EVALUATING ONLINE TOP SELLING PRODUCTS IN IRAN, BY USING FUZZY TOPSIS METHOD

ArdalanSameti*

HamidrezaKhalili**

Abstract

Electronic commerce means electronic and nonphysical commercial interaction between consumers and producers or sellers of goods and services. Electronic commerce importance is rising significantly day by day, as a new channel for products distribution. This research seeks to prioritize the online top selling products in Iran. For this purpose, 8 criteria influencing on goods purchasing from commercial websites and 4 online top selling products were selected based on literature review and by using Delphi method.

Whereupon, after ranking the 4 online top selling products by fuzzy TOPSIS method, the results showed that prioritizing the top selling goods in Iran are as following order: electronic devices, book, pharmaceutical products and venereal products.

Keywords: Fuzzy TOPSIS, Electronic Commerce, Online Shopping

*MBA in Strategic Management, University of science & culture, Tehran, Iran

**MBA in Strategic Management, University of science & culture, Tehran, Iran

Introduction

Electronic commerce commonly known as e-commerce or e-comm, refers to the buying and selling of products or services over electronic systems such as the Internet and other computer networks. Electronic commerce draws on such technologies as electronic funds transfer, supply chain management, Internet marketing, online transaction processing, electronic data interchange (EDI), inventory management systems, and automated data collection systems. Modern electronic commerce typically uses the World Wide Web at least at one point in the transaction's life-cycle, although it may encompass a wider range of technologies such as e-mail, mobile devices and telephones as well.

- Electronic commerce is generally considered to be the sales aspect of e-business. It also consists of the exchange of data to facilitate the financing and payment aspects of business transactions.

E-commerce can be divided into:

- E-tailing or "virtual storefronts" on Websites with online catalogs, sometimes gathered into a "virtual mall"
- The gathering and use of demographic data through Web contacts
- Electronic Data Interchange (EDI), the business-to-business (B2B) exchange of data
- E-mail and fax and their use as media for reaching prospects and established customers (for example, with newsletters)
- Business-to-business buying and selling
- The security of business transactions (Wikipedia, 2014).

Technology acceptance factor

Websites are essentially a type of information technology. Direct confrontation is an Internet transaction platform. Shopping websites allow customers to choose products based on their own needs and then provide businesses transaction platforms through interactive communications to fulfill the transactions. However, for the customer to easily consume online, he/she must first find the website useful and easy to use. This takes account of information search, Internet subscription, payment methods, etc.

A good number of previous studies adopt technology acceptance factors as a measure of willingness of customers to consume online. Davis in 1989 proposed the technology acceptance model (TAM) to explain and predict user acceptance of information systems (IS) or information technology (IT). Davis defined PU as ‘‘the degree to which a person believes that using a particular system would enhance his or her job performance,” and defined PEOU as ‘‘the degree to which a person believes that using a particular system would be free of effort.” Within TAM, PU is a major factor, and PEOU is a secondary factor in determining system usage. Davis then

also suggested that PEOU has a positive, indirect effect on system usage through PU (Sun & Lin, 2009; Davis, 1989).

Shihin 2004 argued that individual attitudes toward e-shopping are strongly and positively correlated with user acceptance. His empirical research results confirmed that perceived ease of use of trading online (PEOUT) and perceived usefulness (PU) significantly determine individual loyalty toward e-shopping. It also confirmed the significant effect of PEOU of the Web on PEOUT, which in turn affects PU as well. However, PU was not found to affect user acceptance significantly (Shih, 2004).

Additionally, user satisfaction with the Internet WWW and perceptions of information, system and service were shown to affect user acceptance significantly. On the other hand, recent findings also suggested that customer satisfaction in the online environment is significantly higher than in traditional channels as a result of ease of use in acquiring information. Ease of use can also affect transaction costs when it pertains to information search (Sun & Lin, 2009; Shanker, Smith, &Rangaswamy, 2000)

Website service quality

Due to the importance of clients satisfaction for companies and organizations in general, tools emerged to measure quality in the service and therefore, to know the level of satisfaction of the clients, as the SERVQUAL tool that was developed by Parasuramany, Zeithaml and Berry. The SERVQUAL instrument consists of five underlying dimensions, with two sets of 22 item statements for the 'expectation' and 'perception' sections of the questionnaire. Perceived service quality is measured by subtracting customer perception scores from customer expectation scores, both for each dimension and overall. The five dimensions of SERVQUAL are: tangibility, reliability, responsiveness, assurance and empathy (Sun & Lin, 2009; Parasuraman, Zeithaml, & Berry, 1988a, 1988b; Ibarra, Casas, &Partida, 2014; Han &Baek, 2004).

In electronic commerce, service quality measures have been applied to assess the quality of search engines and factors associated with website success. However, consumers' perceptions of online service quality remain unexplored. There are indications that electronic commerce service issues go beyond product price and may be the reason for consumers' preference for the channel. Researchers in 2002 redefined the traditional service quality dimensions in the context of online services, and suggested an instrument consisting of seven online service dimensions (reliability, access, ease of use, personalization, security, credibility, and responsiveness) (Yang & Jun, 2002). In addition, Barnes and Vidgen in 2002 introduced a method for assessing the service quality of e-commerce web-sites, called WebQual. Many studies, including these two, have introduced a variety of instruments without testing the suitability of SERVQUAL as an online service measure. Keeney in 1999 developed a means-ends objectives network for Internet commerce. The means objectives represent aspects of the customer's desired e-service experience (e.g., assure system security, maximize product information, maximize ease of use)

and are operationalized by e-service process attributes during the customer's interaction with the e-service (Sun & Lin, 2009; Keeney, 1999; Barnes &Vidgen, 2002).

Relevant to service dimensions of the website, Devaraj reported results of a study that measured consumer satisfaction with the e-commerce channel through constructs prescribed by three established frameworks, namely technology acceptance model (TAM), transaction cost analysis (TCA) and SERVQUAL. The study found that TAM components, perceived ease of use and usefulness are important in forming consumer attitudes and in strengthening the e-commerce channel. This study found empirical support for the assurance dimension of SERVQUAL as a determinant in e-commerce channel satisfaction (Devaraj, Fan, &Kohli, 2002).

On the other hand, when the customers perceive better website service quality such as special treatment benefits, they will have more e-satisfaction, when the customers feel e-satisfaction of the website, they will be more e-loyalty, when the website is responsiveness, it will influence directly the customers' e-loyalty (Lai, Chen, & Lin, 2007).

Furthermore, based on data from an online questionnaire of customers of an e-banking service, Oliveira in 2007 employed structural equation modeling to examine the link between website service quality and customer loyalty. His research found a strong and significant link between the two constructs, suggesting that this relationship also holds in e-service settings (Sun & Lin, 2009; Oliveira, 2007).

Aesthetic impact

On the basis of the combined results, when online consumers pursue their purchase tasks, perceived aesthetic formality shows stronger impacts on consumers' cognitive, affective, and conative responses than does perceived aesthetic appeal. Hypotheses relevant to task-oriented consumers are supported except that the satisfaction–consultation path in the "purchase tasks are pursued, satisfaction with web aesthetics increases the propensity to purchase" and decreases the propensities to consult customer service and/or search on other websites, and the arousal-search path in, "purchase tasks are pursued, arousal by web aesthetics decreases the propensity to purchase, and increases the propensities to consult customer service and/or search on other websites", are not statistically significant (Wang, Minor, & Wei, 2011).

Product quality, price and security

The need to understand consumer behavior regarding Internet shopping is imperative to promote the benefits of convenience of Internet shopping, ensuring delivery of product quality, maintaining fair product pricing and ensuring security and privacy, not only affects the intention of consumers to buy, but also directly affects the effective purchasing behavior, in terms of preference, costs and frequency of visits. Study shows Internet shopping, ensuring delivery of product quality because people believe that the quality is equal in comparison with other kinds of shopping. Product quality and product pricing have been tested and proven to be the factors that consumers will evaluate when they shop online, but being encounter with products in stores,

usually can better convince customers to buy, with booth layout, sellers' behavior and so on. Information security in the Internet is important and this study has also proven that information security is positively related to consumer purchasing online (Beng, 2008).

Price and trust

Study investigated the independent and combined impact of perceived trust and perceived price on the purchase intention of online customers. Building on previous research, it determined the significance of perceived trust over perceived price as a key factor affecting customer decisions in the context of Internet shopping, a finding contrary to what has been reported for traditional shopping (Kim, Xu, & Gupta, 2012; Von Neumann & Morgenstern, 1953) and Internet commerce (Reibstein, 2002). Furthermore, this study illustrates the differential importance of perceived trust and perceived price in affecting the decisions of potential and repeat customers at an Internet vendor. In particular, the findings of this study should equip Internet vendors with an evidential basis for developing effective and customized strategies to make initial and repeat sales. As the value of Internet commerce continues to grow (Pavlou, Liang, &Xue, 2007) competition among Internet vendors also becomes intense. As Internet vendors strive to attract increasingly sophisticated customers in their efforts to increase (or at least maintain) their market share, it is imperative that these vendors understand the decision calculus of customers (Kim et al., 2012).

Reputation and trustworthy photo influences

Post-hoc tests indicated that positive reputation led to significantly higher trust ratings and purchase rates than negative as well as missing reputation, but no supporting data was found.

Trustworthy photos differed significantly from untrustworthy photos and missing photo conditions in the predicted direction. The mere presence of a photo positively influences on trust, photos with a moderately untrustworthy appearing seller produce higher trust levels and purchase rates than missing photos. No significant deviation of empirical values from expected values was indicated, suggesting that there is no interaction effect of reputation and photo on purchases. Overall findings support the hypotheses, which state that reputation scores as well as photos both exert significant influence on trust and purchase behavior in the trust game. Study found no interaction effect of reputation and photos was observed. So no support could be found for the effects of reputation and photos appear as largely independent from each other and strictly additive (Bent, Baptist, &Leuschner, 2012).

Customer's characteristics and web security

High levels of Internet self-efficacy positively affect user attitudes toward online shopping. Increased personal perceptions of web security positively affect user attitudes toward purchasing expensive, infrequently purchased products or services. High levels of personal

perceived web security positively affect user attitudes toward online shopping and increased personal privacy concerns negatively affect user attitudes toward purchasing tangible or physical products or services.

High privacy concerns negatively affect user attitudes toward online shopping and high product involvement positively affects user attitudes toward online shopping in the context of all employed products or services.

High levels of product involvement positively affect user attitudes toward online shopping, products and service types influence the relationships between consumer characteristics and attitudes toward online shopping.

Product and service type affect the relationships between consumer characteristics and attitudes toward online shopping, in designing a marketing plan, online retailers must consider two key questions. The first question involves the identity of potential buyers. This study provided the consumer characteristics of online shoppers. Based on these characteristics, online business can identify their target market easily. The second question involves the type of products that are suitable for online marketing (Lian& Lin, 2008).

Intention-behavior effect

The intention-behavior link will be weaker if the intention is ‘‘good’’. If a person believes he/she is observed, it will affect the intention-behavior link positively. The significant interaction effect between monitoring and intention type can show this issue.

If a person believes he/she is observed, it will have a greater positive effect on intention-behavior link if the intention is ‘‘good’’. The time between intention-formulation and subsequent behavior will affect the intention-behavior link negatively. This is supported by looking at the significant main effect for temporal disjunction. The time between intention-formulation and subsequent behavior will have a greater negative effect on the intention- behavior link if the intention is ‘‘good’’, since the interaction effect for intention and temporal disjunction is significant (O¨hman, 2011).

Online purchase intention

Consumer intention to purchase online personalized products will be stronger for consumers of more individualistic countries than for those of less individualistic countries. ”Purchase intention was greater in conditions of high individualism than for low individualism”.

Consumer intention to purchase online personalized products will be stronger for consumers of less uncertainty avoiding countries than for those of more uncertainty avoiding countries. Consumer intention to purchase online personalized search products will be stronger than the intention to purchase online personalized experience products. (Regarding product type effect was supported). As predicted, the purchase intention was greater for the search product than for the experience product.

A price premium up to some level will not affect customer purchase intention for personalized products. Price factor was not significant and a multiple comparison test did not indicate difference in any pair of the three price levels. Thus, suggesting no price effect up to some level was supported (Moon, Chadee, &Tikoo, 2008).

Introduction and informational websites' effects

The impact of the introduction of a transactional website shows:

(1) Marketing efforts can move customers into a particular channel.

(2) Most customers use multiple channels after the addition of an Internet channel.

(3) Adding a transactional Internet channel may either decrease or increase customer's buying behavior(Nierop, Leeflang, Teerling, &Huizingh, 2011).

Marketing efforts not only influence customer channel choice, but also may explain the increase in buying by multichannel customers (Neslin et al., 2006). This argument could hold for informational websites as well, because customers who use both channels gain exposure to more marketing efforts and brands than do those using a single channel (Ansari, Mela, &Neslin, 2008; Nierop et al., 2011). Provide empirical support for this effect, and Wallace, Giese, and Johnson (2004) show that retailers may receive a loyalty payoff because customers perceive an enhanced portfolio of service outputs provided by multiple channels.

The effect of the introduction and usage of informational websites shows, almost all studies use cross-sectional data from surveys. For most customers, the introduction and use of a retailer's informational website has negative effects on the number of shopping trips they take, their decision to buy in a particular category, and the amount of money they spend across categories:

First, customer exhibits more planned shopping behavior as consequence of their access to and use of more information.

Second, the information on a website can be easily compared with information from competitive stores.

Third, the quality of the website might also explain the negative effect.

As a consequence, consumers may reduce the number of visits to the store. With respect to the amount spent, being more informed about what they want might help consumers self-regulate better when they are in the store (Baumeister, 2002) and thus spend less money. While browsing the website, it is not possible to touch and feel the product, and such stimuli tend to induce impulse-buying behavior (Peck & Childers, 2006; Baumeister, 2002; Nierop et al., 2011).

According to Underhill, "almost all unplanned buying is a result of touching, hearing, smelling, or tasting something on the premises of the store." When website users cannot approach the product, it may reduce their impulse buying and thus their spending. More impulsive customers choose products on the basis of their spontaneous evoked affect rather than cognitions. Providing highly impulsive customers with an informational website, with which they can interact but not transact, puts them in a position from which they can engage sufficient processing resources, with more emphasis on cognition. Findings indicate, for customers who

use the website, offline purchase incidence drops, as does spending in the store. Therefore, they should have fewer opportunities to choose products in response to the affect the products evoke as they walk through the store. Therefore, website visits may reduce impulse buying behavior in the physical store. Switching costs are very low in online environments. The informational website offers information that can be compared easily with the information provided by competitors that also have informational or even transactional websites. After obtaining information on the website of the focal company, consumers may have an impulse to buy, but they can do so only on the competitors' transactional websites (Nierop et al., 2011).

The extent to which customers appreciate the website also might help explain the behavior.

First, for a small percentage of customers, visiting the website has a positive impact on the amount spent in the store. If these customers contribute substantially to the firm's revenues, an exclusive website makes sense.

Second, managers could consider changing the content of their informational websites to obtain more positive effects. The website should focus on information that has positive effects such as references to brand building efforts, the availability and arrival of new services, and any news that makes customers curious about visiting the store. In this respect, products sold only by one retailer likely have different effects than products that are not unique and can be sold in virtually the same conditions elsewhere (Pauwels et. al., 2011). More (experimental) research among a firm's consumers could provide specific insights, before the introduction of the website.

Third, managers may upgrade or link their informational websites to transactional websites this option is possible only if customers are willing to buy online, the merchant is able to execute the website in a cost-effective way, and the negative effects of online transactional channels in previous studies are smaller than those for the informational website (e.g., Ansari et al., 2008; Gensler, Dekimpe, &Skiera, 2007; Nierop et al., 2011).

Fourth, it is useful to monitor the effects of a new channel on existing channels as soon as possible after its introduction. Monitoring satisfaction scores of the website, in this respect is less useful than monitoring its effects on metrics such as the average number of shopping trips, revenues, the amount spent per trip and so on.

Fifth, this study indicates that a de-composition may provide insights into which components of consumer behavior are affected by which variables (Van Nierop&Franses 2008; Nierop et al., 2011).

Electronic shopping cart

Online shoppers' intent to purchase during their current online session increases the frequency of electronic shopping cart use. Indeed, the results show that current purchase intent is the strongest predictor of cart placement. Consumers' desire to take advantage of price promotions also leads to greater frequency of cart use. Search for entertainment would lead consumers to more frequently place items in their online shopping carts. However, the data do not completely support this. The frequency of electronic cart use would increase along with

organizational intent of online cart use. The last proposed predictor of shopping cart use is research and information search.

The research results do not support, research and information search intent will increase the frequency of consumers' online shopping cart use, but that research and information search intent leads to greater frequency of cart use.

The customers' current purchase intent as well as the frequency of shopping cart use (i.e., placing items in the virtual cart).

The results indeed show that an increase in the current purchase intent leads to a greater frequency of buying, as does an increase in the frequency of shopping cart use (Close &Kukar-Kinney, 2010).

Methodology

The fuzzy TOPSIS method

This study uses this method to evaluate the product shopping alternatives performance and rank the priority for them accordingly.

TOPSIS views a MADM problem with m alternatives as a geometric system with m points in the n dimensional space. The method is based on the concept that the chosen alternative should have the shortest distance from the positive-ideal solution and the longest distance from the negative-ideal solution. TOPSIS defines an index called similarity to the positive-ideal solution and the remoteness from the negative-ideal solution. Then the method chooses an alternative with the maximum similarity to the positive- ideal solution (Wang & Chang, 2007). It is often difficult for a decision-maker to assign a precise performance rating to an alternative for the attributes under consideration. The merit of using a fuzzy approach is to assign the relative importance of attributes using fuzzy numbers instead of precise numbers. This section extends the TOPSIS to the fuzzy environment (Yang & Hung, 2007; Sun & Lin, 2009).

This method is particularly suitable for solving the group decision making problem under fuzzy environment. We briefly review the rationale of fuzzy theory before the development of fuzzy TOPSIS.

Step 1: Determine the weighting of evaluation criteria A systematic approach to extend the TOPSIS is proposed to solve the estimation of shopping websites under a fuzzy environment in this section. In this paper the importance weights of various criteria and the ratings of qualitative criteria are considered as linguistic variables (as Table 1) (Chen, Lin, & Huang, 2006; Sun & Lin, 2009).

Step 2: Construct the fuzzy decision matrix and choose the appropriate linguistic variables for the alternatives with respect to criteria.

Table 1
Linguistic scales for the importance of each criterion

Linguistic variable	Corresponding triangular fuzzy number
Very Low (VL)	(0 , 0 , 0.1)
Low (L)	(0 , 0.1 , 0.3)
Medium Low (ML)	(0.1 , 0.3 , 0.5)
Medium (M)	(0.3 , 0.5 , 0.7)
Medium High (MH)	(0.5 , 0.7 , 0.9)
High (H)	(0.7 , 0.9 , 1)
Very High (VH)	(0.9 , 1 , 1)

$$\tilde{D} = \begin{array}{c} \\ A_1 \\ A_2 \\ \vdots \\ A_m \end{array} \begin{array}{c} \begin{array}{cccc} C_1 & C_2 & \cdots & C_n \end{array} \\ \begin{pmatrix} \tilde{x}_{11} & \tilde{x}_{12} & \ldots & \tilde{x}_{1n} \\ \tilde{x}_{21} & \tilde{x}_{22} & L & \tilde{x}_{2n} \\ M & M & O & M \\ \tilde{x}_{m1} & \tilde{x}_{m2} & L & \tilde{x}_{mn} \end{pmatrix} \end{array}, i = 1,2,...,m; j = 1,2,...,n \qquad (1)$$

$$\tilde{x}_{ij} = \frac{1}{k}\left[\tilde{x}_{ij}^{1} + \tilde{x}_{ij}^{2} + \cdots + \tilde{x}_{ij}^{k}\right]$$

Where $\tilde{x}_{ij}^{k}$ is the rating of alternative A_i with respect to criterion C_j evaluated by expert, and $\tilde{x}_{ij}^{k} = a_{ij}^{k}, b_{ij}^{k}, c_{ij}^{k}$

Step 3: Normalize the fuzzy decision matrix,the normalized fuzzydecision matrix denoted by $\tilde{R}$ is shown asfollowing formula:

$$\tilde{R} = \left[\tilde{r}_{ij}\right]_{m\times n}, \; i = 1,2,...,m; \; j = 1,2,...,n \qquad (2)$$

Then the normalization process can be performed by followingformula:

Where $\tilde{r}_{ij} = \left(\frac{a_{ij}}{c_j^+}, \frac{b_{ij}}{c_j^+}, \frac{c_{ij}}{c_j^+}\right) c_j^+ = \max c_{ij}$

The normalized $\tilde{r}_{ij}$ are still triangular fuzzy numbers. For trapezoidalfuzzy numbers, the normalization process can be conducted in the same way.

The weighted fuzzy normalized decision matrix is shown as following matrix $\tilde{V}$:

$$\tilde{V} = \left[\tilde{v}_{ij}\right]_{m\times n},\ i = 1,2,...,m;\ j = 1,2,...,n \qquad (3)$$

$$\tilde{v}_{ij} = \tilde{r}_{ij} \otimes \tilde{w}_j \qquad (4)$$

Step 4: Determine the fuzzy positive-ideal solution (FPIS) and fuzzy negative-ideal solution (FNIS) according to the weighted normalized fuzzy decision matrix, we know that the elements $\tilde{v}_{ij}$ are normalized positive TFNs and their ranges belong to the closed interval [0, 1]. Then, we can define the FPIS A^+ and FNIS A^-, as following formula:

$$A^+ = \tilde{v}_1^+, \tilde{v}_2^+, ..., \tilde{v}_n^+ \qquad (5)$$

$$A^- = \tilde{v}_1^-, \tilde{v}_2^-, ..., \tilde{v}_n^- \qquad (6)$$

Where $\tilde{v}_j^+ = 1,1,1$ and $\tilde{v}_j^- = 0,0,0$, $j = 1,2,...,n$

Step 5: Calculate the distance of each alternative from FPIS and FNIS The distances (d_i^+ and d_i^-) of each alternative A^+ from and A^- canbe currently calculated by the areacompensation method.

$$d_i^+ = \sum_{j=1}^{n} d(\tilde{v}_{ii}, \tilde{v}_j^+), i = 1,2,...,m; j = 1,2,...,n \qquad (7)$$

$$d_i^- = \sum_{j=1}^{n} d(\tilde{v}_{ij}, \tilde{v}_j^-), i = 1,2,...,m; j = 1,2,...,n \qquad (8)$$

Step 6: Obtain the closeness coefficient and rank the order of alternatives.

The CC_i is defined to determine the ranking order of all alternativesonce the d_i^+ and d_i^- of each alternative have been calculated.

Calculate similarities to ideal solution. This step solves the similarities to an ideal solution by formula:

$$CC_i = \frac{d_i^-}{d_i^+ + d_i^-}, i = 1,2,...,m \qquad (9)$$

According to the CC_i , we can determine the ranking order of allalternatives and select the best one from among a set of feasible alternatives.

In the last years, some fuzzy TOPSIS methods were developed in the different applied field. Researchers in 2008 adopted fuzzy TOPSIS for order selection and pricing of manufacturer (supplier) with make-to-order basis when orders exceed production capacity (Lin & Chang, 2008). Chen and Tsao in 2008 developed the TOPSIS method based on interval-valued fuzzy sets in decision analysis. Ashtiani used interval-valued fuzzy TOPSIS method is aiming at solving MCDM problems in which the weights of criteria are unequal, using interval-valued fuzzy sets concepts (Sun & Lin, 2009; Chen &Tsao, 2008). Researchers in 2007 applied fuzzy TOPSIS to help the Air Force Academy in Taiwan choose optimal initial training aircraft in a fuzzy environment (Wang & Chang, 2007). Li in 2007 developed a compromise ratio (CR) methodology for fuzzy multi-attribute group decision making (FMAGDM), which is an important part of decision support system (Sun & Lin, 2009; Li, 2007). Wang and Lee in 2007 generalized TOPSIS to fuzzy multiple-criteria group decision-making (FMCGDM) in a fuzzy environment. Wang and Elhag proposed a fuzzy TOPSIS method based on alpha level sets and presents a non-linear programming solution procedure (Sun & Lin, 2009).

Empirical evidence from online product shopping

In order to select the criteria and products Delphi method was used. According to this method, criteria and products based on literature review and researchers' attitudes were selected and sent to 20 of the top commercial websites senior managers, and after normalizing their answers in 4 steps, 8 criteria influencing on goods purchasing from commercial websites and 4 online top selling products were selected. Regarding the evaluation of the product shopping, 12 experts were invited to survey four main alternatives and eight essential criteria using the research. This research framework includes 8 evaluation criteria such as website design (C1), Store and brand's reputation (C2), Culture (C3), Being up to date (C4), Price (C5), Attitudes of others (C6), Technology acceptance (C7), Online purchase after comparisons (C8).

In addition, there are four alternatives of product shopping that encompass, Book (A1), Electronic devices (A2), Pharmaceutical products (A3) and Venereal products (A4). After the construction of the hierarchy the different priority weights of each criteria, attributes and alternatives are calculated using the fuzzy TOPSIS approach. The comparison of the importance or preference of one criterion, attribute or alternative over another can be done with the help of the questionnaire. The method of calculating priority weights of the different decision alternatives is discussed following parts.

Step 1: Determine the linguistic weighting of each criterion. We adopt fuzzy TOPSIS method to evaluate the weights of different criteria for the online product shopping following the construction of fuzzy TOPSIS model, it is extremely important that expert's fill the judgment matrix. In this study, one website designers, one software engineers, one online product shopping owners and one engineer Management Information Systems experts are involved. From the viewpoint of expert validity, the buildup of most of the operationalization was based on the literature that caused them to have expert validity.

Table 2
Weights of each criterion

criterion	Weights	BNP	Rank
C_1	(0.5,0.7,0.8)	0.69	4
C_2	(0.3,0.5,0.7)	0.50	5
C_3	(0.8,0.9,1.0)	0.85	1
C_4	(0.7,0.8,0.9)	0.84	2
C_5	(0.6,0.8,0.9)	0.82	3
C_6	(0.3,0.5,0.7)	0.50	5
C_7	(0.5,0.7,0.8)	0.69	4
C_8	(0.7,0.8,0.9)	0.84	2

This research applies the COA method to compute the BNP valueof the fuzzy weights of each dimension:
To take the BNP value of the weight of C1 as an example, the calculation process is as follows:

$$BNP_{W1} = \left[U_{W1} - L_{W1} + M_{W1} - L_{W1} \right] / 3 + L_{W1}$$
$$= \left[0.87 - 0.5 + 0.7 - 0.5 \right] / 3 + 0.5 = 0.69 \qquad (10)$$

Then, the weights for the remaining dimensions can be found as shown in Table 2.

The weights for each driving forces are: C1 (0.69), C2 (0.506), C3 (0.85), C4 (0.84), C5 (0.82), C6 (0.506), C7 (0.69) and C8 (0.84). From the fuzzy TOPSIS results, we can understand the first two important factors for the competitive advantage of online product shopping are C3 (0.85) and C8 and C4 (0.84). Moreover, the less important factor is C2 and C6 (0.506).

Step 2: Estimating the performance this paper focus on determining the best online product shopping, so we assume that questionnaire have collected completely and will start with building dataset that are collected. The evaluators have their own range for the linguistic variables employed in this study according to their subjective judgments (Hsieh, Lu, &Tzeng, 2004).

For each evaluator with the same importance, this study employs the method of average value to integrate the fuzzy/vague judgment values of different evaluators regarding the same evaluation dimensions. The evaluators then adopted linguistic terms (see Table 3), including ‘‘very poor”, ‘‘poor”, “Medium Poor”, ‘‘fair”, ‘‘Medium Good “, “good” and ‘‘very good” to express their opinions about the rating of every shopping website regarding each performance criteria, based on the technological data of the four shopping websites listed in Table 4.

Table 3
Linguistic scales for the rating of each cluster policy

Linguistic variable	Corresponding triangular fuzzy number
Very Poor (VP)	(0 , 0 , 1)
Poor (P)	(0 , 1 , 3)
Medium Poor (MP)	(1 , 3 , 5)
Fair (F)	(3 , 5 , 7)
Medium Good (MG)	(5 , 7 , 9)
Good (G)	(7 , 9 , 10)
Very Good (VG)	(9 , 10 , 10)

Table 4
Subjective cognition results of evaluators towards the seven levels of linguistic variables

	A_1	A_2	A_3	A_4
C_1	(5.0,7.0,8.7)	(8.5,9.7,10)	(0.0,0.5,2.0)	(3.7,5.0,6.2)
C_2	(0.0,0.5,2.0)	(8.0,9.5,10)	(5.5,7.0,8.0)	(0.7,2.2,4.0)
C_3	(7.5,9.2,10)	(7.0,8.7,9.7)	(0.0,0.5,2.0)	(7.5,9.0,9.7)
C_4	(8.0,9.5,10)	(8.5,9.7,10)	(5.0,6.7,8.0)	(4.0,6.0,7.7)
C_5	(0.5,2.2,4.0)	(2.5,4.5,6.5)	(1.5,3.5,5.5)	(4.5,6.5,8.2)
C_6	(2.2,4.0,6.0)	(5.5,7.5,9.0)	(5.2,6.5,7.5)	(7.5,9.7,10)
C_7	(6.5,8.5,9.7)	(8.5,9.7,10)	(0.0,0.0.2.0)	(3.0,4.2,7.7)
C_8	(8.5,9.7,0.9)	(0.2,1.2,3.0)	(0.7,1.7,3.5)	(5.0,7.0,8.7)

Table 5
Normalized fuzzy decision matrix

	A_1	A_2	A_3	A_4
C_1	(0.5,0.7,0.8)	(0.8,0.9,1.0)	(0.0,0.0,0.2)	(0.3,0.5,0.6)
C_2	(0.0,0.0,0.2)	(8.0,9.5,1.0)	(0.5,0.7,0.8)	(0.1,0.2,0.4)
C_3	(0.7,0.9,1.0)	(0.7,0.8,0.9)	(0.0,0.0,0.2)	(0.7,0.9,0.9)
C_4	(0.8,0.9,1.0)	(0.8,0.9,1.0)	(0.5,0.7,0.8)	(0.4,0.6,0.8)
C_5	(0.0,0.3,0.5)	(0.3,0.5,0.7)	(0.1,0.4,0.6)	(0.5,0.7,1.0)
C_6	(0.2,0.4,0.6)	(0.5,0.7,0.9)	(0.5,0.6,0.7)	(0.7,0.9,1.0)
C_7	(0.6,0.8,0.9)	(0.8,0.9,1.0)	(0.0,0.0.0.2)	(0.3,0.4,0.8)
C_8	(0.8,0.9,1.0)	(0.0,0.1,0.3)	(0.0,0.1,0.3)	(0.5,0.7,0.8)

Step 3: Normalize the fuzzy decision matrix Using Eq. (2), we can normalize the fuzzy decision matrix as Table 5.

Step 4: Establish the weighted normalized fuzzy decision matrix the forth step in the analysis is to find the weighted fuzzy decision matrix and the resulting fuzzy weighted decision matrix is shown as Table 6.

Step 5: Determine the fuzzy positive and fuzzy negative-ideal reference points.
Then we can define the fuzzy positive-ideal solution (FPIS) and the fuzzy negative-ideal solution (FNIS) as: A^+ and A^-. This is the fifth step of the fuzzy TOPSIS analysis.

$$A^+ = [\ 1,1,1\ ,\ 1,1,1\ ,\ 1,1,1\ ,\ 1,1,1\ ,\ 1,1,1\ ,\ 1,1,1\ ]$$
$$A^- = [\ 0,0,0\ ,\ 0,0,0\ ,\ 0,0,0\ ,\ 0,0,0\ ,\ 0,0,0\ ,\ 0,0,0\ ]$$

Step 6: Estimating the performance and ranking the alternatives In order to calculate the closeness coefficients of each of the alternatives d_i^+ and d_i^- calculation is used as an example as follows.

Table 6
Weighted normalized fuzzy decision matrix

	A_1	A_2	A_3	A_4
C_1	(0.25,0.49,0.75)	(0.42,0.67,0.87)	(0.00,0.03,0.47)	(0.18,0.35,0.54)
C_2	(0.00,0.02,0.14)	(0.25,0.47,0.70)	(0.17,0.35,0.56)	(0.02,0.11,0.28)
C_3	(0.60,0.87,1.00)	(0.56,0.82,0.97)	(0.00,0.04,0.20)	(0.46,0.85,0.97)
C_4	(0.56,0.82,0.97)	(0.60,0.84,0.97)	(0.35,0.58,0.77)	(0.28,0.52,0.04)
C_5	(0.04,0.23,0.46)	(0.19,0.46,0.75)	(0.12,0.36,0.64)	(0.35,0.66,0.97)
C_6	(0.07,0.20,0.40)	(0.17,0.37,0.60)	(0.16,0.32,0.52)	(0.24,0.48,0.70)
C_7	(0.32,0.60,0.84)	(0.42,0.68,0.87)	(0.00,0.03.0.17)	(0.10,0.25,0.67)
C_8	(0.60,0.84,0.97)	(0.01,0.10,0.30)	(0.04,0.14,0.34)	(0.30,0.61,0.84)

Once the distances of cluster policy from FPIS and FNIS are determined, the closeness coefficient can be obtained with Eq. (9). The index CC_1 of first alternative is calculated as:

$$d_1^+ = 4.288 \qquad d_1^- = 4.26$$

From the alternative evaluation results in Table 7, the best two online product shopping are electronic devices and book.

$$CC_1 = 4.26 /\ 4.288 + 4.26\ = 0.498$$
$$CC_2 > CC_1 > CC_4 > CC_3$$

Table 7
Closeness coefficients and ranking

Alternative	d_i^+	d_i^-	CC_i	Rank
Book	4.288	4.26	0.498	2
Electronic devices	3.96	4.608	0.536	1
Pharmaceutical products	6.10	2.310	0.274	4
Venereal products	4.75	3.98	0.455	3

Conclusion

(Limitation and future research direction)

At the very beginning of this research formation, researchers' attitudes were a little different from the main framework of the following presented results, we thought the venereal products' online shopping, has a very sudden growth in Iran with overcoming at other alternatives. Yet, book has the most online buying in Iran and electronic devices have the highest online advocates. In the first process of this research, researchers' hypothesis formed more accurate, although the basis of the rudimentary thought was lasting, which was the sudden growth of venereal products' online shopping in Iran, but the phrase "overcoming at other alternatives" was not precise.

All the results for the hypothesis were expected, electronic devices acquire the first place as the most attractive issue in selling websites in Iran, which means the most of famous selling websites have especial consideration or completely dedicated to electronic devices, that we categorized it into cell phone, camera, video and audio devices like television and disk player, laptop and computer equipment, home appliances for instance refrigerator, air conditioner, vacuum cleaner and so forth. Electronic devices' first place acquisition is highly depends on a factor, that is the ample range of devices' diversity which implies eagerness to advancement of technology chase, and emersion of new tech tracing. Meanwhile, we cannot neglect that electronic devices have the most affinity with Internet, which can help this spreading on cyberspace.

We should consider, although electronic devices achieved the first place, rate of online purchase for most types of these devises is low (all but few consumers purchase electronic devices in this way, likewise most of them purchase authentic branded goods and services from authentic websites) and achieving this place is only related to our used criteria. It means, electronic devices are searched abundantly on Internet but this searching is without purchase intent, and usually is for new devices tracing in market (markets in Iran or global market's new tech). Furthermore, online tracing used for comparison between models, facilities, prices, availability, sale representative and so on. Afterwards, if the purchase intent be created, they as

buyers will refer to traditional electronic stores to buy desired devices. Whereupon, it should be noted that online stores are highly influential on their purchase intention.

For further research is important issue to discover consumer and seller behavior in this field (electronic devices), in order to online purchase barriers elimination, barriers like lack of trust to seller such as fear of fraud, delivering counterfeit commodity, higher price and so forth, which also is related to relevant legal infrastructures in Iran. Yet, our research shows, these barriers elimination would make a fertile market in Iran, so the field for further research for overcoming these problems and providing appropriate solutions is ample.

On the other side, book achieved the second place. Presumably, because it is cheaper in comparison with electronic devices, has unit price, small size it has and could not be bogus (in Iran), therefore, makes more trust in transaction. In addition, book's online selling has longer precedent in Iran. Also we should note, approximately most of the books are published in Tehran, and for this reason, cities where are away from Tehran, need to order the books for universities, organizations, libraries and so on, that online purchasing helps them seeing new published books and ordering.

In this research, venereal products attained the third place in online market in Iran, and research indicates its market dramatic growth, despite venereal product's market is roughly new market in Iran, which we classified to, condom and other contraceptive products, sexual stimulus enhancement drug and apparatus and so forth.

What is noteworthy point about increasingly growth of venereal products' online purchase in Iran is that, in Iran and other Islamic countries, cultural issues such as impermissibility of these products (some of these products' dealing is considered as taboo), pudency and shame of purchasing these products in person, that buyer must glare in seller's eyes and verbally order the venereal products, which for most of Moslems makes embarrassment, lead them to venereal products' online market. In this way they can compare products and make buying decision without any stress, and this can create a particular value for this kind of consumers. Another attractive point is, the research shows, they even prefer non-person (private) dealing in delivery process or at least taking delivery of these commodities in unrelated packs to conceal the product type. In other words, they like anybody (even the courier) knows about what they have ordered, that will create more value for these kind of consumers.

Finally, pharmaceutical products obtained the last place between our four alternatives, it shows these products need more attention in online market, because as we believe, these products have potential ability in online market like book, in that most of its characteristics are similar to books and this matter also makes threshold for further researches to improve pharmaceutical products' online market. Furthermore, researchers interested in online shopping issues should assess, identify and recommend new goods and services to be added to online stores and commercial websites.

REFERENCES

Ansari, A., Mela, C., &Neslin, S. (2008). Customer channel migration.Journal of Marketing Research.45(1), 60−76.

Barnes, S., &Vidgen, R. (2002). An Integrative Approach to the Assessment of E-Commerce uality. Working Paper, University of Bath.

Beng, T. P. (2008). A Study of customer' expectations in online shopping.Multimedia University, MBA thesis, Malaysia.

Bent, G. Baptist, O., &Leuschner, H. (2012). To buy or not to buy: Influence of seller photos and reputation on buyer trust and purchase behavior. Int. J. Human-Computer Studies, 70, 1–13.

Chen, C. T. Lin, C. T., & Huang, S. F. (2006).A fuzzy approach for supplier evaluation and selection in supply chain management. International Journal of Production Economics, 102(2), 289–301.

Chen, T. Y., &Tsao, C. Y. (2008).The interval-valued fuzzy TOPSIS method and experimental analysis. Fuzzy Sets and Systems, 159(11), 1410–1428.

Close, A. G., &Kukar-Kinney, M. (2010). Beyond buying: Motivations behind consumers' online shopping cart use. Journal of Business Research, 63(9-10), 986–992.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319–340.

Devaraj, S. Fan, M., &Kohli, K. (2002). Antecedents of B2C Channel Satisfaction and Preference: Validating e-Comme Metrics. Information Systems Research, 13(3), 316-333.

Gensler, S., Dekimpe, M. G., &Skiera, B. (2007).Evaluating channel performance in multi-channel environments.Journal of Retailing and Consumer Services, 14(1), 17−23.

Han, S. L., &Baek, S. (2004). Antecedents and Consequences of Service Quality in Online Banking: An Application of the SERVQUAL Instrument. Advances in Consumer Research, 31, 208-214.

Hsieh, T. Y. Lu, S. T., &Tzeng, G. H. (2004). Fuzzy MCDM approach for planning and design tenders selection in public office buildings. International Journal of Project Management, 22(7), 573–584.

Ibarra, L. Casas, E., &Partida, A. (2014). SERVQUAL METHOD applied to Agencia Fiscal del Estado de Sonora: An analysis about service quality. Procedia - Social and Behavioral Sciences, 148, 87 – 93.

Keeney, R. L. (1999). The value of Internet commerce to the customer. Management Science, 45, 533–542.

Kim, H. W. Xu, Y., & Gupta, S. (2012). Which is more important in Internet shopping, perceived price or trust?. Electronic Commerce Research and Applications, 241–252.

Lai, C. S. Chen, C. S., & Lin, P. J. (2007). The effects of service quality on customer relational benefits in travel website. Management of Converging Technologies, Portland International Center for Management of Engineering and Technology (PICMET 2007), 5–9 August 2007 (pp. 1133–1140).

Li, D. F. (2007).Compromise ratio method for fuzzy multi-attribute group decision making.Applied Soft Computing, 7(3), 807–817.

Lian, J. W., & Lin, T. M. (2008). Effects of consumer characteristics on their acceptance of online shopping: Comparisons among different product types. Computers in Human Behavior, 48-65.

Lin, H. T., & Chang, W. L. (2008).Order selection and pricing methods using flexible quantity and fuzzy approach for buyer evaluation. European Journal of Operational Research, 187(2), 415–428.

Moon, J. Chadee, D., &Tikoo, S. (2008). Culture, product type, and price influences on consumer purchase intention to buy personalized products online. Journal of Business Research, 31-39.

Nierop, J. v. Leeflang, P. Teerling, M., &Huizingh, K. (2011).The impact of the introduction and use of an informational website on offline customer buying behavior.Intern. J. of Research in Marketing, 155-165.

Neslin, S. A., Grewal, D., Leghorn, R., Shankar, V., Teerling, M. L., Thomas, J. S., et al. (2006).Challenges and opportunities in multichannel customer management.Journal of Services Research, 9(2), 1−18 Special Issue on Customer Relationship Management.

O¨hman, N. (2011). Buying or lying—the role of social pressure and temporal disjunction of intention assessment and behavior on the predictive ability of good intentions. Journal of Retailing and Consumer Services, 194-199.

Oliveira, R. C. (2007). Evidences from link between quality and loyalty in e-service: An empirical study. SISTEMAS and GESTÃO, 2(1), 1–15.

Parasuraman, A. Zeithaml, V. A., & Berry, L. L. (1988a). Communications and control process in the delivery of service quality. Journal of Marketing (April), 35–48.

Parasuraman, A. Zeithaml, V. A., & Berry, L. L. (1988b). SEVQUAL: A multiple item scale for measuring consumer perceptive of service quality. Journal of Retailing, 64(1), 12–37.

Pavlou, P. A. Liang, H. G., &Xue, Y. J. (2007). Understanding and mitigating uncertainty in online exchange relationships: a principal-agent perspective. MIS Quarterly, 31(1), 105–136.

Reibstein, D. J. (2002). What attracts customers to online stores and what keeps them coming back?. Journal of the Academy of Marketing Science, 30(4), 465–473.

Shanker, V. Smith, A., &Rangaswamy, A. (2000).Customer satisfaction and loyalty in online and offline environments.Working paper.E-Business Research Center, Penn State University.

Shih, H. P. (2004). An empirical study on predicting user acceptance of e-shopping on the web. Information and Management, 41(3), 351–368.

Sun, C. C., & Lin, T. R. G. (2009).Using fuzzy TOPSIS method for evaluating the competitive advantages of shopping websites. Expert Systems with Applications, 11764–11771.

Van Nierop, E. Fok, D., &Franses, P. H. (2008).Interaction between shelf layout and marketing effectiveness and its impact on optimizing shelf arrangements.Marketing Science, 27(6), 1065−1084.

Von Neumann, J., & Morgenstern, O. (1953).Theory of Games and Economic Behavior.3rd edition, Princeton University Press, Princeton, NJ, USA.

Wallace, D. W., Giese, J. L., & Johnson, J. L. (2004). Customer retailer loyalty in the context of multiple channel strategies.Journal of Retailing, 80(4), 249−263.

Wang, T. C., & Chang, T. H. (2007).Application of TOPSIS in evaluating initial training aircraft under a fuzzy environment. Expert Systems with Applications, 33, 870–880.

Wang, Y. J. Minor, M. S., & Wei, J. (2011). Aesthetics and the online shopping environment: Understanding consumer responses. Journal of Retailing, 46-58.

Wikipedia.(2014). E-commerce, Ratwers Viewed on October 2014. http://en.wikipedia.org/wiki/E-commerce.

Yang, T., & Hung, C. C. (2007). Multiple-attribute decision making methods for plant layout design problem. Robotics and Computer-Integrated Manufacturing, 23(1), 126–137.

Yang, Z., & Jun, M. (2002). Consumer Perception of E-Service Quality: From Internet Purchaser and Non-Purchaser Perspectives. Journal of Business Strategies, 19(1), 19-41.