



Contents lists available at ScienceDirect

Expert Systems with Applications

journal homepage: www.elsevier.com/locate/eswa

Rank B2C e-commerce websites in e-alliance based on AHP and fuzzy TOPSIS

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ARTICLE INFO

Keywords:

E-commerce

E-alliance

AHP

TOPSIS

Fuzzy

ABSTRACT

E-alliance is the union of e-commerce and its success and efficiency is related to comprehensive quality of e-commerce. Thus, ranking e-commerce websites in e-alliance is of importance, which is a multi-criteria decision-making (MCDM) problem. This paper proposes an evaluation model based on analytic hierarchy process (AHP), fuzzy sets and technique for order performance by similarity to ideal solution (TOPSIS), to tackle the issue in fuzzy environment. The AHP is applied to analyze the structure of ranking problem and to determine weights of the criteria, fuzzy sets is utilized to present ambiguity and subjectivity with linguistic values parameterized by triangular fuzzy numbers, and TOPSIS method is used to obtain final ranking. Case analysis is conducted to illustrate the utilization of the model for the problem. It demonstrates the effectiveness and feasibility of the proposed model.

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1. Introduction

The advent of the Internet has led to the flourishing development of e-commerce. According to the nature of transactions, e-commerce can be classified into following types: business-to-business (B2B), business-to-consumer (B2C), consumer-to-consumer (C2C), consumer-to-business (C2B) et al. Many popular B2C e-commerce websites are operated well in the Internet. However, there are still some difficulties for users to conduct B2C e-commerce transaction. Finding right product in the B2C e-commerce websites mainly relies on web search engines such as Google and Yahoo. In order to find right products, users have to visit websites recommended by these engines one by one until they find suitable products (Kwon, Kim, Kim, & Kwak, 2008). The process is tedious and wastes time. Besides, for some small and medium e-commerce websites, it is impossible to complete with large e-commerce firms (Wang & Lin, 2009). One useful approach is to establish e-alliance. E-alliance is the union to support e-commerce transaction. Information of e-commerce websites can be presented in the form of e-alliance. As stated by Castellani et al. (2003), e-alliance is a software infrastructure. E-commerce strategic alliance model has been implemented into Taiwan tourism industry and achieved better performance (Huang, 2006).

E-commerce performance is related to the success and efficiency of B2C e-alliance. Thus, ranking e-commerce in e-alliance is very critical. The main purpose of this paper is to provide a

useful solution for ranking e-commerce in e-alliance. Many factors influence the quality of e-commerce, which determines that the issue is multiple criteria decision-making (MCDM) (Vincke, 1992). There are many possible approaches to classify the MCDM methods. Belton and Stewart (2002) gave classification: Value measurement model such as multi-attribute utility theory (MAUT) and analytical hierarchy process (AHP); outranking models such as Elimination and (Et) Choice Translating Reality (ELECTRE) and Preference Ranking Organization Method for Enrichment Evaluation (PROMETHEE) and at last, goal aspiration and reference level models such as Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). The foundation of above theory is that the decision maker chooses the alternative for which the expected utility value is a maximum (Keeney & Raiffa, 1976). TOPSIS is often criticized for its inability to deal with vague and uncertain problems. However, fuzzy sets have the ability to present these problems and AHP is widely used for tackling MCDM problems in real situations (Chan & Kumar, 2007). Thus, AHP, fuzzy sets and TOPSIS are combined to rank e-commerce in e-alliance, which utilizes AHP to acquire criteria weights, fuzzy sets to describe vagueness with linguistic values and triangular fuzzy numbers, and TOPSIS to obtain the final ranking order of e-commerce websites.

The remainder of this study is structured as follows: Section 2 briefly describes e-commerce and e-alliance. In Section 3, comprehensive quality of e-commerce websites in e-alliance is discussed. AHP and TOPSIS are presented in Section 4. Fuzzy TOPSIS is proposed in Section 5. In Section 6, proposed model is demonstrated. Case analysis is conducted in Section 7. In Section 8, conclusion is discussed.

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2. E-commerce and e-alliance

E-commerce can be described as “any form of business transaction in which the parties interact electronically rather than by physical exchanges or direct physical contact” (ECOM, 1998). It refers to business activities involving consumers, manufacturers, service providers, and intermediaries using computer networks such as the Internet (Adam, Dogramaci, Gangopadhyay, & Yesha, 1999). The scope of e-commerce ranges from simple World Wide Web (WWW) to shared business processes and management information system (MIS) connecting different companies. E-commerce saves time and reduces the costs of business transactions, which makes business more practicable and efficient.

E-alliance is the union of e-commerce websites, shown in Fig. 1. It can bring much benefit to e-commerce websites if they join e-alliance. E-alliance can be used to gain access to needed resources, capture economies of scale, enter new markets, learn new skills or technology from partners, enhance usability and security, and improve competitiveness.

The form of B2C e-alliance is web page. By search related keywords, information from e-commerce websites can be demonstrated in e-alliance (Fig. 2). Users can buy products presented in the page, which is equal to purchase products in e-commerce websites. So, how to arrange information from e-commerce websites in e-alliance is very critical. Which display order can be chosen? As the more front the information is located, the more possible it will be paid attention from users. It is more likely that users will look through the information and buy products. So display order is of great importance. This depends on comprehensive quality of e-commerce websites in e-alliance.

3. Criteria influence comprehensive quality of e-commerce web sites in e-alliance

There is a lot of literature on e-commerce website quality evaluation. Ariga and Yoshida (1998) proposed an evaluation standard and checklist to read web pages critically as teaching materials for a network literacy course. Sumi and Yotsuya (2002) demonstrated a 20-item checklist based on a library classification system, concentrating on content reliability. A lot of research pay too much attention to website itself and neglect others which also have something to do with websites. In fact, comprehensive quality of website is related to product, design, technology, service quality and logistics illustrated in Fig. 3.

3.1. Product

Price of product can influence consumers' purchase no matter in e-commerce or supermarket. If price is very too high, consumer

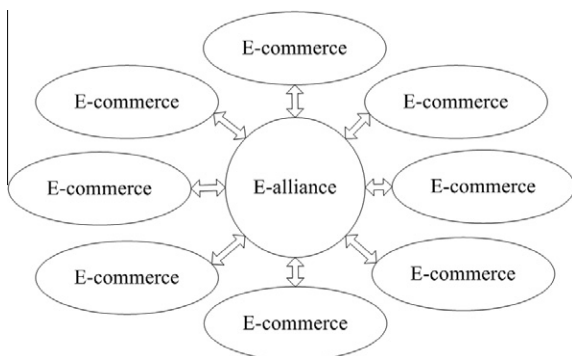


Fig. 1. E-alliance & e-commerce.

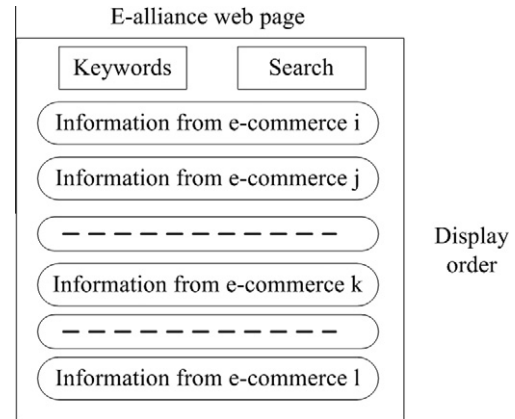


Fig. 2. E-commerce web sites information display order in e-alliance.

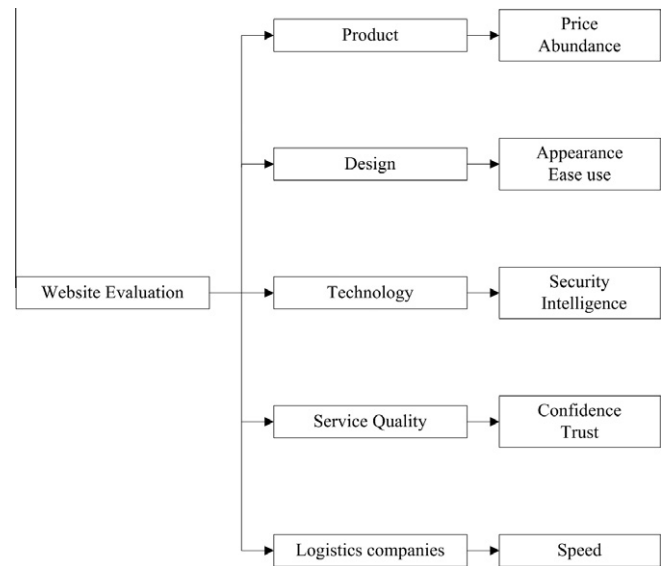


Fig. 3. Criteria influence web sites comprehensive quality.

will not accept. Thus, price should be proper and acceptable. At the same time, when website displays abundant products, customer will browse it more possible and make transaction. Thus, product contains two criteria: price and abundance.

3.2. Design

Before website is deployed in the Internet, it will be designed by developer. The more attractive website is, the more possible visitors will stay and make purchase. So, appearance is one criterion for website design. What's more, ease use is also related to website design. Ease use indicates that it is very easy to operate website and convenient to browse. Nielsen (Nielsen, 1999; Nielsen, Molich, Snyder, & Farrel, 2001; Nielsen & Tahir, 2001) described usability studies, and provided numerous instructions for making web pages more usable.

Based on above discussion, website design embodies appearance and ease use.

3.3. Technology

Website is an Internet platform, which allows consumers to purchase products. During the process, consumers may submit

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