A^+$ are solutions; thus $A^- = [G_1^-, G_2^-, ...G_n^-]$, and $A^+ = [G_1^+, G_2^+, ...G_n^+]$, where,

$G_j^- = Lo(\{G_{1j}, G_{2j}, ...G_{mj}\})$, and

$G_j^+ = Up(\{G_{1j}, G_{2j}, ...G_{mj}\})$, for $j = 1, 2, ....., n$ and $G_j^+ \succ G_{ij} \succ G_j^-$,

where $i = 1, 2, ....., m;\ j = 1, 2, ...., n.$

Let $W_{jk} = (w_{1jk}, w_{2jk}, w_{3jk})$ be expert weights, $E_k$ under criteria $C_j$, where $j = 1, 2, ....., n.$; $k = 1, 2, ...., p.$ Assume $W_j$ to be the average weight on criterion $C_j$; thus $W_j = (w_{1j}, w_{2j}, w_{3j}) = (1/p) \otimes (W_{j1} \oplus W_{j2} \oplus W_{j3} \oplus .... \oplus W_{jp})$, where $j = 1, 2, ....., n$, giving

$$w_{1j} = \sum_{k=1}^{p} w_{1jk} / p \quad ,$$

$$w_{2j} = \sum_{k=1}^{p} w_{2jk} / p \quad , \text{ and}$$

$$w_{3j} = \sum_{k=1}^{p} w_{3jk} / p \tag{6}$$

**Table 2:** Negative and Positive weight for alternatives

| Alternative | Negative | Positive |
|---|---|---|
| $A_1$ | $D_1^-$ | $D_1^+$ |
| $A_2$ | $D_2^-$ | $D_2^+$ |
| $\vdots$ | $\vdots$ | $\vdots$ |
| $A_m$ | $D_m^-$ | $D_m^+$ |

Let $D_i^- = \sum_{j=1}^{n} W_j \otimes d_{ij}^-$, and $D_i^+ = \sum_{j=1}^{n} W_j \otimes d_{ij}^+$, where $i = 1, 2, ...., m$, the weighted distance of $A_i$ is $\left[D_i^-, D_i^+\right]$, and Let

$LD^- = Lo\left(\left\{D_1^-, D_2^-, ..., D_m^-\right\}\right)$, $UD^- = Up\left(\left\{D_1^-, D_2^-, ..., D_m^-\right\}\right)$,

$LD^+ = Lo\left(\left\{D_1^+, D_2^+, ..., D_m^+\right\}\right)$, and $UD^+ = Up\left(\left\{D_1^+, D_2^+, ..., D_m^+\right\}\right)$.

Using Lo & Up, $\left[LD^-, UD^+\right]$ and $\left[UD^-, LD^+\right]$ denote weighted distance values. Let $A_i^-$ and $A_i^+$ denote the distance from $\left[D_i^-, D_i^+\right]$ to $\left[LD^-, UD^+\right]$, and $\left[D_i^-, D_i^+\right]$ to $\left[UD^-, LD^+\right]$. Define

$A_i^- = d\left(D_i^-, LD^-\right) + d\left(D_i^+, UD^+\right)$, and $A_i^+ = d\left(D_i^-, UD^-\right) + d\left(D_i^+, LD^+\right)$ where $i = 1, 2, ...., m$ and the final equation by:

$$A_i^* = \frac{A_i^-}{A_i^- + A_i^+}, \text{ where } i = 1, 2, ...., m. \tag{7}$$

## 3. Development of Research Model

We employed the fuzzy Delphi method to finalize the web/transaction flexibility dimensions of five big shopping portals in India *i.e.* Flipkart, Snapdeal, Myntra, Amazon and Shopclues. The study conducted a paper-based survey by convenience sampling and followed a rigorous process. Interviews were conducted with industry experts working in customer interface at selected internet malls *i.e.* Flipkart, Snapdeal, Myntra, Amazon and Shopclues; with academic experts, teaching online marketing and online consumer behaviour and with customers who have been purchasing online for the last five to six years. Allied to a review of studies of web and transaction flexibilities, the primary criteria have been screened. Depending on higher or lower values of the threshold, there will be less or more of the filtering criteria, and hence, the result will be determined. In this study, the threshold least value used is 0.6 and highest is 0.7. The output from this screening method is shown in Table 3. As per the results of the criteria screening, the four criteria-navigation/organization, visual appearance, reducing delivery time, and after-sales-are cancelled not mentioned in Table 3. During detailed interviews with experts,

it was suggested that these dimensions should consider another construct, not these two. The final evaluation model has been developed as showed in Figure 2.

**Table 3:** The sifting result of important web and transaction flexibility selection criteria

| Scale | Criteria | S |
|---|---|---|
| Web Flexibility Dimensions | User Interface Design (UID) ($C_1$) | 0.67201 |
| | Web Localization ($C_2$) | 0.66320 |
| | Web Quality ($C_3$) | 0.71432 |
| | Online Reputation Management ($C_4$) | 0.73041 |
| Transaction Flexibility Dimensions | Payment Options ($C_5$) | 0.66430 |
| | Ease of Payment Procedure ($C_6$) | 0.69831 |
| | Delivery Options ($C_7$) | 0.74543 |
| | Point of Sale Options ($C_8$) | 0.75340 |

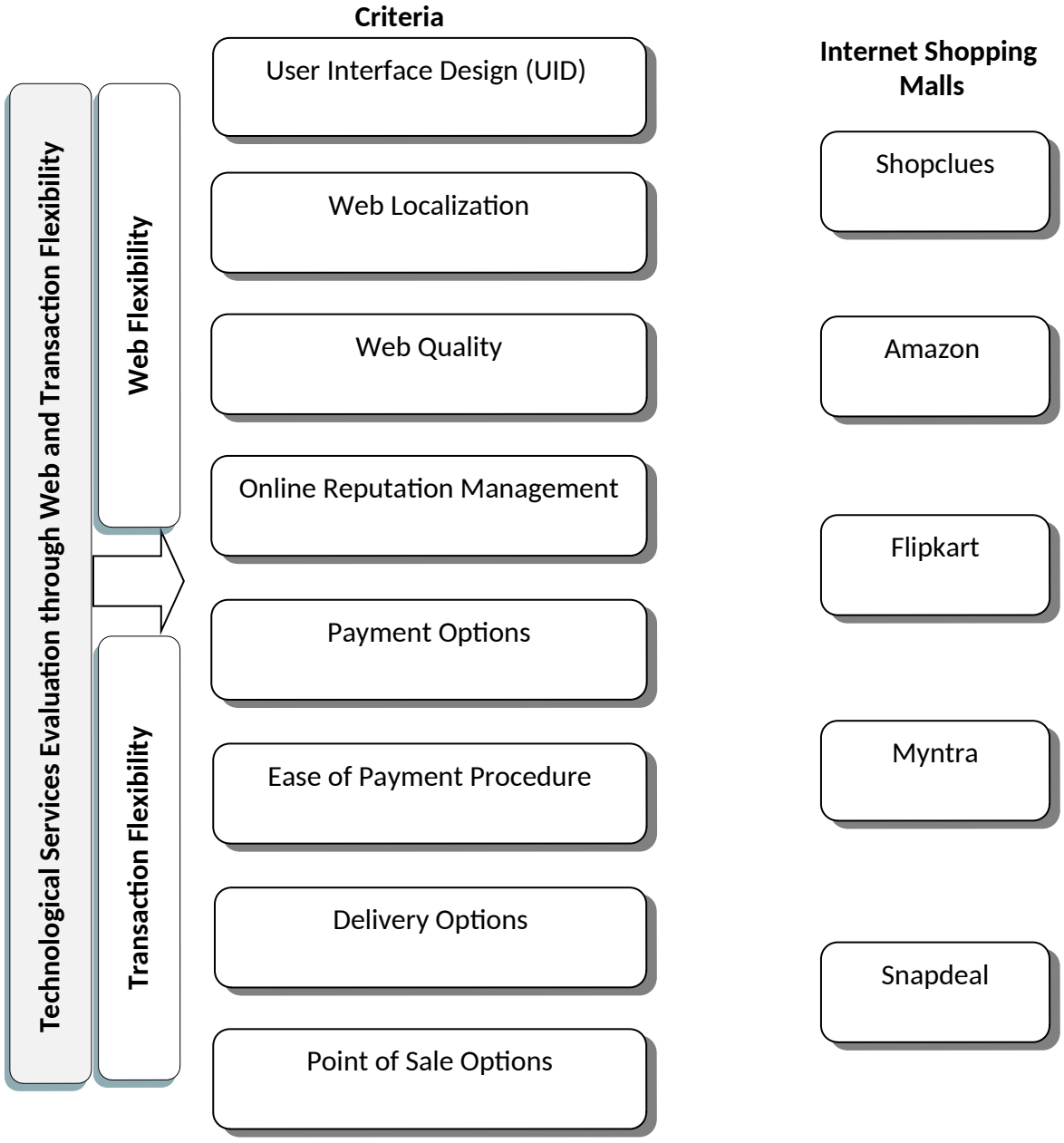

**Figure 2**: Proposed Evaluation Model

## 4. Evaluation of the Proposed Model

To evaluate identified web and transaction flexibility dimensions of five internet shopping malls, data has been collected through structured questionnaires from both experts working in the customer interfaces in these shopping malls and from their customers. The elements of the questionnaire are linguistics as shown in Table 4.

**Table 4:** Measurement scale

| **Measurement for criteria** | **Triangular Fuzzy Number (TFN)** |
|---|---|
| Extremely Important | (0.8, 1.0, 1.0) |
| Important | (0.6, 0.8, 1.0) |
| Medium Important | (0.5, 0.6, 0.8) |
| Fair | (0.4, 0.5, 0.6) |
| Medium Poor | (0.2, 0.4, 0.4) |
| Unimportant | (0.0, 0.2, 0.4) |
| Extremely Unimportant | (0.0, 0.0, 0.2) |
| **The elements of the linguistic weight** | **Triangular Fuzzy Number (TFN)** |
| Very High | (0.7, 1.0, 1.0) |
| High | (0.5, 0.7, 1.0) |
| Medium | (0.3, 0.5, 0.7) |
| Low | (0.0, 0.3, 0.5) |
| Very Low | (0.0, 0.0, 0.3) |

The experts' lingual ratings and the weights of operation performance under 8 criteria for the five internet shopping malls, the fuzzy average ratings of the five internet shopping malls computed are shown in Table 5.

**Table 5**: The average rating of internet malls on eight flexibilities ($C_1$ to $C_8$)

| $A_1$ | $A_2$ | $A_3$ | $A_4$ | $A_5$ |
|---|---|---|---|---|
| (.23, .43, .61) | (.50, .70, .90) | (.60, .80, 1.00) | (0.29, 0.47, 0.66) | (0.54, 0.74, 0.94) |
| (.19, .37, .57) | (.54, .73, .86) | (.33, .53, 0.69) | (0.37, 0.57, 0.77) | (0.35, 0.53, 0.69) |
| (.30, .50, .69) | (.37, .57, .73) | (.20, .40, 0.50) | (0.69, 0.89, 1.00) | (0.29, 0.49, 0.67) |
| (.57, .77, .89) | (.27, .47, .61) | (.37, .57, 0.74) | (0.34, 0.54, 0.67) | (0.44, 0.64, 0.77) |
| (.44, .63, .81) | (.21, .40, .60) | (.63, .83, 0.93) | (0.17, 0.37, 0.57) | (0.34, 0.54, 0.74) |
| (.60, .80, .90) | (.40, .60, .80) | (.57, .77, 0.93) | (0.40, 0.60, 0.80) | (0.57, 0.76, 0.90) |
| (.71, .91, .96) | (.60, .80, .96) | (.76, .96, 1.00) | (0.60, 0.80, 1.00) | (0.70, 0.90, 1.00) |
| (.29, .49, .66) | (.71, .91, .96) | (.67, .87, 0.93) | (0.69, 0.89, 0.91) | (0.71, 0.91, 0.97) |
| $A_1$-Shopclues, $A_2$-Amazon, $A_3$-Flipkart, $A_4$-Myntra, and $A_5$-Snapdeal | | | | |

Then

$A^+ = \left[ G_1^+, G_2^+, ..., G_8^+ \right]$, and $A^- = \left[ G_1^-, G_2^-, ..., G_8^- \right]$, where

$G_1^+ =_{(0.60, 0.80, 1.00)}$, $G_1^- =_{(0.23, 0.43, 0.61)}$, $G_2^+ =_{(0.54, 0.73, 0.86)}$, $G_2^- =_{(0.19, 0.37, 0.57)}$,
$G_3^+ =_{(0.69, 0.89, 1.00)}$, $G_3^- =_{(0.20, 0.40, 0.60)}$, $G_4^+ =_{(0.57, 0.77, 0.89)}$, $G_4^- =_{(0.27, 0.47, 0.61)}$,
$G_5^+ =_{(0.63, 0.83, 0.94)}$, $G_5^- =_{(0.17, 0.37, 0.57)}$, $G_6^+ =_{(0.60, 0.80, 0.90)}$, $G_6^- =_{(0.40, 0.60, 0.80)}$,
$G_7^+ =_{(0.76, 0.96, 1.00)}$, $G_7^- =_{(0.60, 0.80, 0.96)}$, $G_8^+ =_{(0.71, 0.91, 0.97)}$, $G_8^- =_{(0.29, 0.49, 0.66)}$

And below are the various distance values.

| $A_1$ | | $A_2$ | | $A_3$ | |
|---|---|---|---|---|---|
| $d\left(G_{1j}, G_j^+\right)$ | $d\left(G_{1j}, G_j^-\right)$ | $d\left(G_{2j}, G_j^+\right)$ | $d\left(G_{2j}, G_j^-\right)$ | $d\left(G_{3j}, G_j^+\right)$ | $d\left(G_{3j}, G_j^-\right)$ |
| .3763 | .0027 | .1000 | .2768 | .0000 | .3768 |
| .3353 | .0027 | .0025 | .3344 | .1963 | .1387 |
| .3665 | .0955 | .3037 | .1584 | .4620 | .0000 |
| .0027 | .2931 | .2912 | .0027 | .1830 | .1129 |
| .1745 | .2588 | .3972 | .0354 | .0020 | .4319 |
| .0000 | .1732 | .1732 | .0000 | .0286 | .1584 |
| .0448 | .0933 | .1330 | .0016 | .0023 | .1304 |
| .3907 | .0039 | .0082 | .3866 | .0395 | .3479 |

| $A_4$ | | $A_5$ | |
|---|---|---|---|
| $d\left(G_{4j}, G_j^+\right)$ | $d\left(G_{4j}, G_j^-\right)$ | $d\left(G_{5j}, G_j^+\right)$ | $d\left(G_{5j}, G_j^-\right)$ |
| .3288 | .0485 | .0571 | .3197 |
| .1431 | .1950 | .1913 | .1436 |
| .0035 | .4589 | .3807 | .0812 |
| .2243 | .0693 | .1244 | .1691 |
| .4307 | .0014 | .2606 | .1729 |
| .1732 | .0000 | .0297 | .1462 |
| .1306 | .0231 | .0490 | .0849 |
| .0378 | .3549 | .0036 | .3903 |

Average weights are calculated by using linguistic weight scales as mentioned in Table 3:

$W_1$ (0.45, 0.68, 0.85); $W_2$ (0.50, 0.73, 0.93); $W_3$ (0.35, 0.55, 0.78); $W_4$ (0.33, 0.58, 0.73); $W_5$ (0.70, 1.00, 1.00); $W_6$ (0.65, 0.93, 1.00); $W_7$ (0.50, 0.73, 0.85); $W_8$ (0.45, 0.68, 0.93).

$D_1^+ =_{(0.473, 1.512, 1.492)}$, $D_1^- =_{(0.473, 0.714, 0.806)}$,
$D_2^+ =_{(0.708, 1.063, 1.225)}$, $D_2^- =_{(0.548, 0.816, 1.064)}$,
$D_3^+ =_{(0.358, 0.559, 0.741)}$, $D_3^- =_{(0.903, 1.553, 1.553)}$,
$D_4^+ =_{(0.790, 1.168, 1.309)}$, $D_2^- =_{(0.475, 0.724, 0.977)}$,
$D_5^+ =_{(0.523, 0.784, 0.946)}$, $D_3^- =_{(0.733, 1.095, 1.342)}$,

Thus

$UD^+ = (0.790, 1.168, 1.309)$, $UD^- = (0.903, 1.553, 1.553)$,

$LD^+ = (0.358, 0.559, 0.741)$, $LD^- = (0.473, 0.714, 0.806)$,

and

$d(D_1^+, UD^+) = 0.29$, $d(D_1^+, LD^+) = 0.69$, $d(D_1^-, UD^-) = 0.12$, $d(D_1^-, LD^-) = 0.32$,

$d(D_2^+, UD^+) = 0.09$, $d(D_2^+, LD^+) = 0.55$, $d(D_2^-, UD^-) = 0.17$, $d(D_2^-, LD^-) = 0.54$,

$d(D_3^+, UD^+) = 0.54$, $d(D_3^+, LD^+) = 0.00$, $d(D_3^-, UD^-) = 0.83$, $d(D_3^-, LD^-) = 0.51$,

$d(D_4^+, UD^+) = 0.00$, $d(D_4^+, LD^+) = 0.63$, $d(D_4^-, UD^-) = 0.10$, $d(D_3^-, LD^-) = 0.43$,

$d(D_5^+, UD^+) = 0.34$, $d(D_5^+, LD^+) = 0.31$, $d(D_5^-, UD^-) = 0.51$, $d(D_3^-, LD^-) = 0.31$,

$A_i^+$ and $A_i^-$ $(i = 1, 2, 3, 4, 5)$:

$A_1^- = d(D_1^+, LD^+) + d(D_1^-, UD^-) = 0.12 + 0.69 = 0.81$ $A_1^- = d(D_1^+, UD^+) + d(D_1^-, LD^-) = 0.29 + 0.32 = 0.61$

$A_2^- = d(D_2^+, LD^+) + d(D_2^-, UD^-) = 0.17 + 0.55 = 0.72$ $A_2^- = d(D_2^+, UD^+) + d(D_2^-, LD^-) = 0.09 + 0.54 = 0.63$

$A_3^- = d(D_3^+, LD^+) + d(D_3^-, UD^-) = 0.83 + 0.00 = 0.83$ $A_3^- = d(D_3^+, UD^+) + d(D_3^-, LD^-) = 0.54 + 0.51 = 1.05$

$A_4^- = d(D_4^+, LD^+) + d(D_4^-, UD^-) = 0.10 + 0.63 = 0.73$ $A_4^- = d(D_3^+, UD^+) + d(D_4^-, LD^-) = 0.00 + 0.43 = 0.43$

$A_3^- = d(D_5^+, LD^+) + d(D_5^-, UD^-) = 0.51 + 0.31 = 0.82$ $A_5^- = d(D_3^+, UD^+) + d(D_5^-, LD^-) = 0.34 + 0.31 = 0.65$

The final ranking of five internet shopping malls has been calculated as follows:

$$A_1^* = \frac{0.60}{0.60 + 0.81} = 0.423,\ A_2^* = \frac{0.63}{0.63 + 0.72} = 0.469,\ A_3^* = \frac{1.05}{1.05 + 0.83} = 0.559,\ A_4^* = \frac{0.43}{0.43 + 0.73} = 0.372,$$

and

$$A_5^* = \frac{0.65}{0.65 + 0.85} = 0.443$$

The grading of the coefficients is in the following order- $A_3$, $A_2$, $A_5$, $A_1$ and $A_4$. The ranking is on the basis of the comparison between the closeness coefficients. Hence, from the ranking of the coefficients, it can be seen that $A_3$ is the best performer, meaning that according to the proposed research model for web and transaction flexibility dimensions, internet shopping malls Flipkart ($A_3$) with weight 0.559 is ranked first followed by Amazon ($A_2$) with 0.469, Snapdeal ($A_5$) with 0.443, Shopclues ($A_1$) with 0.423 and Myntra ($A_4$) with 0.372 respectively.

## 5. Managerial Implications and Conclusion

In today's competitive environment, providing excellent service to the customer is the top priority for the online service provider; this ensures customer loyalty, satisfaction and retention but as noted in the literature review, although the marketing flexibility concept has received considerable attention in the traditional marketing context, it has seldom been examined in the online marketing context, especially with internet malls. Thus we need to extend extant findings to the online marketing context. From a theoretical perspective, the study has developed a research model based on two essential constructs of online marketing flexibility i.e. web flexibility and transaction flexibility.

From a managerial perspective, the output of this study can help them to devise a marketing strategy for the type of flexibilities their customers want in terms of web flexibility and transaction flexibility. Most importantly, the findings of this study are based not only on expert

opinions but also on customer preferences. Data has been collected from experts working in the customer interface by using these portals. The elements of the questionnaire are linguistics, used to capture vagueness. The internet mall Flipkart is ranked first followed by Amazon, Snapdeal, Shopclues and Myntra respectively; this means that Flipkart is providing more flexibility to their customers in terms of web flexibility and transaction flexibility. Web flexibility includes User Interface Design (UID), Web Localization, Web Quality and Online Reputation Management; these are playing vital roles to achieve customer retention. Therefore, service providers should think about their flexibilities. They need to ask how they can make their websites more user-friendly, how they can make their web pages more localized so that everyone can have access in their local language, how they can increase website quality and how they can improve their online reputation. In today's competitive environment, customers are busy and do not have time to waste on sites that are not user-friendly. Because of this, flexibilities in terms of payment options, ease of the payment process and delivery options are better received by customers who have a variety of service providers to choose from taking this into consideration, online shopping websites must focus on this transaction flexibility to achieve customer satisfaction and retention.

The study examines flexibility dimensions in terms of web and transaction since very few articles consider flexibility in the context of online channels. No research has ever considered flexibility to develop an evaluation model for internet shopping malls; this work is beneficial to both service providers and customers by providing and using flexibility in the context of web and transaction services. A Delphi method and TOPSIS in fuzzy mathematics have been employed to capture the vagueness of information and to facilitate better decisions for the customer in selecting the best shopping malls in online platforms; the service providers have the ability to make flexible options in their online web and transaction facilities. The main contributions of this research to the body of existing literature are firstly, having recognized that flexibility is widely used in literature, in the context of online marketing there is a gap. This study helps to fill the gap and develops constructs of web and transaction flexibilities which can help online service providers to develop their websites and services for customers. Secondly, there is no study where authors have used both Delphi and TOPSIS methods in the fuzzy environment to understand web/transaction flexibility. This study has done so. Thirdly, using fuzzy TOPSIS, the weightings of the criteria have been established, the internet shopping malls have been ranked using generalized Fuzzy TOPSIS and an evaluation model, including eight flexibility criteria of web and transaction, has been proposed. For future work, more flexibility dimensions can be considered, such as price flexibility, product flexibility and promotion flexibility on online platforms. This paper is only opening a window for future researchers in this domain.

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