Pricing and promotion strategies of an online shop based on customer segmentation and multiple objective decision making

C.-C. Henry Chan [a], Chi-Bin Cheng [b,*], Wen-Chen Hsien [a]

[a] Department of Industrial Engineering and Management, Chaoyang University of Technology, Wufeng, Taiwan, ROC
[b] Department of Information Management, Tamkang University, 151, Yingzhuan Road, Danshui Disrict, New Taipei City, Taiwan, ROC

ARTICLE INFO

ABSTRACT

The advent of the Internet and web technologies has enabled the prosperity of virtual stores, which greatly reduce customers' search costs and retailers' overhead. However, the furious competition between online shops makes it difficult for them to generate profits. This study attempts to establish pricing and promotion strategies for online shops to enhance their profitability. The pricing decision is based on the concept of customer relationship management, where a greater margin of price concession is given to customers who are more valuable to the shop. The process of our approach is: clustering customers into different classes based on their RFM data, computing and presenting the list prices of products to customers according to their classes, allowing customers to bargain over the price and offering conceded prices which are computed based on customer classes and a multi-objective decision making model, and finally providing promotion options to customers to reinforce their purchase inclination. The proposed approach is implemented at an online shop of a computer peripherals retailer. Transaction data before and after the implementation are collected and compared to assess the performance of the proposed approach.

© 2011 Elsevier Ltd. All rights reserved.

1. Introduction

Business-to-consumer electronic commerce provides a new and effective channel for retailers and their consumers to perform online transactions through commercial Web sites. However, the furious competition between online shops makes it difficult for them to generate profits. The competition arises from the following combination: reduced barriers to product information, easier access to a great number of potential suppliers, and increased threat of substitutes (Wilson-Jeanselme & Reynolds, 2005). Furthermore, the Internet has reduced the differentiation among products and services and hence has switched the focus of customers to price discounting (Porter, 2001). Consequently, buyers generally surf through many shops and compare their list prices of the target product to look for the best offer on the Internet. Therefore, unless visitors of the online shop can be converted into buyers and be kept by creating value for them, online transactions will not be profitable (Wilson-Jeanselme & Reynolds, 2005).

The list price of a product of an online shop is generally the first factor that determines if a visitor will stay and further seek a chance to get a bargain. The belief that price is a primary purchasing determinant for online buyers was reinforced by the objective of always offering the lowest prices of some online shops (Kung, Monroe, & Cox, 2002). Price promotions significantly affect consumers' price perception (Folkes & Wheat, 1995). For example, offering a product with a rebate results in higher perceptions as measured by the most one would pay (Laroche, Pons, Zgolli, & Kim, 2001). Such a consumer behavior has been explained from a mental accounting perspective by Thaler (2008). The transaction utility theory of Thaler (2008) suggested to price a product according to its value perceived by customers, where the perceived value is the sum of the customer's acquisition utility and transaction utility, in which the utility function involved three factors, namely the actual price, the reference price, and the reservation price (i.e. the maximum the individual would pay).

Web-based pricing strategies differ with the merchant, the market, and the type of customer (Awad, 2004). In other words, different market strategies should be applied to different type of customer to enhance profitability and customer satisfaction. Personalization is a mean to achieve such a goal. When being applied in market segmentation, personalization can transform a standard product into a specialized solution for an individual. Businesses are able to know their customers' buying behaviors and thus develop appropriate promotion actions to attract each customer of a specific type.

* Corresponding author.
E-mail address: cbcheng@mail.tku.edu.tw (C.-B. Cheng).

Through personalization, the customer's satisfaction and loyalty can be enhanced, and the increase of each customer's visiting frequency can further create more transaction opportunities and hence benefit the online shop (Lee, Liu, & Lu, 2002).

A number of web-based personalized systems have been developed, e.g. Borchers, Herlocker, Konstan, and Reidel (1998), and Changchien, Lee, and Hsu (2004). Personalization usually works by filtering a candidate set of items through some presentation of personal profile. For example, a prototype system of Changchien et al. (2004) for online personalized sales promotion consisted of three modules, namely marketing strategies, promotion patterns model, and personalized promotion products, to select promotion products based on the experiences analyzed and retrieved from historical transactions. The authors also used simulations to evaluate the performance of their prototype systems.

To enhance the profitability of online shops, the present study also uses personalization to suggest different pricing and promotion strategies in the transaction process. In addition, the pricing and bargaining decisions are based on the concept of customer relationship management (CRM). In our pricing strategy, a lower list price will be presented to customers who are more valuable to the shop, and a greater margin of price concession will also be given to such customers in the further bargaining process. The proposed approach contains the following steps:

- Clustering customers into different classes based on their RFM (recency, frequency, and monetary value) data.
- Computing and presenting the list prices of products to customers according to their classes.
- Allowing customers to bargain over the price and offering conceded prices which are also computed based on customer classes.
- Providing promotion options to customers to reinforce their purchase inclination.

The proposed approach is implemented on the online shop of a computer peripherals retailer in Taiwan. Transaction data before and after the implementation are collected and compared to assess the performance of the proposed approach.

2. Customer segmentation, pricing, and promotion

This study suggests applying different pricing and promotion strategies to different types of customers based on the concept of customer relationship management. To identify the type of a customer, the first step is to distinguish different characteristics among customers from their historical transactions by clustering techniques, and then recognize the value of each customer class. The pricing and promotion strategies are customized to different classes of customers to optimize their effects.

2.1. Customer segmentation

Customer segmentation is a process of dividing customers into distinct groups which might require separate service mixes (Venugopal & Baets, 1994). Traditional customer segmentation models were generally based on various customer characteristics, including demographics, attitudinal, and psychographic attributes of a customer (Griffin, 2003). Such models often yield too simple results and poor accuracy for today's complicated business environment, and thus customer transactional and behavioral data (e.g. purchase types, volume and history, etc.) are more commonly used in recent years (Lee & Park, 2005). The recency, frequency, and monetary (RFM) model is a popular method to represent the characteristic of customer transaction data, where recency is the period since a customer's last purchase, frequency is the number of purchase made within a certain period, and monetary refers to the amount that a customer spent during a certain period (Bult & Wansbeek, 1995). The basic premise of RFM is that customers who have purchased more recently, more frequently and have spent more are the best prospects for future sales. By RFM values we are able to identify customers who are more valuable or less valuable to the store.

There are a number of scoring approaches that can be used with RFM. The present study adopts the weighted ranking approach which begins with scoring customers based on each RFM factor (i.e. R, F, and M) separately. Customers are sorted based on each RFM factor values in an ascending order; the sorted results of each factor are then split into quintiles (i.e. five equal groups), respectively, and then points of 1–5 are assigned to corresponding quintiles from the bottom one to the top one. This score assignment will result in 125 cells of customers, i.e. from ($R = 1$, $F = 1$, $M = 1$) to ($R = 5$, $F = 5$, $M = 5$). Chen, Chiu, and Chang (2005) suggested that the weight allocation of the three RFM factors for retailers ought to be $R > F > M$. Accordingly, the present study sets the weights of these three factors to 5, 3, and 2; thus, the customer value defined by concatenating the individual RFM scores together can range from 10 ($=5 \times 1 + 3 \times 1 + 2 \times 1$) to 50 ($=5 \times 5 + 3 \times 5 + 2 \times 5$). By employing the k-mean clustering technique based on individual RFM scores and customer values, customers are grouped into four classes, G_1, G_2, G_3, and G_4, which are numbered in a descent order of their values to the retailer. This clustering is updated once a week.

2.2. Pricing strategies

Chan, Cheng, and Hsu (2007) argued that providing dynamic pricing to keep customers staying at the store can enhance the profitability of online shops. The concept of dynamic pricing is to vary the price of a product depending on the demand characteristics of the customer or the supply situation of the seller. A dynamic pricing mechanism can encourage customers to stay at the shop to negotiate an acceptable price instead of searching for a lower price somewhere else. Thus, the main pricing strategy of this study is to generate the list price of a product based on some pricing techniques, and then provide a price bargaining function to customers if they did not accept the list price. In this pricing process, the list price and the concession magnitude allowed in the bargaining are determined based on customer classes.

Dolan and Simon (1996) have summarized commonly-used pricing methods as cost concern, differential pricing, product line pricing, bundle pricing, and promotion price. From which it is noted that the determinant factors of pricing include: cost of the product, competitors' price, customer perceive-value, and demand and supply situation. Our case study retailer is in a furious price competition environment where many competitors sell the same functions of products. Thus, it is important to refer to competitors' prices when determining the list price of a product. Thus, the list price is determined by regulating an expected price of the seller with references of competitors' prices.

Let p^L denote the list price, and it is generated by the following equation:

$$p^L = \sum_{i=1}^{3} w_i \cdot p_i^E \cdot \left\{ 1 - \left(\frac{p_i^E}{p_i^T} - 1 \right) \right\}, \tag{1}$$

where p^E is the expected price determined by markup pricing, i.e. obtained by adding a profit margin g on the product cost C:

$$p^E = (1 + g) \times C. \tag{2}$$

Since competitors' prices vary in the market, we consider three kinds of competitor prices in Eq. (1), namely the highest market