APPLYING CLUSTERING AND BPNN TECHNIQUES INTO CONSTRUCTING THE PREDICTION MODEL OF BRAND DILUTION

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ABSTRACT

In this study, we address the issue about constructing the prediction model of brand dilution for the fashion industry in Taiwan. Those possible factors have effect on brand dilution; brand association and brand uniqueness were defined well according to review the relating literatures or theories. Herein, the clustering technique will be used to perform the customers’ clustering analysis according to the evaluation about brand recognition. Besides, a backpropagation neural networks (BPNN) technique was also applied into constructing the prediction model due to the characteristics of the non-linear correlation and the parallel computation. Herein, the evaluation of brand associations and brand uniqueness/the evaluation of four possible factors about brand dilution will be reviewed as the input/output signals of the prediction model. The managers can use the constructed models to perform the necessary analysis to derive the suitable activities or strategies to their brand management. Finally, we take an illustrative example to demonstrate the feasibility and the rationality of the proposed affection/evaluation model of brand dilution.

Keywords: Brand Dilution, Brand Associations, Brand Uniqueness, Fashion Industry, Artificial Neural Networks (ANNs)

1. INTRODUCTION

Brand had known as a unique symbol of a product representing the source, the quality, the reputation and other special characters of the product. Aaker (1991; 1996) and Keller (1993) had also referred to brand equity in terms of the components of customer based brand knowledge including brand loyalty, brand awareness, perceived quality, brand associations and other proprietary brand assets. Tauber (1988) had mentioned one practical issue in managing brand equity is to provide marketing planners useful strategies on brand equity through brand extensions. Herein, brand extension involves applying an existing brand name to products that are new to the brand name. While successful brand extension can reap many benefits, brand equity also has a finite life. However, the practical management can not ignore the negative side, especially the risk of extension failure. It will damage the original brand by creating undesirable attribute associations or damaging the brand’s perceived quality (Aaker, 1990). Loken and Roedder (1993) also indicated that dilution effects do occur when brand extension attributes are inconsistent with the family brand beliefs.

Taiwan has been attempting to promote the brand identity of its products since, 1990. Slogans such as “It is made in Taiwan (MIT)” had been used to associate Taiwanese products with better known Taiwanese brands. The Fashion industry in Taiwan also focused on the Taiwanese brands. For most managers in Fashion industry, how to hold the possible information from the brand evaluation, brand dilution and brand association will be a meaningful issue to be addressed. Hence, constructing a model to screen out the affection effect about brand dilution and constructing a model to review the estimation of brand dilution for different customer clusters will be chosen to be achieved in this study. Finally, an illustrative example owing to Taiwanese Fashion SME will be taken into demonstrating the rationality and feasibility of the proposed approach.
2. LITERATURE REVIEW:

2.1 Dilution
Brand dilution is the weakening of a brand through its overuse. This frequently happens as a result of ill-judged brand extension. Price cutting that increases volumes but moves a brand down-market can be similarly damage a brand. Brand dilution is an ever present risk for companies that rely on a strong brand for high margins. A company that owns a strong brand obviously wants to sell as much as possible, but the very strategies used to pursue this end often also brings the danger of brand dilution. Brand dilution mostly occurs for goods like cola, fashion goods. In case of cigarette industry the launch of a new brand will obviously cut the consumption of other products in the same segment. Obviously the new brand will increase the revenue by cutting the revenue from other brands. But in the long run the product will grab a greater market share and it will increase the overall revenue. So brand dilution can cut the sales of a segment but it may help the organization to be more potential.

Romeo (1991) had known as the first scholar to empirically test the effects of negative information upon the evaluation of a family brand. Romeo’s results indicated that when the extension was in a similar product category as the family brand, the negative information did not significantly lead to an average decrease in the family-brand image. Keller and Aaker (1992) examined the dilution effects from the perspective of intervening extensions using perceived quality, intention, and inferior or superior product. Loken and Roedder (1993) found different results from the above two studies. Their experimental investigation indicated that a negative impact happened to a family brand when the brand extension attributes were inconsistent, particularly for a distinctive attribute but not for a more general attribute. This means that the typicality of a brand extension is the key for dilution effects regardless of brand extension category. Dilution can occur in two ways. Dilution by blurring is the most common dilution claim. Blurring occurs when the famous mark’s ability to identify its product has been impaired due to an association in the minds of consumers arising from similarity between another mark and the famous mark. For example, a famous mark such as EXXON is uniformly and nearly automatically associated with the energy and petrochemical company. However, the name NATIONAL may evoke several different mental associations, such as NATIONAL BANK, NATIONAL UNIVERSITY or NATIONAL RAILWAY. And, dilution by tarnishment is the second form of dilution. It occurs when the reputation of a famous mark has been harmed by negative associations arising from the similarity between another mark and the famous mark.

2.2 Association
Biel (1992) argued that brand association could result from the corporate image, product image and user image. Each of these three images can be divided into two types of association. One is the perception of utilitarian and functional attributes, like speed or ease to operate. The other is related to soft or emotional attributes, like providing fantasy or being exciting, innovative, or trustworthy. Brand attitudes are defined as consumers’ overall evaluations of a brand. Brand attitudes are important because they often form the basis for consumer behavior (e.g., brand choice). Though different models of brand attitudes have been proposed, one widely accepted approach is based on a multi-attribute formulation in which brand attitudes are a function of the associated attributes and benefits that are salient for the brand. Chen (2001) suggested categorizing brand association into two types – product associations and organizational associations. Product associations could be divided into functional attribute associations and non-functional attribute associations (e.g., emotional association). Organizational associations could be grouped into corporate ability associations and corporate social responsibility associations.

2.3 Backpropagation neural networks (BPNN)
A neural network is known as a computational algorithm which consists of a number of simple, highly interconnected processing elements (PE) (NeuralWare, 1990). It had been employed into many applications (Rumelhart et al., 1986; Ko et al., 1998; Sanjay et al., 2005; Mandal & Roy, 2006; Chen et al., 2007; Vassiliopoulos et al., 2007; Barletta et al., 2007; Hsieh, 2009; Hsieh, 2010), especially for the modeling issue about non-linear relationship between input and output for a complicate system. The perceptron, backpropagation neural network (BPNN), learning vector quantization (LVQ), counter propagation network (CPN) has regarded as the conventional supervised learning neural models (Ko et al., 1998; Neural Ware, 1990; Hsieh, 2001; Hsieh, 2006). Basically, a BPNN consists of three or more layers, including an input layer, one or more hidden layers, and an output layer. The backpropagation learning algorithm employs a gradient- or steepest- heuristic
(Rumelhart, Hinton and Williams, 1986) that enables a network to self organize in such ways that improve its performance over time. In training this type of network, an input pattern is presented and the network adjusts the set of weights in all the connecting links such that the desired output is obtained at the output node. The output generated by the network is compared to the known target value. If there is no difference, no learning takes place. If a difference exists, the resulting error term is propagated back through the network, using a gradient- or steepest-descent heuristic to minimize the error term by adjusting the connection weights. The overall training process for the network using the gradient descent technique can be referred to the relating literatures (Rumelhart, Hinton and Williams, 1986; NeuralWare, 1990).

3. THE PROPOSED AFFECTION/EVALUATION MODEL OF BRAND DILUTION:

As we mentioned, trademark dilution will be an important issue to most enterprises during the competitive environment. Several possible factors had mentioned to evaluate the brand dilution, e.g. (i) degree of similarity between the marks, (ii) degree of inherent or acquired distinctiveness of the famous mark, (iii) the extent to which the owner of the famous mark is engaging in substantially exclusive use of the mark, (iv) the degree of recognition of the famous mark. Besides, the key consideration can be viewed as the affection of uniqueness and the brand association for different degree of brand dilution. After reviewing the related literatures, four factors including the famous degree, similarity degree, usability degree and innovation degree are chosen to prediction model construction. And, three association factors including functional, emotional and organizational association and uniqueness will be also taken into considerations. Constructing a model to screen out the affection effect about brand dilution with different customer clusters according to the brand evaluation and the architecture diagram can be graphically depicted in Figure 1. The detailed construction procedure will be given as follows:

Phase 1. Collect the data via an on-line questionnaire platform.

1-1. Three primary parts will be designed in the questionnaire platform. The first part includes the possible cause affecting brand dilution: (1) famous degree, (2) similarity degree, (3) visibility degree, (4) innovation degree. Each cause will have three evaluation items to be included. The second part will include the evaluation about related evaluation of the association (including the functional, emotional, organizational associations) and uniqueness. The third part will keep the related attributes about the respondent and the evaluation about brand recognition (three evaluation items will be set). Herein, all the evaluation items will be designed as a Likert five scale (i.e., the larger value denote a higher expectation or higher evaluation).

Figure 1: The architecture of the affection model for different customer clusters.

1-2. Perform the clustering analysis depending on the information about the evaluation of brand recognition. The number of clusters will be an important choice, basically, the suitable number of clusters can be defined as from three to six clusters with the practice considerations.

Phase 2. Constructing prediction model for the different clusters.

2.1. Randomly take around one-fourth from the experimental data or historical data to form the testing set of BPNN. The remaining parts of the experimental data forms the training set of BPNN.

2.2. The evaluation about functional, emotional, organizational association and uniqueness/the evaluation of famous degree, similarity degree, usability degree and innovation degree will be taken as the input/output of the BPNN, i.e. the number of PE in input/output layer will be set as 4/12.

2.3. Test several different architectures (e.g., the number of PEs in the input layer-the hidden layer-output layer, the learning rate, the learning rule, the momentum, etc) of BPNN by
using the training set and testing set chosen in Step 2-1. The root mean square error (RMSE) (NeuralWare, 1990; Su and Miao, 1998) of the training and testing data for each architecture can be utilized as the criterion in determining the best BPNN architecture. A pre-determined training epoch can be regarded as the stopping criteria of training process (NeuralWare, 1990). The best architecture can simultaneously minimize the RMSEs of the training set and testing set in Step 2-1.

2.4. Combine the training set and testing set chosen in Step 2-1 into a final training set. Restated, assign all historical manufacturing data as the training set. Retrain the best BPNN chosen from Step 2-3 until the best BPNN's architecture reaches the pre-determined training epoch.

4. ILLUSTRATIVE EXAMPLE:

We choose the fashion industry in Taiwan as an illustrative example to demonstrate the rationality and feasibility of the proposed approach. The managers of a SME in fashion industry recognized that the brand dilution problem may exist during the competitive fashion environment. A project team is grouped to perform a study to address such issue. The managers would like to know the effect on the functional association, the emotional association, the organizational association from the consumers’ viewpoint with respect to the possible causes of dilution. Besides, they also would like to realize the status about uniqueness of brand. Hence, this project team intends to construct a brand dilution model by using the on-line questionnaire platform. There are about three hundred members for this SME. In order to collect the necessary information, a questionnaire platform is opened about six months periods from 2014/03~2014/06. Totally about two hundred members had logged into such platform to fulfill the questionnaire. As for the questionnaire from, there are three evaluation items for the brand recognition, famous degree, similarity degree, usability degree and innovation degree, and one evaluation item for functional, emotional, organizational association and uniqueness. Herein, the Likert five-scale is used to perform the evaluation.

Firstly, the evaluation of brand recognition will be taken into performing the clustering analysis. About three clusters can be screened out via inputting the evaluation items into SPSS 12.0. Then, the managers can perform the detailed analysis for those three customer clusters. Herein, the features of such three clusters can be showed as the center of cluster: (4.2, 3.3, 2.8), (4.1, 3, 4.2), (3, 2.8, 4.5). Next, the project team will construct the detailed prediction model for each cluster. About fifty-six data records are randomly selected as the testing data set and the rest part are selected as the training data set. It will keep the ratio of testing/training data to be as 1/4 (NeuralWare, 1990; Hsieh, 2009; Hsieh, 2010).

Figure 3: The RMSE comparison results for different architectures (for cluster 1).

Figure 4: The RMSE comparison results for different architectures (for cluster 2).

Figure 5: The RMSE comparison results for different architectures (for cluster 3).

Then, the four signals owing to the associations and uniqueness, and the three evaluation items of those four causes affecting the brand dilution (i.e. the famous degree, similarity degree, usability degree, innovation degree) will be taken as the inputs/outputs of the BPNN model, i.e the number of PE in input/output layer is 4/12. Herein, the learning rule is initially set as delta-bar-delta rule,
earning rate is set as 0.1, the momentum is set as 0.8, the learning epochs are set as 10000 according to the previous random trails. Next, the root of mean square error (RMSE) of training and testing will be regarded as the criteria to determine the optimum BPNN architecture with the minimum training and testing RMSE values, i.e. the number of PEs in the hidden layer. Depending on different architectures of BPNN, the optimum architecture with the minimum training RMSE and testing RMSE can be determined as 4-16-12 for cluster 1, 4-12-12 for cluster 1, 4-12-12 for cluster 1 (in Figure 35).

The obtained models can be viewed as a reference model based on the most customers’ viewponts. The managers can realize the predicted status of their brand dilution during the competitive fashion industry. For example, the senior managers in SME had collected some new customers' information via the on-line platform. They would like to check out the estimated brand dilution about those new customers. The average evaluation of those new customers had computed as (4.12, 3.25, 4.22) and it will have the least distance to the second cluster. Next, the prediction model of the second cluster will be taken to the latter brand dilution analysis. The senior managers in SME input the four evaluations of association (3.8, 4.22, 3.65, 2.85) into the prediction model, and the expected evaluations of famous, similarity, visibility and innovation can be obtained as (3.12, 3.08, 2.82, 3.05, 2.89, 3.61, 3.42, 3.55, 3.18, 4.62, 4.44, 4.38). Next, the manager can compute the actual evaluation for famous, similarity, visibility and innovation degree and find out only the innovation degree will exceed 4. It will provide useful information to managers about their subsequent marketing strategies setting to pay more attention to the issue about innovation for their brand. The managers can dynamically re-construct the BPNN model according to their requirement without time limitation. Especially, such model is constructed with respect to the consumers’ viewpoint.

5. CONCLUDING REMARKS:

We can find out that the brand dilution model can be regarded as a useful and meaningful model to enterprise’s managers after reviewing the demonstration about the illustrative example last section. Such model can be dynamically constructed via using the consumer’s evaluation records. Basically, we incorporate the evaluation of consumers about the famous degree, similarity degree, usability degree and innovation degree for the particular brand and construct a prediction model. During the competitive environment, brand dilution effect can provide more useful information to those issues including the marketing strategy, segmentation, etc. Especially, such model can be reconstructed well under the actual requirement.

REFERENCES:


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