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Research Article

Consumers' Demand and Online Promotion of the Food Retailing Through the E-Commerce Websites in China

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Abstract: Over the last decade online shopping provides an open window for producers who will market their products and becomes one of the most rapidly growing forms of shopping. In order to take full advantage of the potential offered by the internet, it is essential that the e-commerce websites meet the customer requirements and be prepared and organized with highly usable manner. This study is an attempt to identify the factors that may have an impact on consumers' probability to buy food through the internet and investigate the current issues and challenges for the top 10 B2C e-commerce websites in terms of promoting food retailing in China. Fuzzy TOPSIS is employed to evaluate the quality of these websites based on the conceptual model of willingness to buy products through internet for the online consumers. The managerial implications and suggestions for future research are also discussed.

Keywords: Consumer behavior, e-commerce, empirical study, food retail market, online promotion

INTRODUCTION

Over the past several years e-commerce has changed the way business transaction occur for its convenience of ordering and paying for the products online and have them delivered to the doorstep. As one of the developing countries that experience the highest online population growth rates in China. According to a report by the China Internet Network Information Center (CNNIC, 2013), there are 242 million Internet users engaging in e-commerce activities in China and the e-commerce market racked up a whopping 190 billion USD worth of transactions in 2012, an increase of 66.5% over 2011′s total. According to Ystats (2013), it is expected to grow by more than 30% annually between 2013 and 2016.

In terms of population, China is the largest country in the world and thus the food is in great demand. However, with the rapidly development of the e-commerce, the online food shopping is not as popular as the other categories such as fashion, shoes and bags, as well as computers and household appliances. Morganosky and Cude (2002) argue that online shoppers are better educated, had relative higher incomes and tend to be somewhat younger, implying that the online consumers' demand is different from the general populations. It is necessary to identify the main factors effecting consumer willingness to buy online products. However, the related research is still in its infancy (Morganosky and Cude, 2002).

E-commerce website quality has become one of the critical factors in attracting online shoppers to visit a company's online store and learn more about its products and services, with possible follow-up purchase (Korner and Zimmermann, 2000; Geissler, 2001). From observations, however, there exist many issues and challenges in the current e-commerce websites regarding the actual performance in terms of the effectiveness of their promotional effort. In order to provide practical insight and guidelines for improving the effectiveness of the e-commerce in food retail market, an empirical study to investigate the demand of the online shoppers and evaluation these e-commerce websites is needed, which is the primary motivation of this research.

LITERATURE REVIEW

As the increase of the income, particularly of the lower and middle-income households, there is a significant impact on the food demand and the consumers have now become more discriminating in their food product choices and have started emphasizing more on the quality, freshness and convenience (Ali *et al*., 2010), determining the online food retailing through the e-commerce is getting more and more popular.

There is not a widely accepted definition for e-commerce, which is generally classified as B2B, B2C, C2C and C2B e-commerce (Madu and Madu, 2002).

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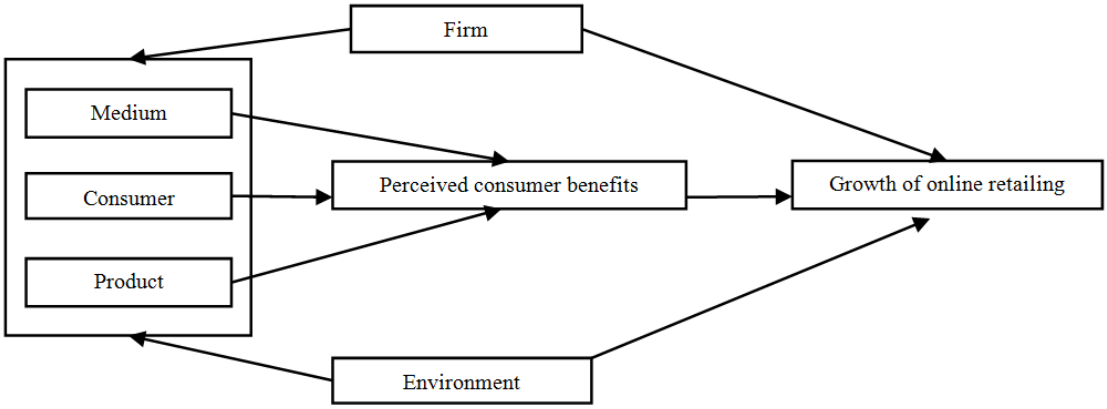

Fig. 1: A conceptual model for online retailing

Vijayaraman and Bhatia (2002) define e-commerce as a process to buy and sell products through computerized business transaction. Choi *et al*. (1997) distinguish in their e-commerce model three elements: product, agent and process and they argue that the transactions where one of the above elements involves the internet will be e-commerce. According to this definition, buying food from a vending machine with a smart card can be seen as e-commerce (Turban *et al*., 2002). In this study, online consumers are restricted to those who buy products via internet websites.

The consumer online behavior is studied by many researches. Szymanski and Hise (2000) study more than a thousand online consumers and find perception of convenience is the most important factor in terms of e-satisfaction assessments. This conclusion has been supported by the research of Corbett (2001), indicating convenience and time saving factors are the primary motivators of the online consumers. Mathwick (2002) study more than 800 shoppers and argues that consumers enter into online purchasing because they expect to receive positive value from their online participation. Sindhav and Balazs (1999) propose a conceptual model for on-line retailing, including three factors affect the growth of e-commerce: the company, the environment and the perceived consumer benefits. Perceived consumer benefits are, in their model, in turn seen as related to the medium, the consumer and the product. Grunert and Ramus (2005) review literature on factors that may have an impact on consumers' probability to buy food over the internet and suggest a modified model that delineates five groups of factor affecting perceived consumer benefits (Fig. 1). A research by Singh (2002) argues that e-services are important in B2C e-commerce for managing customer relations and enhancing sales. Park (2002) puts forward a model of consumer buying intention online which includes five main factors that influence online purchase: product type, product interest, shopping orientation, experience of online buying and website trust.

While it is generally acknowledged that the e-commerce website is one of the major factor to improve the willingness to buy products through internet and many related researches have been done on improving effectiveness of the e-commerce websites (Thorleuchter and Poel, 2010; Li and Li, 2011; Nielsen, 1999; Nielsen and Tahir, 2001; Aladwani and Palvia, 2002; Kim and Stoel, 2004; Koufaris, 2002; Soliman and Youssef, 2003). However, a study by Elliot and Fowell (2000) show that the online customers have been relatively frustrated with the quality of the websites they visited. Davidavičienė and Tolvaišas (2011) describe the quality factors of an e-commerce website and services based on the survey of Lithuanian online store visitors. Cao *et al*. (2005) identify factors of effect the e-commerce web site quality using an IS success model which include: system quality, information quality, service quality and attractiveness. The study by Lin (2007) shows that website design, interactivity, in formativeness, security responsiveness and trust affect customer satisfaction, while empathy does not have a statistically significant effect on customer satisfaction.

Swaminanthan *et al*. (1999) argue that consumers evaluate websites when they make purchase decisions and the perception of their shopping experience at the websites plays a major role in creating demand for online purchasing. The research of Zhang *et al*. (2011) shows that perceived website usability positively impacted customer repurchase intention. Investigating online consumers' website evaluation criteria is important for the companies to develop a website which can attract online consumers and communicate successfully with them, which eventually helps the company to sell its products and retain its online customers. However, most of the researches in the area indicate that this is a complicated task (Jones and Hughes, 2001; Sigman and Boston, 2013), in the mean

time, Goi (2012) observes that although website design and development is concerned, few sets of criteria are available on the web and from the researchers' website evaluation criteria.

In summary, the online promotion of B2C e-commerce websites both in theory and in practice has proven to be very important and since China is one of the developing countries which experience the highest online population growth, it is necessary to study the online customer behavior and online promotion of the e-commerce websites in China's market. However, there are few studies focusing on the food retailing market in terms of online consumer demand and online promotion of the B2C e-commerce websites in China, which is the primary motivation of this research.

METHODOLOGY

There are many factors influencing the quality of e-commerce, which determines that the issue is Multiple Criteria Decision-Making (MCDM) (Vincke, 1992). The TOPSIS method selected for the data analysis in this research was first proposed in 1981 (Hwang and Yoon, 1981) and it is employed to solve the related MCDM problems under the fuzzy environment (Muralidhar *et al*., 2013; Ataei *et al*., 2008; Zeki and Rifat, 2012).

Fuzzy sets and fuzzy numbers:

Definition 1: A Fuzzy set $\tilde{a}$ in a universe of discourse X is characterized by a membership function $\mu_{\tilde{a}}(x)$ which associates with each element x in X, a real number in the interval (0, 1). The function of $\mu_{\tilde{a}}(x)$ is termed the grade of membership of x in $\tilde{a}$ (Zadeh, 1965). The present study uses triangular Fuzzy numbers. $\tilde{a}$ can be defined by a triplet (a_1, a_2, a_3). Its conceptual schema and mathematical form are shown as below:

$$\mu_{\tilde{a}}(x)\begin{cases}0 & x \le a \\ \dfrac{x-a_1}{a_2-a_1} & a_1 \prec x \le a_2 \\ \dfrac{a_3-x}{a_3\text{-}a_2} & a_2 \prec x \le a_3 \\ 1 & x \succ a_3\end{cases}$$

Definition 2: Let $\tilde{a}$ = (a_1, a_2, a_3) and $\tilde{b}$ = (b_1, b_2, b_3) be two triangular fuzzy numbers. According to Wang (2009), a distance measure function $(\tilde{a}, \tilde{b})$ can be defined as below:

$$d(\tilde{a},\tilde{b}) = \sqrt{\frac{1}{3}[(a_1-b_1)^2+(a_2-b_2)^2+(a_3-b_3)^2]}$$

Definition 3: Let a triangular Fuzzy number $\tilde{a}$, then α-cut defined as below:

$$\tilde{a}_\alpha = [(a_2-a_1)\alpha+a_1, a_3-(a_3-a_2)\alpha]$$

Definition 4: Let $\tilde{a}$ = (a_1, a_2, a_3), $\tilde{b}$ = (b_1, b_2, b_3) be two triangular Fuzzy number and $\tilde{a}_\alpha$, $\tilde{b}_\alpha$ be α-cut, $\tilde{a}$ and $\tilde{b}$, then the method is defined to calculate the divided between $\tilde{a}$ and $\tilde{b}$ as follows:

$$\frac{\tilde{a}_\alpha}{\tilde{b}_\alpha} = \left[\frac{(a_2-a_1)\alpha+a_1}{-(b_3-b_2)\alpha+b_3}, \frac{-(a_3-a_2)\alpha+a_3}{(b_2-b_1)\alpha+b_1}\right]$$

When α = 0:

$$\frac{\tilde{a}_0}{\tilde{b}_0} = \left[\frac{a_1}{b_3}, \frac{a_3}{b_1}\right]$$

When α = 1:

$$\frac{\tilde{a}_1}{\tilde{b}_1} = \left[\frac{(a_2-a_1)+a_1}{-(b_3-b_2)+b_3}, \frac{-(a_3-a_2)+a_3}{(b_2-b_1)+b_1}\right]$$

$$\frac{\tilde{a}_1}{\tilde{b}_1} = \left[\frac{a_2}{b_2}, \frac{a_2}{b_2}\right]$$

So the approximated value of $\tilde{a}$ /$\tilde{b}$ will be:

$$\frac{\tilde{a}}{\tilde{b}} = \left[\frac{a_1}{b_3}, \frac{a_2}{b_2}, \frac{a_3}{b_1}\right]$$

Definition 5: Assuming that both $\tilde{a}$ = (a_1, a_2, a_3) and $\tilde{b}$ = (b_1, b_2, b_3), are real numbers, the distance measurement d ($\tilde{a}$, $\tilde{b}$) is identical to the Euclidean distance.

The basic operations on Fuzzy triangular numbers are as follows (Yang and Hung, 2007):

For approximation of multiplication: $\tilde{a}\otimes\tilde{b}$ = $(a_1\times b_1, a_2\times b_2, a_3\times b_3)$

For addition:

$$\tilde{a}\oplus\tilde{b} = (a_1+b_1, a_2+b_2, a_3+b_3)$$

Fuzzy membership function: In the evaluating process, the weights expressed with the linguistic terms, represent the important degrees of criteria from experts via surveys on subjective assessments. These linguistic terms are categorized into Very Low (VL), Low (L), Medium (M), High (H) and Very High (VH). Assume that all linguistic terms can be transferred into triangular fuzzy numbers and these fuzzy numbers are limited in (0, 1). As a rule of thumb, each rank is assigned an evenly spread membership function that has an interval of 0.30 or 0.25 (Yang and Hung, 2007).

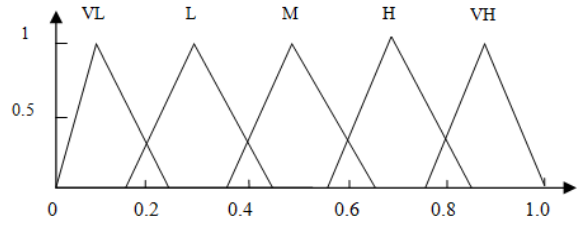

Fig. 2: Fuzzy triangular membership functions

Table 1: Transformation for fuzzy membership functions

Rank	Sub-criteria grade	Membership function
Very Low (VL)	1	(0.00, 0.10, 0.25)
Low (L)	2	(0.15, 0.30, 0.45)
Medium (M)	3	(0.35, 0.50, 0.65)
High (H)	4	(0.55, 0.70, 0.85)
Very High(VH)	5	(0.75, 0.90, 1.00)

Based on assumptions above, a transformation table can be found as shown in Table 1. Figure 2 illustrates the Fuzzy membership function (Yang and Hung, 2007).

Fuzzy TOPSIS model: It is formulated that a Fuzzy Multiple Criteria Decision Making (FMCDM) problem about the comparative evaluation of the selected websites. The FMCDM problem can be concisely expressed in matrix format as follows:

$$\begin{array}{c} \\ A_1 \\ A_2 \\ A_3 \\ \vdots \\ A_n \end{array} \begin{array}{c} \begin{array}{ccccc} C_1 & C_2 & C_3 & \cdots & C_n \end{array} \\ \begin{bmatrix} \tilde{x}_{11} & \tilde{x}_{12} & \tilde{x}_{13} & \cdots & \tilde{x}_{1n} \\ \tilde{x}_{21} & \tilde{x}_{22} & \tilde{x}_{23} & \cdots & \tilde{x}_{2n} \\ \tilde{x}_{31} & \tilde{x}_{32} & \tilde{x}_{33} & \cdots & \tilde{x}_{3n} \\ \vdots & & & & \\ \tilde{x}_{n1} & \tilde{x}_{n1} & \tilde{x}_{n1} & \cdots & \tilde{x}_{n1} \end{bmatrix} \end{array}$$

$$\tilde{W} = [\tilde{w}_1, \tilde{w}_2, \cdots \tilde{w}_n]$$

where,

$$x_{ij}, i = 1, 2, \cdots, m; j = 1, 2, \cdots, n$$

and

$$\tilde{w}_j, j = 1, 2, \cdots, n$$

are linguistic triangular Fuzzy numbers:

$$\tilde{x}_{ij} = (a_{ij}, b_{ij}, c_{ij}) \text{ and } \tilde{w}_j = (a_{j1}, b_{j2}, c_{j3})$$

The normalized Fuzzy decision matrix is denoted by:

$$\tilde{R} = [\tilde{r}_{ij}]_{m \times n}$$

The weighted Fuzzy normalized decision matrix is shown as follows:

$$V = \begin{bmatrix} \tilde{v}_{11} & \tilde{v}_{12} & \tilde{v}_{13} & \cdots & \tilde{v}_{1n} \\ \tilde{v}_{21} & \tilde{v}_{22} & \tilde{v}_{23} & \cdots & \tilde{v}_{2n} \\ \tilde{v}_{31} & \tilde{v}_{32} & \tilde{v}_{33} & \cdots & \tilde{v}_{3n} \\ \vdots & & & & \\ \tilde{v}_{n1} & \tilde{v}_{n1} & \tilde{v}_{n1} & \cdots & \tilde{v}_{n1} \end{bmatrix}$$

$$= \begin{bmatrix} \tilde{w}_1\tilde{r}_{11} & \tilde{w}_2\tilde{r}_{12} & \tilde{w}_3\tilde{r}_{13} & \cdots & \tilde{w}_n\tilde{r}_{1n} \\ \tilde{w}_1\tilde{r}_{21} & \tilde{w}_2\tilde{r}_{22} & \tilde{w}_3\tilde{r}_{23} & \cdots & \tilde{w}_n\tilde{r}_{2n} \\ \tilde{w}_1\tilde{r}_{31} & \tilde{w}_2\tilde{r}_{32} & \tilde{w}_3\tilde{r}_{33} & \cdots & \tilde{w}_n\tilde{r}_{3n} \\ \vdots & & & & \\ \tilde{w}_1\tilde{r}_{m1} & \tilde{w}_2\tilde{r}_{m2} & \tilde{w}_3\tilde{r}_{m3} & \cdots & \tilde{w}_n\tilde{r}_{mn} \end{bmatrix}$$

Given the above Fuzzy theory, the proposed Fuzzy TOPSIS procedure is then defined as follows:

Step 1: Choose the x_{ij}, $i = 1, 2, \ldots, m; j = 1, 2, \ldots, n$ for alternatives with respect to criteria and $\tilde{w}_j$, $j = 1, 2, \ldots, n$ for the weight of the criteria.

Step 2: Construct the weighted normalized Fuzzy decision matrix V.

Step 3: Identify positive ideal (A^+) and negative ideal (A^-) solutions:

$$A^+ = \{\tilde{v}_1^+, \tilde{v}_2^+, \cdots \tilde{v}_n^+\}$$
$$= \{(\max_i \tilde{v}_{ij} \mid i = 1, 2, \cdots, m), j = 1, 2, \cdots, n\}.$$

$$A^- = \{\tilde{v}_1^-, \tilde{v}_2^-, \cdots \tilde{v}_n^-\}$$
$$= \{(\min_i \tilde{v}_{ij} \mid i = 1, 2, \cdots, m), j = 1, 2, \cdots, n\}.$$

Step 4: Calculate separation measures. The distance of each alternative from A^+ and A^- can be identified as follows:

$$d_i^+ = \frac{1}{n}\sum_{j=1}^{n} d(\tilde{v}_{ij}, \tilde{v}_j^+), i = 1, 2, \cdots, m$$

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

Step 5: Calculate the similarities to ideal solution:

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

Step 6: Rank alternatives according to CC_i in descending order (Yang and Hung, 2007).

DATA COLLECTION AND RESULTS ANALYSIS

Since this research is mainly focus on the food retailing through the B2Ce-commerce websites in China, the top 10 B2C e-commerce websites in retail market shown in Table 2 are selected based on the transaction size.

The modified model for online retailing proposed by Grunert and Ramus (2005) is adopted in this study. According to this model, there are five groups of factors affecting perceived consumer benefits as shown in Fig. 1. A pre-designed observation sheet including these five groups of factors (medium, consumer, product, firm and environment) is used to collect all necessary data from these e-commerce websites. The selected items from all websites are rated with the widely used Little Scale method, i.e., from a scale of 1 (being the worst) to 5 (meaning excellent) accordingly.

The detailed index for each factor affecting perceived consumer benefit are proposed in this study according to related research and the results of the collected data are summarized in Table 3 to 7. Sinadhav and Balazs (1999) mention three relevant characteristics of the medium: interactivity, variety of channels and logical capability. Interactivity refers to the work by Alba *et al*. (1997), who define it by response time and response contingency. Considering the websites perspective in this study, color assortment and visual attraction are included and it can be seen that most of the e-commerce websites (7 out 10) show satisfactory

Table 2: Top 10 B2C e-commerce websites in retail market in China

No	E-commerce website	Transaction proportion (%)
1	Tmall	52.1
2	Jingdong	22.3
3	Suning	3.6
4	Tencent	3.3
5	Vancl	2.7
6	Amazon (China)	2.3
7	Coo8	1.4
8	Dangdang	1.2
9	Yixun	0.6
10	Newegg (China)	0.3

Table 3: Summary of the medium

Category	Ranking	Number	(%)
Color assortment	Need improvement (<2.67)	3	30
	Satisfied (≥2.67)	7	70
Total		10	100
Visual attraction	Need improvement (<2.67)	3	30
	Satisfied (≥2.67)	7	70
Total		10	100
Online seller	Time-consuming (<1 min)	3	30
	Time-consuming (≥1 min)	7	70
Total		10	100
Handle consumers' complaints	Time-consuming (<0.5 days)	4	40
	Time-consuming (≥0.5 days)	6	60
User friendly of the structure	Need improvement (<2.67)	1	10
	Satisfied (≥2.67)	9	90
Total		10	100
Varity of channels	Need improvement	9	90
	Satisfied	1	10
Total		10	100
Text	Exist in website (1)	10	100
	No exist in website (0)	0	0
Video	Exist in website (1)	1	10
	No exist in website (0)	9	90
Photo	Exist in website (1)	10	100
	No exist in website (0)	0	0
Comparing of products	Need improvement (<2.67)	2	20
	Satisfied (≥2.67)	8	80
Total		10	100
Detailed sorting	Need improvement (≤4)	2	20
	Satisfied (>4)	8	80
Total		10	100

Table 4: Summary of the consumer

Category	Ranking	Number	(%)
Nonworking time delivery	Exist (1)	6	60
	Non exist (0)	4	40
Total		10	100
Logistic speed	Need improvement (<2.67)	3	30
	Satisfied (≥2.67)	7	70
Total		10	100
E-service	Need improvement (<4)	7	70
	Satisfied (≥4)	3	30
Total		10	100
Personalized web pages	Exist in (1)	10	100
	No exist (0)	0	0
FAQs	Exist in (1)	9	90
	No exist (0)	1	10
Chat room	Exist in (1)	8	80
	No exist (0)	2	20
E-mail and automated response	Exist in (1)	4	40
	No exist (0)	6	60
Help desks and call centers	Exist (1)	2	20
	No exist (0)	8	80
Support automatic payment	Exist (1)	10	100
	Non exist (0)	0	0
Total		10	100
Support cash on delivery	Exist (1)	8	80
	Non exist (0)	2	20
Total		10	100

Table 5: Summary of the environment

Category	Ranking	Number	(%)
Traffic rank	(0, 50)	3	30
	(50, 100)	3	30
	(100, 500)	2	20
	(500, +∞)	2	20
Total		10	100
Daily page-viewing on site	(0, 5)	5	50
	(5, 10)	4	40
	(10, +∞)	1	10
Total		10	100
Retail size	Need improvement (≤4)	3	30
	Satisfied (>4)	7	70
Total		10	100
Coffee	(0, 10)	6	60
	(10, 50)	2	20
	(50, +∞)	2	20
Organic food	(0, 5)	5	50
	(5, 10)	2	20
	(10, +∞)	3	30
International market food	(0, 5)	4	40
	(5, 10)	5	50
	(10, +∞)	1	10
Average lead-time of main page	Time-consuming (<4 sec)	6	60
	Time-consuming (≥4 sec)	4	40
Total		10	100
Security	Need improvement (<2.67)	0	0
	Satisfied (≥2.67)	10	100
Total		10	100

Table 6: Summary of the product

Category	Ranking	Number	(%)
Classification of products	Need improvement (≤4)	3	30
	Satisfied (>4)	7	70
Total		10	100
Multi-restriction search	Exist (1)	10	100
	Non exist (0)	0	0
Total		10	100
Selectivity of similar products	Need improvement (<2.67)	2	20
	Satisfied (≥2.67)	8	80
Total		10	100
Product introduction	Highly detailed	2	20
	Detailed	6	60
	Not enough detailed	2	20
Total		10	100
Buyers' evaluation	Exist (1)	10	100
	Non exist (0)	0	0
Wide variety of products	Need improvement (≤4)	5	50
	Satisfied (>4)	5	50
Total		10	100

Table 7: Summary of the firm

Category	Ranking	Number	(%)
Loyalty programs	Need improvement (≤3)	3	30
	Satisfied (>3)	7	70
Total		10	100
Benefits to consumers	Need improvement (≤3)	4	40
	Satisfied (>3)	6	60
Total		10	100
Free delivery	Exist (1)	9	90
	Non exist (0)	1	10
Free return	Exist (1)	10	100
	Non exist (0)	0	0
Presence of transparent	Need improvement (≤4)	3	30
	Satisfied (>4)	7	70
Total		10	100
Efficient logistic systems	Need improvement (≤3)	0	0
	Satisfied (>3)	10	100
Total		10	100
Data supplied	Exist (1)	10	100
	Non exist (0)	0	0
Deliver products on time	Exist (1)	7	70
	Non exist (0)	3	30

Table 8: The measures of the qualities of the e-commerce websites in food retailing

Factor	Criteria	Sub-criteria
Medium	Interactivity	SC_1 color assortment
		SC_2 visual attraction
		SC_3 response time
		SC_4 user friendly of the structure
	Varity of channels	sc_5 text
		SC_6 photo
		SC_7 video
	Logical capability	SC_8 comparing of products
		SC_9 detailed sorting
Consumer	Desire	SC_{10} nonworking time delivery
		SC_{11} logistic speed
		SC_{12} E-service
	Ability	SC_{13} support automatic payment
		SC_{14} support cash on delivery
Environment	Critical mass	SC_{15} traffic ranking
		SC_{16} daily time on site
		SC_{17} retail size
	Technical considerations	SC_{18} average lead time of main page
		SC_{19} security
Product	Easy to search	SC_{20} classification of products
		SC_{21} multi-restriction search
	Information intensity	SC_{22} product introduction
		SC_{23} buyers' evaluation
	Degree of differentiation	SC_{24} selectivity of similar products
		SC_{25} wide variety of products
Firm	Creation of stickiness	SC_{26} loyalty programs
		SC_{27} benefits to consumers
	Enhancing transaction efficiency	SC_{28} presence of transparent
		SC_{29} efficient logistic systems

performance as shown in Table 3. Online seller of the website could help the online shoppers to get the exact information they wanted. However, 3 out of 10 selected websites don't have the online sellers, so there is probability that the online shoppers can't acquire the information they wanted to know about the products they intend to buy when they have some questions and finally give up buying them. In addition, the response time of the online sellers as well as the consumers' complaints definitely need to be improved as show in Table 3. Variety of channels refers to the number of channels, e.g., text and video. However, a large proportion (90%) of the selected websites doesn't have video clips, which is clearly more attractive and persuasive to potential online shoppers. Logical capability refers to the opportunity to perform logical operations on the data supplied, e.g., sorting and comparing.

In consumer market, the quality of the service is the most important for establishing loyal relationships between buyer and seller. There are some web-related tools available to provide online services to consumers in e-commerce, e.g., personalized web pages, FAQs (Frequently asked questions), chat room, e-mail and automated response, help desks and call centers (Singh, 2002). However, as shown in Table 4, the application of these e-service tools is not satisfying. For example: more than half of the observed e-commerce websites never apply the help desks and call centers. It is no doubt that the consumers prefer to online shopping because of its convenience. You can get what you wanted at home with the click of the mouse! Nonworking time delivery can help the online shoppers to pick up the packages when they at home. However, 4 of the selected websites don't offer the service.

Sindhav and Balazs (1999) discuss two aspects of the environment: critical mass and technical and legal considerations. Critical mass refers to a minimum level of both consumers and retailers on the internet which are regarded as necessary for online shopping to take off, which is less clear, though, where that threshold is. In this research, three measures are employed to assess the popularity of the selected websites in order to make sure that they meet or exceed the minimum level:

- Online traffic rank
- Daily page-viewing on site
- Retail size

As shown in Table 5, half of the observed websites (5 out of 10) selected for which daily page-viewing per user is lower than 5 pages, which implying that this part of the visitors don't buy the desired products on these e-commerce websites. Four of the selected website is ranked after 100 based on the number of the visitors, implying that there are not many online shoppers visiting these e-commerce websites frequently. It is hard to identify the retail size of the food retailing for the e-commerce website, so coffee, organic food and international market food as selected as samples to make a rough evaluation. For example, we search for organic in the websites and check the number of the brands sold in these websites. As shown in Table 5, the number of the brands of the organic food in half of the observed e-commerce websites is less than 5. As the increase of the income, there are more and more health-conscious consumers who want to buy organic food or international market food. However, there are not various selections for these consumers.

Average lead-time of main page and security are identified as the measures for technical and legal considerations. One of the e-commerce challenges on the websites is when users experience intolerably long wait for a website's page to load. When the loading time exceeds the time that an online shopper is willing to wait, he will either redirect the web-browser to another website or never use the website again (Weinberg, 2000; Roslow *et al*., 1992). However, as shown in Table 5, the average leadtime of opening the main page of the observed e-commerce websites is relatively slow.

Table 9: The linguistic weights given by five experts

No.	E_1	E_2	E_3	E_4	E_5	No.	E_1	E_2	E_3	E_4	E_5
SC_1	L	VL	M	VL	VL	SC_{16}	H	H	H	M	H
SC_2	M	M	L	L	H	SC_{17}	VH	VH	VH	VH	H
SC_3	H	H	H	M	H	SC_{18}	H	H	H	M	H
SC_4	H	VH	H	M	H	SC_{19}	VH	VH	VH	VH	VH
SC_5	H	H	H	H	VH	SC_{20}	H	M	M	M	H
SC_6	VH	VH	VH	VH	VH	SC_{21}	H	H	VH	H	H
SC_7	H	M	H	H	VH	SC_{22}	VH	VH	VH	H	VH
SC_8	VH	VH	VH	H	VH	SC_{23}	VH	VH	H	H	VH
SC_9	H	M	L	M	M	SC_{24}	VH	VH	VH	M	VH
SC_{10}	H	M	H	H	H	SC_{25}	H	VH	H	VH	VH
SC_{11}	H	H	VH	M	H	SC_{26}	M	M	L	M	M
SC_{12}	VH	VH	VH	H	H	SC_{27}	H	H	H	H	M
SC_{13}	M	M	H	H	M	SC_{28}	H	M	M	H	H
SC_{14}	H	H	M	H	VH	SC_{29}	H	M	M	M	H
SC_{15}	H	H	M	H	VH						

Table 10: Part of the normalized decision matrix for TOPSIS analysis

No.	SC_1	SC_2	SC_3	SC_4	SC_5	SC_6
A_1	0.5	1.0	1.00	1.0	1	1
A_2	1.0	1.0	0.75	1.0	1	1
A_3	0.5	0.5	0.75	1.0	1	1
A_4	1.0	1.0	0.75	1.0	1	1
A_5	0.5	0.5	0.50	1.0	1	1
A_6	0.0	0.0	0.00	0.0	1	1
A_7	0.5	0.5	0.50	0.5	1	1
A_8	0.5	0.5	0.50	1.0	1	1
A_9	0.0	0.0	0.50	0.5	1	1
A_{10}	0.0	0.0	0.25	0.5	1	1

Table 11: Part of the normalized decision matrix using fuzzy linguistic variables

No.	SC_1	SC_2	SC_3	SC_4	SC_5	SC_6
A_1	M	VH	VH	VH	VH	VH
A_2	VH	VH	H	VH	VH	VH
A_3	M	M	H	VH	VH	VH
A_4	VH	VH	H	VH	VH	VH
A_5	M	M	M	VH	VH	VH
A_6	VL	VL	VL	VL	VH	VH
A_7	M	M	M	M	VH	VH
A_8	M	M	M	VH	VH	VH
A_9	VL	VL	M	M	VH	VH
A_{10}	VL	VL	L	M	VH	VH

A clear classification of goods and wide variety of products are believed to have an impact on how consumers search for information about products and evaluate them is based on whether they are characterized mainly by search, experience or credence qualities (Darby and Karni, 1973). However, it can be seen again that in this regard, there are many issues and challenges in these websites in terms of product quantities and service. For instant, thirty percent of the selected websites need to improve the classification of products, as shown in Table 6. The variety of food products is not satisfactory for half of the top 10 B2C e-commerce websites. In addition, the product introduction in two of the observed websites is not very detailed, which is definitely very important for e-commerce websites to attract more online shoppers and reduce return possibility.

Zott *et al*. (2000) discuss two factors as success factors in e-commerce for firms: creation of stickiness and enhancing transaction efficiency. The related measures in terms of creation of stickiness and enhancing transaction efficiency are shown in Table 7. Transaction efficiency is tightly linked to the presence of transparent and efficient logistics systems (Loebbecke and Powell, 1998), which can create additional consumer benefit of online retailing compared to conventional store shopping. However, 3 out of 10 top B2C e-commerce websites need to improve the presence of transparent and almost half of these observed websites (4 out of 10) need to improve the benefits for consumers.

Solutions from fuzzy TOPSIS analysis: To further identify the relative importance of the major measures for evaluating the e-commerce website effectiveness in terms of promotional and marketing power discussed in the earlier section, the fuzzy TOPSIS, as a quantitative tool, is employed in this research. These specific measures are proposed based on the conceptual model suggested by Grunert and Ramus (2005) in Table 8 for the further quantitive analysis:

The important degrees of the above sub-criteria weights are given with linguistic terms, i.e., VL, L, M, H and VH, employed by five experts E_1, E_2, E_3, E_4 and E_5, as shown in Table 9.

The fuzzy linguist variables of the above matrix are then transformed into a Fuzzy triangular membership function. In the next step, we calculate the average of the elements of each row and then the average criteria weights are derived:

$W_1 = (0.10, 0.22, 0.37)$, $W_2 = (0.31, 0.46, 0.61)$,
$W_3 = (0.51, 0.54, 0.69)$, $W_4 = (0.55, 0.70, 0.84)$,
$W_5 = (0.59, 0.74, 0.88)$, $W_6 = (0.75, 0.90, 1.00)$,
$W_7 = (0.55, 0.70, 0.84)$, $W_8 = (0.71, 0.86, 0.97)$,
$W_9 = (0.35, 0.50, 0.65)$, $W_{10} = (0.51, 0.66, 0.81)$,
$W_{11} = (0.55, 0.70, 0.84)$, $W_{12} = (0.67, 0.82, 0.94)$,
$W_{13} = (0.43, 0.62, 0.77)$, $W_{14} = (0.55, 0.70, 0.84)$,
$W_{15} = (0.55, 0.70, 0.84)$, $W_{16} = (0.51, 0.66, 0.81)$,
$W_{17} = (0.71, 0.86, 0.97)$, $W_{18} = (0.51, 0.66, 0.81)$,
$W_{19} = (0.75, 0.90, 1.00)$, $W_{20} = (0.43, 0.62, 0.77)$,
$W_{21} = (0.59, 0.74, 0.88)$, $W_{22} = (0.71, 0.86, 0.97)$,
$W_{23} = (0.67, 0.82, 0.94)$, $W_{24} = (0.67, 0.82, 0.93)$,
$W_{25} = (0.71, 0.86, 0.97)$, $W_{26} = (0.12, 0.26, 0.41)$,
$W_{27} = (0.51, 0.54, 0.69)$, $W_{28} = (0.47, 0.62, 0.77)$,
$W_{29} = (0.43, 0.58, 0.73)$

Table 12: Part of the fuzzy decision matrix

No.	SC_1	SC_2	SC_3	SC_4	SC_5	SC_6
A_1	(0.35, 0.50, 0.65)	(0.75, 0.90, 1.00)	(0.75, 0.90, 1.00)	(0.75, 0.90, 1.00)	(0.75, 0.90, 1.00)	(0.75, 0.90, 1.00)
A_2	(0.75, 0.90, 1.00)	(0.75, 0.90, 1.00)	(0.55, 0.70, 0.85)	(0.75, 0.90, 1.00)	(0.75, 0.90, 1.00)	(0.75, 0.90, 1.00)
A_3	(0.35, 0.50, 0.65)	(0.35, 0.50, 0.65)	(0.55, 0.70, 0.85)	(0.75, 0.90, 1.00)	(0.75, 0.90, 1.00)	(0.75, 0.90, 1.00)
A_4	(0.75, 0.90, 1.00)	(0.75, 0.90, 1.00)	(0.55, 0.70, 0.85)	(0.75, 0.90, 1.00)	(0.75, 0.90, 1.00)	(0.75, 0.90, 1.00)
A_5	(0.35, 0.50, 0.65)	(0.35, 0.50, 0.65)	(0.35, 0.50, 0.65)	(0.75, 0.90, 1.00)	(0.75, 0.90, 1.00)	(0.75, 0.90, 1.00)
A_6	(0.00, 0.10, 0.25)	(0.00, 0.10, 0.25)	(0.00, 0.10, 0.25)	(0.00, 0.10, 0.25)	(0.75, 0.90, 1.00)	(0.75, 0.90,1.00)
A_7	(0.35, 0.50, 0.65)	(0.35, 0.50, 0.65)	(0.35, 0.50, 0.65)	(0.35, 0.50, 0.65)	(0.75, 0.90, 1.00)	(0.75, 0.90, 1.00)
A_8	(0.35, 0.50, 0.65)	(0.35, 0.50, 0.65)	(0.35, 0.50, 0.65)	(0.75, 0.90, 1.00)	(0.75, 0.90, 1.00)	(0.75, 0.90, 1.00)
A_9	(0.00, 0.10, 0.25)	(0.00, 0.10, 0.25)	(0.35, 0.50, 0.65)	(0.35, 0.50, 0.65)	(0.75, 0.90, 1.00)	(0.75, 0.90, 1.00)
A_{10}	(0.00, 0.10, 0.25)	(0.00, 0.10, 0.25)	(0.15, 0.30, 0.45)	(0.35, 0.50, 0.65)	(0.75, 0.90, 1.00)	(0.75, 0.90, 1.00)
W	(0.10, 0.22, 0.37)	(0.31, 0.46, 0.61)	(0.51, 0.54, 0.69)	(0.55, 0.70, 0.84)	(0.59, 0.74, 0.88)	(0.75, 0.90, 1.00)

Table 13: The distance of each alternative from A^+ and A^-

E-commerce	d_i^+	d_i^-	CCi
Tmall	0.12	0.31	0.725
Jingdong	0.07	0.36	0.845
Suning	0.17	0.25	0.601
Tencent	0.20	0.22	0.527
Vancl	0.19	0.23	0.552
Amazon	0.22	0.20	0.473
Coo8	0.20	0.23	0.534
Dangdang	0.11	0.31	0.735
Yixun	0.27	0.15	0.355
Newegg	0.36	0.07	0.154

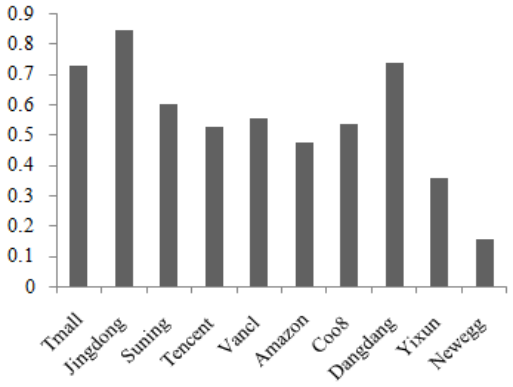

Fig. 3: Summary of the evaluation of the top 10 B2C e-commerce websites in food retailing

The original decision matrix is identified by the raters by observing the websites and the normalized decision matrix is then derived from the original data as shown in Table 10.

The larger, the better type (Yang and Hung, 2007):

$$r_{ij} = \frac{\left[x_{ij} - \min\left\{x_{ij}\right\}\right]}{\left[\max\left\{x_{ij}\right\} - \min\left\{x_{ij}\right\}\right]}$$

The smaller, the better type:

$$r_{ij} = \frac{\left[\max\left\{x_{ij}\right\} - x_{ij}\right]}{\left[\max\left\{x_{ij}\right\} - \min\left\{x_{ij}\right\}\right]}$$

For the present study, SC_7, SC_8, SC_9 and SC_{10} belong to the smaller-the-better type and the others belong to the larger-the-better type. Then the normalized decision matrix using Fuzzy linguistic variables shown in Table 11 can be identified by the Fuzzy membership function proposed in above Section.

The Fuzzy linguistic variable is then transformed into a Fuzzy triangular membership function as shown in Table 12 and then the resulting Fuzzy weighted decision matrix can be derived based on Table 12 and the weights identified before. The distance of each alternative from A^+ and A^-, as well as the similarities to an ideal solution (CCi), is obtained in Table 13.

In order to see the result more clearly, the resulting Fuzzy TOPSIS analysis is shown in Fig. 3.

The result of the top 10 B2C e-commerce websites shows that 6 out of 10 observed e-commerce websites score less than 0.6, implying that these e-commerce websites have a room for a significant improvement through better and improved website design and updates in order to improve the customer loyalty and food sales.

CONCLUSION

This study is an attempt to identify the factors that may have an impact on consumers' probability to buy food through the internet and investigate the current issues and challenges for the top 10 B2C e-commerce websites in terms of promoting food retailing in China. The specific measures are proposed and Fuzzy TOPSIS is employed to evaluate the quality of these websites based on the conceptual model of willingness to buy products through internet for the online consumers (Grunert and Ramus, 2005). The primary data for this research are collected through a pre-designed observation sheet. Fuzzy TOPSIS is employed to evaluate the current status and effectiveness of the selected e-commerce websites.

It can be seen from the result that Jingdong, Dangdang and Tmall score the highest, while Newegg (www.newegg.com.cn) scores the lowest (0.154), which is also the last one in the top 10 B2C e-commerce websites in retail market in terms of transaction size and the main reason for the lowest score is few variety of the food products. It is no doubt that the Newegg in China can improve the transaction size by increasing the product variety and the other

factors have an impact on consumers' probability to buy food online. There is not much difference among the scores of the rest of the seven B2C e-commerce websites: generally around 35%.

According to the criteria weights derived from this section earlier, the relative top six important measures to evaluate e-commerce websites are:

- Security
- Photo
- Comparing of products
- Retail size
- Product introduction
- Wide variety of products

implying that the online shoppers get very attached to the good selection of the products and the security of the payment online. As such, several important managerial implications are:

- Applying the product categories as many as possible
- Providing the real photos as specific as possible
- Providing the comparing function to suggest the similar products when the online consumers search the products they wanted to buy
- Taking steps to attract more manufactures to sell their products on your e-commerce websites

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