Research on Evaluation Architecture of Marketing Performance for E-Commerce Websites

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Abstract. With the development of e-commerce websites, more and more firms use websites to advertise their products and brands and statues. How to evaluate marketing performance of firms on web-based e-commerce becomes more important problem. This paper analyses influencing factors of marketing performance under e-commerce websites. And it suggests an evaluation model based on combination of fuzzy logic and hierarchy methods. The model uses fuzzy set and average weights way to quantify the factors and thus, it can supplies a way to help firms to improve evaluating tools and modify their marketing strategies.

1 Introduction

E-commerce website is a very important tool that can help firms to implement marketing functions such as brands, products and services, information advertising, customer services and relationships, surveys, integrated resources and the Internet marketing. Under the condition of customers-centered websites, e-commerce framework integrates 4P(produce, price, place, promotion) strategies. Firms are focused on influencing factors, evaluation and assessment, measurement problems of web-based marketing performance. To research and solve these problems can effectively promote the levels of the Internet marketing and improve optimized design on websites. Therefore, the websites can obtain maximum visits and firms can obtain maximum profits by web-based e-commerce.

In general, the research on websites evaluation and influencing factors is divided into the following types: (1) from firms marketing management; (2) from online survey. A famous company, ForresterResearch uses online customers survey,

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statistical data from websites and expertise's analysis with "punchy evaluation method" to analyse a website; (3) websites evaluation and indexes based on customer demands and satisfactions[1]; (4) comparing e-commerce websites with not e-commerce websites to analyze index system of marketing profits and services effects[2]; (5) professional evaluation and analysis report on websites[3].

All above the kinds of research, to some degree, can supply influencing factors and methods on websites evaluation. Based on some results from local and other countries research, and also based on professinal evaluation and analysis report on websites , this paper surveys influencing factors on websites marketing performance in three catalogues of 15 subtypes with 45 items according to websites functions, website contents and customer actions, along with websites owners, builders, potential users and customers. At the same time, it suggests some detailed factors and constructs a model of index system architecture of e-commerce websites. [See Fig.1.]. It includes: (1) Interesting contents with specialty, fresh, updating, trust, practices; (2) Disturbing noises of browsers with unkind behaviors such as advertisements, components and reserved actions etc; (3) Security of information with no-cheating, no-healthy, misguides; quick-access with download speeds and shortest paths; (4) Function services with common and perfect.

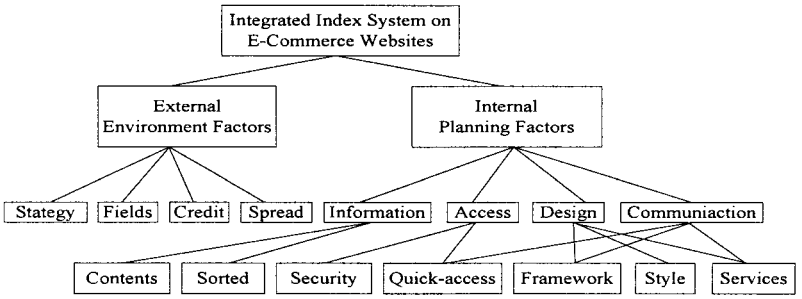

Fig 1. Evaluation architecture of integrated index system for e-commerce websites

E-commerce websites can supply business activities for enterprises on the Internet. The enterprises use the websites to advertise and communicate their information such as enterprises status, products, services and developing schedules etc by texts and images. Therefore, effective information is related to websites and enterprises operations. Websites internal planning factors depend on effective information, security, standerdized structure and style. So under the condition of fixed external environment, the effective analysis of internal information can improve the level of marketing on websites and realize maximal access and profits through optimized design. This gives firms a chance to use index system to evaluate and modify their websites.

The index sytsem can effectively avoid uncertainty on websites evaluation and unreality on seeking number of access websites. It can help websites owners to maintain information on the websites and get some formal e-commerce websites. In Fig 1.,external factors are common, but internal factors include effective information and sorted information such as fresh information, special information, real information and trusted information etc. Through these information, the goal of e-commerce websites is to absorb and hold customers, and also hope to make potential

customers to be permanent ones.One thing is to keep the websites fresh and interesting; and special information shows some products and services of their enterprises, it can be special point to absorb browsers'eyes; and also about real and credited information can satify basic requirements which are those real materials of products and services; The sorted information shows information sturcture on websites. Effective access includes safe access and response quickly. Safe access provides safe, realibility, stablity operation and contents. This asks the websites to tolerate and against disturbance from other websites. And safe contents should be healthful, legal and useful information. As usual, the websites can reply on any quiries through reducing capacity of network and simplify access layers. The different informations from websites become very important factors to build websites.

Most firms use electronic commerce websites as the Internet marketing ways which totally depend on quality of websites. They present quality by access of customers from external environment leading into websites, and security of internal planning and basic training of customers. Therefore, the quality of websites is from the above three perceptions. In Fig.1., it shows an integrated index system architecture of evaluating e-commerce websites in validity of some degree. The index system architecture presents some kinds of factors and also impacts evaluation of marketing performance under e-commerce websites. These factors are interacted with each other. Through the factors analysis, the index system architecture is a complex problem with multi-hierarchy, multi-factors and uncertainty. The paper studies current existing influencing factors and suggests the evaluation model based on e-commerce websites by using fuzzy integrated evaluation method to add weights on influencing factors. Meanwhile, particularly single factor of different sub-index hierarchies can also guide optimized design of website planning to satisfy maximal marketing demands.

2 Fuzzy integrated evaluation model analysis

We can use fuzzy logic process to build fuzzy integrated evaluating model for the above factors in Fig.1. The following part shows process steps.

First step, setting a total goal set of factors $U=\{u_1, u_2, u_3\}$,and a set of sub-goal factors $u_1=\{u_{11}, u_{12}, u_{13}, u_{14}\}$,$u_2=\{u_{21}, u_{22}, \ldots, u_{27}\}$; and a set of evaluation $V=\{v_1, v_2, \ldots, v_5\}$ separately equal to very good, good, common, bad, very bad.

The second step, setting a fuzzy set $A=\{a_1, a_2, a_3\}$, a_i is weight of u_i.

The third step, setting R is fuzzy mapping function from U to V. $R(u_i)=(r_{i1}, r_{i2}, \ldots, r_{ij})$ is a member of R, it's subset of V, when the condition $0 \le r_{ij} \le 1$, it describes that u_i is a membership of v_j.

In a finally, it is so called integrated evaluation exchanged matrix as a single factor evaluated matrix $R=(r_{ij})$, which combines all of vector quantities from fuzzy mapping function R. So it gets first fuzzy integrated evaluation model using fuzzy matrix mixed operations[4].

$$B=A\bullet R=(b_1,\ b_2,\ \ldots,b_j)$$

$$b_j=\sum_{i=1}^{5} a_j r_{ij},\ j=1,2,3,4,5;\quad b_j \text{ is a function of } r_{ij}.$$

It will be expended to form a multi-hierarchy fuzzy integrated evaluation model. This means that it makes initial model to apply multi-factors, the bottom layer's result becomes closed to above layer's input until the first layer.

About to obtain fuzzy evaluation matrix, first step is to select website owner and customers expression and some experts as an evaluation team, and then to evaluate single factor according to the second layer from the index system. It can use questionnaire tables to get single factor fuzzy evaluation matrix by surveying and analysis and statistic these tables.

$$R=\begin{bmatrix} r_{i11} & r_{i12} & \cdots & r_{i1n} \\ r_{i21} & r_{i22} & \cdots & r_{i2n} \\ \vdots & \vdots & \cdots & \vdots \\ r_{im1} & r_{im2} & \cdots & r_{imn} \end{bmatrix},\quad (i=1,\ 2)$$

m is element number of the set of evaluation u_i

n is element number of the set evaluation V.

The integrated evaluation process is as following:

$$B_i=A_i\circ R_i=(b_{i1},\ b_{i2},\ b_{i3},\ b_{i4},\ b_{i5}),\quad R=\begin{bmatrix} B_1 \\ B_2 \end{bmatrix}$$

$$B=A\circ R=A\circ\begin{bmatrix} B_1 \\ B_2 \end{bmatrix}=A\begin{bmatrix} A_1\circ R_1 \\ A_2\circ R_2 \end{bmatrix}=(b_1,\ b_2,\ b_3,\ b_4,\ b_5)$$

3 The evaluating process of marketing performance

3.1 Calculating weights by hierarchy analysis methodology

During the process of fuzzy integrated evaluation, weights significantly affect the final results. Different weights sometimes achieve different results. We compute eigenvetor to get factors' weights from comparing evaluating matrix built by experts evaluation method and hierarchy analysis method. These methodologies can effectively correct the wrong real decisions and prevent from subjective minds. And also it can use weights to deal with filtering and restoration of evaluating matrix.

In Fig.1, there are four layers including: the final evaluating layer, factors evaluating layer, evaluating index layer and evaluating index sub-layer. Due to evaluating index sub-layer almost similar to evaluating index layer, the sub-layer only affects the four index layers. Therefore, about considering integrated evaluation, the evaluating index sub-layer belongs to evaluating index layer.

Setting the finial evaluating goal is A, factors evaluating layer has two elements: external environment and internal planning marked as A_1, A_2;

evaluating index layer belongs to A_1, A_2, marked as C_{11}, C_{12}, C_{13}, C_{14}; C_{21}, C_{22}, ..., C_{27} without crossing situation. The method's goal is to assign weights by relative their importance under the elements A_k (k=1,2).

(1) Ascertain weights from the factors in the first layer

Using average weight to calculate A_1, A_2 with final evaluating goal A given by experts team (including researchers, customers, field managers and other persons in this fields) A=(0.35, 0.65) (data from some relative questionaries).

(2)Calculating weights of A_1, A_2 in the factors layer

As we know, according to 1-9 marking methods, it can compare some degree importance of the indexes of A_1, A_2 each other. And then it builds weight table from consulting table by experts team.

$(C_{1j})_{4\times4}$ and $(C_{2m})_{7\times7}$ form decision matrix (j=1,2,3,4; m=1,2,3,4,5,6,7). For instance:

$$A_1=(C_{1j})_{4\times4}=\begin{bmatrix}1 & 1 & 1/5 & 1/7\\ 1 & 1 & 1/3 & 1/7\\ 5 & 3 & 1 & 1/3\\ 7 & 7 & 3 & 1\end{bmatrix},\quad A_2=(C_{2m})_{7\times7}$$

By calculating maximum features roots of deciding matrix and eigenvector, it sets that maximum eigenvector is λ_{max}, the standard eigenvector of λ_{max} is $W=(W_1, W_2, \ldots, W_n)^T$, then W_1, W_2, ..., W_n mapping index C_{11}, C_{12}, C_{13}, C_{14} and index C_{21}, C_{22}, ..., C_{27} as weights of importance degree to A_1, A_2.

And then inspecting consistence:

$$CI=\frac{\lambda_{max}-n}{n-1},\quad CR=CI/RI<0.01$$

It can satisfy consistence between the two matrices.

At last, the model gives the weights result as following:

A_1=(0.15, 0.15, 0.2, 0.5), A_2=(0.2, 0.15, 0.10, 0.15, 0.15, 0.10, 0.15)

(3)Calculating weights from index layer

Setting current layer elements C_1, C_2, ..., C_m by above layer A_1, A_2 to weights vector $W_i=(W_{i1}, W_{i2}, \ldots, W_{in})^T$, i=1, 2, ..., m. And the elements C_1, C_2, ..., C_m related to weights a_1, a_2, ..., a_m, so the current elements A_1, A_2, ..., A_n integrated weights are the following:

$$\sum_{i=1}^{m} a_i W_{i1},\ \sum_{i=1}^{m} a_i W_{i2},\ \ldots,\ \sum_{i=1}^{m} a_i W_{in}$$

3.2 Construct fuzzy evaluation matrix

Through the survey of affecting degree for some e-commerce websites, it shows the evaluating results seeing statistic table 1.

Table 1. The survey table of single factor evaluation

evaluation index	very good	good	common	bad	very bad
strategy					
standard					
credit rules					
path					
interesting					
sorted-information					
security					
quick-access					
framework					
styles					
function services					

Notes: R_1 is a matrix of 5 Rows 4 Columns, R_2 is a matrix of 5 Rows 7 Columns.

Through A_1=(0.15, 0.15, 0.2, 0.5) to obtain evaluating vector from external environment elements: $B_1 = A_1 \circ R_1$

Through A_2 =(0.2, 0.15, 0.10, 0.15, 0.15, 0.10, 0.15) to obtain evaluating vector from internal planning elements: $B_2 = A_2 \circ R_2$

In general, the model can be operated to evaluate and check real websites. The article gives some useful factors and analysis process based on the model.

4 Conclusions

It is an important way that firms use some evaluating factors of marketing performance under web-based e-commerce to improve some marketing strategies. And it can use the evaluation process and results to analyse firms' competition abilities. They use the evaluation results to plan their websites and consider advanced minds by comparing with other firms' websites. However, because web-based e-commerce is a complex system of multi-attributes and the system is affected by customers' psychology, only one evaluating value can not express practical firm's good or bad totally and precisely. As we know, the index system has some degree fuzzification. Therefore, the fuzzy evaluating method combined with hierarchy analytic method is very useful to help firms from the quantities and quality analysis to evaluate marketing performance on e-commerce websites scientifically and systematically.

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