Developing Shopping Websites Competitive Advantages using the fuzzy DEMATEL method

Sun, Chia-Chi

Assistant Professor, Grade Institute & Department of International Business, Tamkang University

Email: samsun0712@gmail.com; ccsun@mail.tku.edu.tw

Abstract

This research adopts the DEMATEL and fuzzy theory as the main analytical tool. To segment the required competencies for shopping website advantages through DEMATEL. The results of this research show that the critical factor of Ease Use with the largest amount is the most important cause factor for competitive advantage for the shopping websites and could make the significant role in responding to the performance of shopping websites. On the other hand, the amount of Efficiency is the most important factor of the effect group. This paper draws on the research results for implications of managerial practice, and then suggests some empirical tactics in order to enhance management performance for the website shopping industry.

Keywords: shopping website, technology acceptance factors, website service quality, Decision Making Trial and Evaluation Laboratory (DEMATEL), fuzzy theory

1. Introduction

Previous studies have emphasized that the issue of consumer purchase process is important (i.e., Butler and Peppard, 1998; Rita and Henriette, 2004; Dan et al., 2008). Particularly, shaped during the online purchase process, consumers' attitudes and beliefs regarding convenience and security concerns have significant effects on their intention to purchase online (Limayem et al., 2000). Shanker, Smith, and Rangaswamy (2000) also contended that service provided during and following the purchase is essential to e-consumers' repeat purchases.

To solve the managerial issue, we apply the Decision Making Trial and Evaluation Laboratory (DEMATEL). It is a suitable method that helps us in gathering group knowledge for forming a structural model, as well as in visualizing the casual relationship of sub-systems through a casual diagram (Wu & Lee, 2007).In addition, the judgment of decision-making are often given as crisp values, but crisp values are an inadequate reflection of vagueness of the real world (Bellman & Zadeh, 1970; Zadeh, 1965). Hence we combined the fuzzy logic and DEMATEL to conduct the issue.

Therefore, the purpose d this paper wants to build up a fuzzy DEMATL model to segment the required competencies for shopping website advantages. We take Taiwan website as our case study. We try to discuss the relationship between different factors and make a casual map hat find out the casual group and effect group. Finally, provide shopping website operators with some strategic recommendations based on the research results.

2. What are competitive advantages for shopping website?

In this paper attention will be given mainly to online B2C transactions. This study begins by establishing a conceptual framework through a review of related theories and literature. There are three topics of conceptualization considered in this section: technology acceptance factors, website service quality and specific holdup cost.

2.1 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 (1989) proposed the technology acceptance model (TAM) to explain and predict user acceptance of information systems (IS) or information technology (IT). He (1989) 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

(1989) then also suggested that PEOU has a positive, indirect effect on system usage through PU.

Shih (2004) argued that individual attitudes toward e-shopping are strongly and positively correlated with user acceptance. His empirical research results (2004) 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. 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 (Shanker et al., 2000).

Based on above discussion, Technology Acceptance Factor contains four criteria about the competitive advantage of shopping websites. There are Efficiency, Practical, Ease Use and Time-Saving. Efficiency means that the browse function in the shopping website can increase customers' shopping efficiency. Practical means that the credit function in the shopping website can raise customers' shopping efficiency. Ease Use means that the operations of the shopping website are easy to understand and convenient to use. Time-Saving means that the shopping website saves customers a lot of other related shopping time.

2.2 Website Service Quality

For Parasuraman, Zeithaml, and Berry (1985; 1988a), service quality (SERVQUAL) is measured in 10 phases: accessibility, communication, capability, courtesy, trustworthiness, reliability, responsiveness, safety, tangibility, and understanding with customers. Parasuraman et al. (1988a；1988b) also reduced the 10 to 5: tangibility, reliability, responsiveness, assurance, and empathy.

In electronic commerce, service quality measures have been applied to assess the quality of search engines and factors associated with Web site 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. Yang, Wu and Wang (2008) used four dimensions of SERVQUAL, which include reliability, responsiveness, assurance, and empathy, to measure the users' cognition of SERVQUAL in online channel. Keeney (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 operationalzed by e-service process attributes during the customer's interaction with the e-service.

Relevant to service dimensions of the website, Devaraj, Fan, and Kohli (2002) 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.

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 et al., 2007). Furthermore, based on data from an online questionnaire of customers of an e-banking service, Oliveira (2007) employed structural equation modelling 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.

According to above discussion, Website Service Quality contains four criteria about the competitive advantage of shopping websites. There are Communication, Confident, Security and Trust. Communication means that the same shopping website personnel or records would remember customers' related consumption habits when customers shopping again. Confident means that customers are confident in buying products in the shopping website. Security means that customers feel secure to buy products in the shopping website. Trust means that customers trust in the shopping website that can provide appropriate service to them.

2.3 Specific holdup cost

Chiu (2006) divided transaction cost into four parts: explicit unit benefit cost, information search cost, moral hazard cost, and specific holdup cost.

With regard to the implicit factors, this study mainly discusses the customer's inner mental perceptions when shopping online. Thus, we will not discuss what explicit unit benefits the shopping website can offer to customers, but will largely measure how much a specific holdup cost would affect customers' e-satisfaction and e-loyalty. It's also because that the issue of familiarity/habit has been overlooked in the study of ecommerce.

In general, specific holdup cost refers to the relative lack of transferability of assets intended for use in a given transaction to other uses. Highly specific assets represent sunk costs that have relatively little value beyond their use in the context of a specific transaction. The concept of specific holdup cost is similar to that of asset specificity. Coase (1988) has suggested six main types of asset holdup specificity: site specificity, physical asset specificity, human asset specificity, brand names, dedicated assets, and temporal specificity. Customers often develop specialized *knowledge* that would be of limited application outside of the relationship in which it was developed (Williamson, Wachter, and Harris 1975). Asset specificity arises because this knowledge is specific to a given relationship – specialized vocabularies, for example, could not be transferred to relationships with another partner.

Therefore, in terms of online shopping activities, if the customer is familiar with transaction methods of shopping websites, he will use these shopping websites more. This also allows the customer to spend more effort and time in learning how to purchase from a particular shopping website. In dealing with the specific holdup cost run through it, the customer can possibly be fastened to the shopping website. In this regard, when customers and shopping websites, for example, make a specific holdup cost, customers' loyalty will be enhanced.

In terms of above discussion, Specific holdup cost contains four criteria about the competitive advantage of shopping websites. There are Familiar, Past Experience, Proficiency and Knowledgeable. Familiar means that customers that understand how to use the shopping website have already spent time to grope and learn. Past Experience means that customers use this shopping website because customers are already used to it. Proficiency means that customers need to spend more time and efforts fumbling and learning it afresh customers give up this shopping website and use another one. Knowledgeable means that customers have infused much time and energies to confirm that this shopping website fits in with customers' needs and preferences.

3. The Fuzzy DEMATEL Method

The DEMATEL method was developed to study the structural relations in the complex system (Liou, Yen & Tzeng, 2008). The mathematics concept borrowed from Liou , Yen & Tzeng (2008) and Wu (2008). The DEMATEL model constructing process is described below:

Step 1: Generating the assessments of decision –makers.

To measure the relationships between the factors which are demonstrated by the $F=\{F_i \mid i=1,2,\ldots,n\}$, the experts were asked to make sets of pair wise comparison. Then the $\tilde{Z}_{(1)},\tilde{Z}_{(2)},\ldots,\tilde{Z}_{(n)}$ can be obtained. Fuzzy matrix $\tilde{Z}_{(k)}$ is the initial direction relation fuzzy matrix of expert k as following Equation (1).

$$\tilde{Z}^k=\begin{bmatrix} 0 & \tilde{Z}_{12}^{(k)} & \cdots & \tilde{Z}_{1n}^{(k)} \\ \tilde{Z}_{21}^{(k)} & 0 & \cdots & \tilde{Z}_{2n}^{(k)} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{Z}_{n1}^{(k)} & \tilde{Z}_{n2}^{(k)} & \cdots & 0 \end{bmatrix};\quad k=1,2,\ldots,P \qquad \text{……………………………………………..(1)}$$

$$\tilde{Z}_{ij}^{(k)}=(l_{ij}^{(k)},m_{ij}^{(k)},u_{ij}^{(k)})$$

Step 2: Normalizing the direct-relation fuzzy matrix

The values of $\tilde{\alpha}_i^{(k)}$ and $r^{(k)}$ are the triangular fuzzy numbers as following Equation (2) and (3).

$$\tilde{\alpha}_i^{(k)}=\sum \tilde{z}_{ij}^{(k)}=(\sum_{j=1}^{n} l_{ij}^{(k)},\sum_{j=1}^{n} m_{ij}^{(k)},\sum_{j=1}^{n} u_{ij}^{(k)}) \text{ ……………………………….(2)}$$

$$r^{(k)}=\max(\sum_{j=1}^{n} u_{ij}^{(k)}) \quad 1\le i\le n \text{ ………………………………………………………….(3)}$$

In addition, the linear scale transformation is used to transform the criteria scale into comparable scales. Then we can get the normalized direct-relation fuzzy matrix as $\tilde{X}^{(k)}$.

$$\tilde{X}^k=\begin{bmatrix} \tilde{X}_{11}^{(k)} & \tilde{X}_{12}^{(k)} & \cdots & \tilde{X}_{1n}^{(k)} \\ \tilde{X}_{21}^{(k)} & \tilde{X}_{22}^{(k)} & \cdots & \tilde{X}_{2n}^{(k)} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{X}_{n1}^{(k)} & \tilde{X}_{n2}^{(k)} & \cdots & \tilde{X}_{nn}^{(k)} \end{bmatrix};\quad k=1,2,\ldots,P \qquad \text{…………………………………………(4)}$$

$$\tilde{Z}_{ij}^{(k)}=(l_{ij}^{(k)},m_{ij}^{(k)},u_{ij}^{(k)})$$

where $\tilde{x}_{ij}^{(k)} = \frac{\tilde{z}_{ij}^{(j)}}{r^{(k)}} = (\frac{l_{ij}^{(k)}}{r^{(k)}}, \frac{m_{ij}^{(k)}}{r^{(k)}}, \frac{u_{ij}^{(k)}}{r^{(k)}})$

This research assume that at least one i such that $\sum_{j=1}^{n} u_{ij}^{k} < r^{(k)}$. Furthermore we use Equation (5) and (6) to calculate the average matrix of $\tilde{X}$.

$$\tilde{X} = \frac{(\tilde{x}^{(1)} \oplus \tilde{x}^{(2)} \oplus \cdots \oplus \tilde{x}^{(p)})}{P} \quad \ldots\ldots(5)$$

$$\tilde{X}^{k} = \begin{bmatrix} \tilde{X}_{11} & \tilde{X}_{12} & \cdots & \tilde{X}_{1n} \\ \tilde{X}_{21} & \tilde{X}_{22} & \cdots & \tilde{X}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{X}_{n1} & \tilde{X}_{n2} & \cdots & \tilde{X}_{nn} \end{bmatrix} \quad \ldots\ldots(6)$$

$$where\ \tilde{x}_{ij} = \frac{\sum_{k=1}^{p} \tilde{x}_{ij}^{(k)}}{P}$$

Step 3: Establish and analyze the structural model.

Once the normalized direct-relation X is obtained, the total-relation matrix T can be calculated, we should ensure the convergence of $\lim_{w \to \infty} \tilde{X}^{w} = 0$. The total-relation fuzzy matrix is shown as following Equation (7), (8) and (9).

$$\tilde{T} = \lim_{w \to \infty} (\tilde{X} + \tilde{X}^{2} + \cdots + \tilde{X}^{w}) \quad \ldots\ldots(7)$$

$$\tilde{T} = \begin{bmatrix} \tilde{t}_{11} & \tilde{t}_{12} & & \tilde{t}_{1n} \\ \tilde{t}_{21} & \tilde{t}_{22} & & \tilde{t}_{2n} \\ & & & \\ \tilde{t}_{n1} & \tilde{t}_{n1} & & \tilde{t}_{nn} \end{bmatrix} \quad \ldots\ldots(8)$$

where $\tilde{t}_{ij} = (l_{ij}^{"}, m_{ij}^{"}, u_{ij}^{"})$

$$Matrix\left[l_{ij}^{"}\right] = X_{l} \times (I - X_{l})^{-1}$$
$$Matrix\left[m_{ij}^{"}\right] = X_{m} \times (I - X_{m})^{-1} \quad \ldots\ldots(9)$$
$$Matrix\left[u_{ij}^{"}\right] = X_{u} \times (I - X_{u})^{-1}$$

Step 4: Producing a casual diagram

The sum of rows and the sum of columns are separately denoted as vector $\tilde{D}_i$ and vector $\tilde{R}_i$. The horizontal axis vector $(\tilde{D}_i + \tilde{R}_i)$ named " Prominence" is made by adding $\tilde{D}_i$ to $\tilde{R}_i$, which represents how much importance the criterion has. We should convert the fuzzy number of vector $\tilde{D}_i$ and vector $\tilde{R}_i$ to the crisp value by applying Equation (10).

Equally, the vertical axis $(\tilde{D}_i - \tilde{R}_i)$ named "Relation" is made by subtracting $\tilde{D}_i$ from $\tilde{R}_i$, which ay divide criteria into a cause group and an effect group. Based on above statements, when $(\tilde{D}_i - \tilde{R}_i)$ is positive, the criterion belongs to the cause group. Otherwise, the $(\tilde{D}_i - \tilde{R}_i)$ is negative, the criterion belongs to the effect group. Therefore, the casual diagram can be acquired by mapping the dataset of the $(\tilde{D}_i + \tilde{R}_i, \tilde{D}_i - \tilde{R}_i)$.

$$L = \min(l_k),\ R = \max(u_k),\ \Delta = R - L$$

$$\tilde{N}_k^{def} = L + \Delta \times \frac{(m-L)(\Delta+u-m)^2(R-l)+(u-L)^2(\Delta+m-l)^2}{(\Delta+m-l)(\Delta+u-m)^2(R-l)+(u-L)(\Delta+m-l)^2(\Delta+u-m)} \quad \text{..............(10)}$$

4. Empirical Study and Discussion

In this section, an empirical study is presented to illustrate the application how an online shopping website applied this proposed method to enhance their advantages.

Step 1: Selecting the committee of experts who have experienced about this research issue

Regarding the evaluation of the shopping website, twelve experts were invited to evaluate the criteria. In this study, two website designers, three software engineers, two shopping websites owners and five engineer Management Information Systems experts are involved. The committee followed the proposed method with four-step procedure.

Step 2: Developing the criteria and designing the fuzzy linguistic scale.

Through the literature investigation and experts' opinions, the committee finally adopted 12 criteria. This research includes three dimensions and twelve evaluation criteria as Table 1. Based on the evaluation criteria, we employed the Fuzzy DEMATEL method for capturing the complex relationships among these evaluation criteria.

We use this kind of expression to compare two criteria by five basic linguistic terms, as "Very high influence," "High influence," "Low influence," "Very low influence," and "No influence," with respect to a fuzzy level scale

.

Table 1 Factors of the shopping website and their function

Construct	Factor		Factor Description
Technology Acceptance Factor	Efficiency	C_1	Customers feel that the browse function in the shopping website can increase customers shopping efficiency.
	Practical	C_2	Customers feel that the credit function in the shopping website can raise customers shopping efficiency.
	Ease Use	C_3	Customers feel that the operations of the shopping website are easy to understand and convenient to use.
	Time-Saving	C_4	Customers feel that the shopping website saves a lot of other related shopping time.
Website Service Quality	Communication	C_5	When customers shopping again, the same shopping website personnel or records would remember related consumption habits.
	Confident	C_6	Customers are confident in buying products in the shopping website.
	Security	C_7	Customers feel secure to buy products in the shopping website.
	Trust	C_8	Customers trust in the shopping website that can provide appropriate service to me.
Specific Holdup Cost	Familiar	C_9	In order to understand how to use the shopping website, customers have already spent time to grope and learn.
	Past Experience	C_{10}	Customers use this shopping website because customers are already used to it.
	Proficiency	C_{11}	If customers give up this shopping website and use another one, customers need to spend more time and efforts fumbling and learning it afresh.
	Knowledgeable	C_{12}	Customers have infused much time and energies to confirm that this shopping website fits in with customers' needs and preferences.

Step 3: Generating the assessments of decision –makers.

To measure the relationships between the factors which are demonstrated by the $C = \{C_i \mid i = 1, 2, \ldots, 12\}$, the experts were asked to make sets of pair wise comparison. Then the $\tilde{Z}_{(1)}, \tilde{Z}_{(2)}, \ldots, \tilde{Z}_{(n)}$ can be obtained, for $\tilde{Z}^1$ as the example

$$\tilde{Z}^1 = \begin{bmatrix} (0,0,0) & (0,0,0.25) & \cdots & (0,0.25,0.5) \\ (0,0,0.25) & (0,0,0) & \cdots & (0.25,0.5,0.75) \\ \vdots & \vdots & \ddots & \vdots \\ (0.25,0.5,0.75) & (0.25,0.5,0.75) & \cdots & (0,0,0) \end{bmatrix}$$

Step 4: Normalizing the direct-relation fuzzy matrix

This research calculates the normalized the direct-relation fuzzy matrix, for $\tilde{X}^1$ as the example:

$$\tilde{X}^1 = \begin{bmatrix} (0,0,0) & (0,0,0.036) & \cdots & (0,0.036,0.071) \\ (0,0,0.036) & (0,0,0) & \cdots & (0.036,0.071,0.107) \\ \vdots & \vdots & \ddots & \vdots \\ (0.036,0.071,0.107) & (0.036,0.071,0.107) & \cdots & (0,0,0) \end{bmatrix}$$

Step 5: Establish and analyze the structural model.

Once the normalized direct-relation $\tilde{X}$ is obtained, the total-relation matrix $\tilde{T}$ can be calculated.

$$matrix\left[l_{ij}^{''}\right] = \begin{bmatrix}
0.004 & 0.019 & 0.038 & 0.033 & 0.008 & 0.003 & 0.015 & 0.011 & 0.021 & 0.013 & 0.008 & 0.011 \\
0.023 & 0.002 & 0.015 & 0.029 & 0.017 & 0.014 & 0.018 & 0.012 & 0.018 & 0.011 & 0.011 & 0.010 \\
0.041 & 0.014 & 0.005 & 0.047 & 0.017 & 0.020 & 0.009 & 0.017 & 0.016 & 0.008 & 0.015 & 0.012 \\
0.033 & 0.020 & 0.045 & 0.005 & 0.020 & 0.012 & 0.014 & 0.032 & 0.022 & 0.006 & 0.007 & 0.011 \\
0.016 & 0.004 & 0.005 & 0.008 & 0.001 & 0.019 & 0.014 & 0.022 & 0.008 & 0.005 & 0.014 & 0.018 \\
0.017 & 0.005 & 0.009 & 0.012 & 0.010 & 0.003 & 0.031 & 0.032 & 0.005 & 0.012 & 0.009 & 0.023 \\
0.014 & 0.014 & 0.024 & 0.015 & 0.008 & 0.031 & 0.003 & 0.031 & 0.006 & 0.007 & 0.009 & 0.005 \\
0.012 & 0.010 & 0.035 & 0.018 & 0.014 & 0.026 & 0.031 & 0.003 & 0.012 & 0.010 & 0.021 & 0.011 \\
0.006 & 0.005 & 0.025 & 0.014 & 0.005 & 0.009 & 0.001 & 0.006 & 0.004 & 0.043 & 0.029 & 0.020 \\
0.015 & 0.013 & 0.012 & 0.024 & 0.008 & 0.014 & 0.008 & 0.002 & 0.044 & 0.004 & 0.041 & 0.023 \\
0.011 & 0.013 & 0.006 & 0.017 & 0.019 & 0.014 & 0.008 & 0.006 & 0.044 & 0.030 & 0.003 & 0.011 \\
0.018 & 0.015 & 0.011 & 0.026 & 0.014 & 0.013 & 0.005 & 0.005 & 0.014 & 0.022 & 0.013 & 0.002
\end{bmatrix}$$

$$matrix\left[m_{ij}^{''}\right] = \begin{bmatrix}
0.029 & 0.068 & 0.097 & 0.093 & 0.043 & 0.038 & 0.052 & 0.037 & 0.068 & 0.051 & 0.041 & 0.055 \\
0.077 & 0.027 & 0.076 & 0.090 & 0.069 & 0.065 & 0.072 & 0.052 & 0.079 & 0.065 & 0.057 & 0.057 \\
0.101 & 0.070 & 0.036 & 0.108 & 0.067 & 0.072 & 0.059 & 0.068 & 0.072 & 0.054 & 0.058 & 0.058 \\
0.094 & 0.078 & 0.102 & 0.035 & 0.060 & 0.053 & 0.058 & 0.077 & 0.073 & 0.044 & 0.047 & 0.056 \\
0.054 & 0.033 & 0.034 & 0.044 & 0.019 & 0.057 & 0.057 & 0.070 & 0.055 & 0.036 & 0.059 & 0.062 \\
0.067 & 0.047 & 0.052 & 0.055 & 0.052 & 0.025 & 0.079 & 0.080 & 0.051 & 0.063 & 0.052 & 0.065 \\
0.056 & 0.057 & 0.072 & 0.067 & 0.056 & 0.081 & 0.025 & 0.083 & 0.051 & 0.046 & 0.051 & 0.040 \\
0.055 & 0.055 & 0.089 & 0.064 & 0.065 & 0.075 & 0.080 & 0.026 & 0.054 & 0.046 & 0.063 & 0.047 \\
0.054 & 0.045 & 0.074 & 0.056 & 0.030 & 0.040 & 0.034 & 0.032 & 0.030 & 0.095 & 0.081 & 0.069 \\
0.066 & 0.063 & 0.059 & 0.078 & 0.054 & 0.055 & 0.045 & 0.042 & 0.104 & 0.030 & 0.093 & 0.083 \\
0.061 & 0.056 & 0.056 & 0.059 & 0.069 & 0.068 & 0.045 & 0.044 & 0.106 & 0.089 & 0.028 & 0.065 \\
0.066 & 0.056 & 0.050 & 0.076 & 0.057 & 0.050 & 0.042 & 0.036 & 0.068 & 0.075 & 0.057 & 0.024
\end{bmatrix}$$

$$matrix\left[u_{ij}^{''}\right] = \begin{bmatrix}
0.321 & 0.370 & 0.422 & 0.423 & 0.342 & 0.346 & 0.355 & 0.341 & 0.398 & 0.362 & 0.351 & 0.363 \\
0.423 & 0.316 & 0.425 & 0.442 & 0.386 & 0.391 & 0.393 & 0.374 & 0.430 & 0.395 & 0.386 & 0.385 \\
0.452 & 0.398 & 0.358 & 0.466 & 0.391 & 0.404 & 0.388 & 0.395 & 0.431 & 0.392 & 0.394 & 0.392 \\
0.437 & 0.399 & 0.447 & 0.354 & 0.377 & 0.378 & 0.379 & 0.397 & 0.424 & 0.375 & 0.376 & 0.383 \\
0.362 & 0.322 & 0.346 & 0.360 & 0.269 & 0.347 & 0.343 & 0.355 & 0.369 & 0.331 & 0.351 & 0.352 \\
0.394 & 0.353 & 0.383 & 0.390 & 0.350 & 0.300 & 0.382 & 0.382 & 0.384 & 0.375 & 0.363 & 0.374 \\
0.383 & 0.361 & 0.401 & 0.401 & 0.354 & 0.387 & 0.295 & 0.385 & 0.384 & 0.359 & 0.362 & 0.351 \\
0.389 & 0.365 & 0.423 & 0.404 & 0.370 & 0.386 & 0.388 & 0.302 & 0.394 & 0.365 & 0.379 & 0.363 \\
0.373 & 0.343 & 0.395 & 0.382 & 0.325 & 0.342 & 0.333 & 0.330 & 0.321 & 0.397 & 0.382 & 0.370 \\
0.410 & 0.383 & 0.406 & 0.428 & 0.370 & 0.379 & 0.366 & 0.362 & 0.450 & 0.325 & 0.417 & 0.406 \\
0.400 & 0.372 & 0.398 & 0.406 & 0.380 & 0.387 & 0.361 & 0.360 & 0.447 & 0.411 & 0.317 & 0.406 \\
0.387 & 0.356 & 0.375 & 0.404 & 0.352 & 0.354 & 0.342 & 0.337 & 0.395 & 0.381 & 0.363 & 0.295
\end{bmatrix}$$

$$\tilde{T}=\begin{bmatrix}(0.004,0.029,0.321) & (0.019,0.068,0.370) & \cdots & (0.011,0.055,0.363)\\ (0.023,0.077,0.423) & (0.002,0.027,0.316) & \cdots & (0.010,0.057,0.385)\\ \vdots & \vdots & \ddots & \vdots \\ (0.018,0.066,0.387) & (0.015,0.056,0.356) & \cdots & (0.002,0.024,0.295)\end{bmatrix}$$

Step 6: Producing a casual diagram

After computing the matrix $\tilde{T}$, the amounts of $\tilde{D}_i+\tilde{R}_i$ and $\tilde{D}_i-\tilde{R}_i$ are calculated. $\tilde{D}_i$ and $\tilde{R}_i$ are sum of the rows and the sum of the columns of matrix $\tilde{T}$. Table 2 displays the amounts of $\tilde{D}_i$, $\tilde{R}_i$, $\tilde{D}_i+\tilde{R}_i$ and $\tilde{D}_i-\tilde{R}_i$.

The sum of rows and the sum of columns are separately denoted as vector $\tilde{D}_i$ and vector $\tilde{R}_i$. The horizontal axis vector $(\tilde{D}_i+\tilde{R}_i)$ named “Prominence” is made by adding $\tilde{D}_i$ to $\tilde{R}_i$, which represents how much importance the criterion has. We should convert the fuzzy number of vector $\tilde{D}_i$ and vector $\tilde{R}_i$ to the crisp value by applying Equation (10).

Table 2 The amount of $\tilde{D}_i$, $\tilde{R}_i$, $\tilde{D}_i+\tilde{R}_i$ and $\tilde{D}_i-\tilde{R}_i$

	$\tilde{D}_i$	$\tilde{R}_i$	$\tilde{D}_i+\tilde{R}_i$	$\tilde{D}_i-\tilde{R}_i$
C_1	(0.183,0.672,4.394)	(0.210,0.780,4.731)	(0.393,1.452,9.125)	(-0.027,-0.109,-0.338)
C_2	(0.181,0.785,4.745)	(0.135,0.654,4.338)	(0.316,1.439,9.084)	(0.046,0.131,0.407)
C_3	(0.221,0.822,4.861)	(0.231,0.795,4.778)	(0.452,1.617,9.639)	(-0.010,0.027,0.083)
C_4	(0.227,0.779,4.726)	(0.248,0.822,4.861)	(0.474,1.601,9.587)	(-0.021,-0.043,-0.135)
C_5	(0.134,0.580,4.107)	(0.141,0.640,4.267)	(0.276,1.219,8.374)	(-0.007,-0.060,-0.161)
C_6	(0.168,0.688,4.430)	(0.184,0.678,4.401)	(0.352,1.366,8.830)	(-0.016,0.009,0.029)
C_7	(0.167,0.686,4.423)	(0.158,0.650,4.325)	(0.325,1.335,8.748)	(0.009,0.036,0.099)
C_8	(0.204,0.719,4.528)	(0.180,0.648,4.320)	(0.384,1.368,8.848)	(0.024,0.071,0.207)
C_9	(0.167,0.639,4.293)	(0.214,0.811,4.827)	(0.381,1.450,9.120)	(-0.046,-0.171,-0.533)
C_{10}	(0.209,0.771,4.702)	(0.170,0.695,4.466)	(0.380,1.466,9.169)	(0.039,0.076,0.236)
C_{11}	(0.189,0.746,4.624)	(0.181,0.687,4.440)	(0.369,1.432,9.064)	(0.008,0.059,0.184)
C_{12}	(0.158,0.655,4.341)	(0.156,0.680,4.419)	(0.314,1.335,8.760)	(0.001,-0.025,-0.078)

Table 3 The amount of $(\tilde{D}_i+\tilde{R}_i)^{def}$ and $(\tilde{D}_i-\tilde{R}_i)^{def}$

		$(\tilde{D}_i+\tilde{R}_i)^{def}$	$(\tilde{D}_i-\tilde{R}_i)^{def}$
C_1	Efficiency	2.739	-5.157
C_2	Practical	2.717	0.167
C_3	Ease Use	2.938	0.032
C_4	Time-Saving	2.921	-0.006
C_5	Communication	2.442	-0.002
C_6	Confident	2.627	0.009
C_7	Security	2.590	0.044
C_8	Trust	2.634	0.092
C_9	Familiar	2.735	-3.252
C_{10}	Past Experience	2.754	0.103
C_{11}	Proficiency	2.713	0.077
C_{12}	Knowledgeable	2.591	-0.019

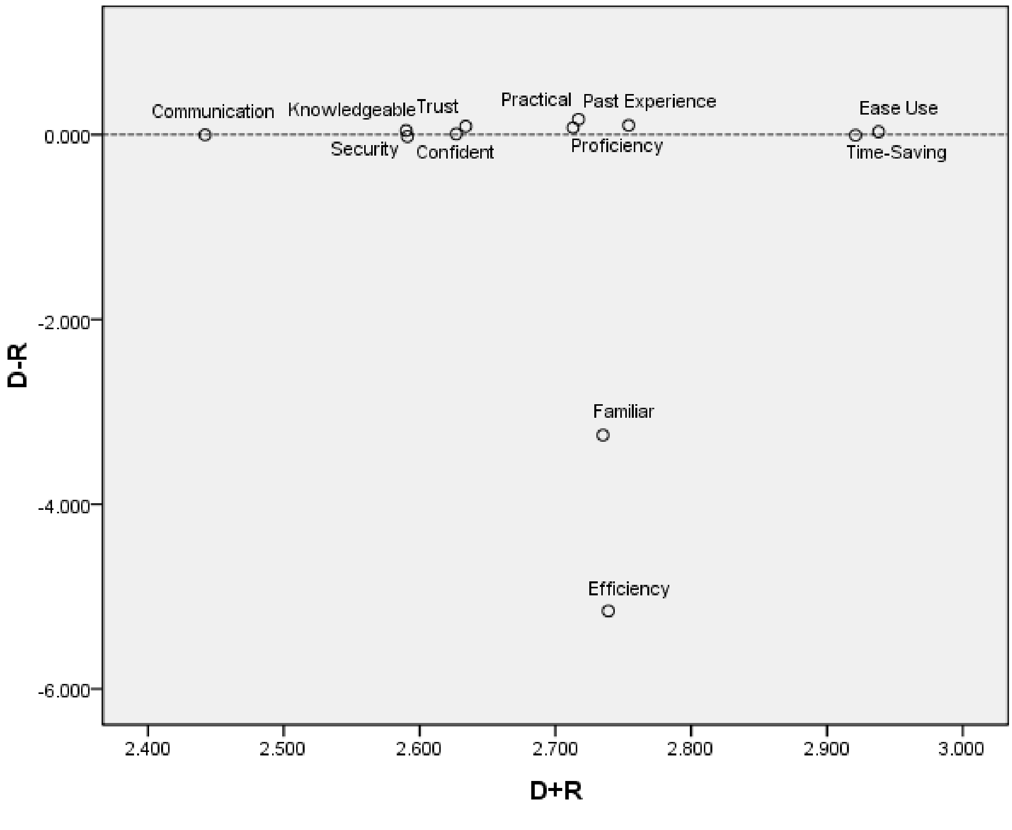

Figure 1 The casual diagram

We can clear and intuitional find out the major factor and the priority of each factor for improving shopping websites' advantages which according to the casual diagram. From the casual diagram, we can obvious that evaluation factors were divided into cause group, including C2,C3, C6, and C7, C8, C10 and C11 while the effect group was the C1, C4, C5, C9, C12.

It is shown that the critical factor of Ease Use (C3), with the largest amount of $(\tilde{D}_i+\tilde{R}_i)^{def}$ is the most important cause factor for competitive advantage for the shopping websites and could make the significant role in responding to the performance of shopping websites. On the other hand, the amounts of $(\tilde{D}_i - \tilde{R}_i)^{def}$ for Efficiency (C1) show that this factor with the most negative amount of $(\tilde{D}_i - \tilde{R}_i)^{def}$ is the most important factor of the effect group.

5. Managerial Implication and Suggestion

In this empirical study, we try to discover the major factor for the competitive advantage of shopping websites. The results of this research show that the critical factor of Ease Use (C3) with the largest amount is the most important cause factor for competitive advantage for the shopping websites and could make the significant role in responding to the performance of shopping websites. On the other hand, the amount of Efficiency (C1) is the most important factor of the effect group. This research has beneficial results and implications for shopping website as follows.

Our research outcome has shown that the critical factor of Ease Use (C3) with the largest amount is the most important cause factor for competitive advantage of the shopping websites, and this is in large part accordant with previous research results (i.e., Chiu, 2006; Flavian, Guinalu and Gurrea, 2006; Fullerton, 2005). As noted before, technology and function offered by website operators certainly involve online consumer welfare and convenience in regard to their online purchasing behavior. Thus, shopping websites should provide proper website-related functions in accordance with the customers' needs.

Aside from this, the study also verifies studies by Shih (2004) and Szymanski and Hise (2000). Shih (2004) contended that perceived ease of use of trading online (PEOUT) and perceived usefulness (PU) significantly determine individual attitudes toward e-shopping. Szymanski and Hise (2000) also pointed out that satisfaction with e-retailing increases as perceptions of convenience become more positive. Therefore, if a shopping website operator wishes particularly to attract non-Internet shoppers, he or she must think of means to increase the website's usefulness. For example, the shopping website can be made simple and easy to understand in order to reduce the customer's shopping time and make Internet shopping more effective. This is because for those e-shoppers who have a high level of Internet familiarity the website operators might need to pay more efforts in meeting their e-satisfaction, and then winning their e-loyalty.

From our research outcome, we note that the effect of website service quality on the competitive advantage of shopping websites is not the most factors. From the results, we can understand that service quality has become the necessary factor. Thus, facing Internet competition, Internet shopping industries want to grasp the customers and the first condition is to provide good website service quality to customers.

Finally and likewise, Internet retailers can also implement different policies to allow customers to trust their service quality more. From the agency theory viewpoint, firms can use three different methods for transaction relations to be more effective: information policies, guarantee policies, and reputation policies (Spremann, 1988). In addition, the expansion of electronic commerce may be expected to lead to an increase in the volume of agency relationships, such as outsourcing or business partnerships (Croson and Jacobides, 1997). Thus the shopping agent is an effective technology that will strengthen e-commerce collaboration, speed up e-commerce globalization, and bring it to success. Its e-service quality rating system will certainly be a useful tool for improving e-service in the global e-commerce environment.

This research also sheds light on the fact that Past Experience (C10) and Proficiency (C11) are also the important cause factor for competitive advantage for the shopping websites.

Campbell (1997) put forward the view that the specific holdup cost is concerned in large part with a condition where "repeat purchases occur on the basis of situational cues rather than on strong partner commitment". Composition links thus strengthen value as well as transformation costs and outwin the competitors who cannot offer such special services for customers. The customers are thus fastened to the composition (Campbell, 1997). Therefore, aside from fulfilling personal service quality and information level, shopping websites can also provide specific member services through social organization such as chat room links or VIP membership. In short, in order to increase customer loyalty, shopping website operators should make the transfer cost to other websites high, so that the shopping website can maintain a longer transaction relationship with the customers.

The topic discussed in this study is still developing at present; it is hoped to be continually explored with the addition of other drivers such as cultural and social factors affecting e-satisfaction and e-loyalty, thus enriching the research contents. Therefore, we hope that succeeding studies can adopt a wider range of constructs to make the whole study share more benefits. Finally, Internet products' distinctions can also affect customers' decisions to shop on the websites or not. From a management perspective, consumers in fact treat high-involvement and low-involvement products with different behavioral models. The product's unit price influences the desires of consumer for Internet shopping as well. Thus, we propose that much research is needed to discover the effects of different product characteristics on customer e-shopping.

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應用模糊 DEMATEL 探討購物網站競爭優勢

孫嘉祈
淡江大學國際企業學系
Email: samsun0712@gmail.com; ccsun@mail.tku.edu.tw

摘要

本研究應用模糊 DEMATEL 方法，探討購物網站之關鍵競爭優勢之因素，從研究結論瞭解購物網站之容易使用性是購物網站主要關鍵成功因素，另一方面購物效率也是購物網站另一關鍵成功因素，本研

究也提出相關管理意涵與產業建議，讓購物網站產業能提升其競爭優勢，並聽其經營績效表現。

關鍵字：購物網站，科技接受因素，網站服務品質，模糊理論，DEMATEL