



## Designing a model of FANP in brand image decision-making

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### ABSTRACT

Both theoretical and practical efforts in brand images often neglect the characteristics having interactions and mutual influence among attributes or criteria, even in the stages of different brand life cycles. This study aims to create a hierarchical framework for brand image management. The analytical network process and fuzzy sets theory have been applied to both mindshare in brand images and inherent interaction/interdependencies among diverse information resources. A real empirical application is demonstrated in the department store. Both the theoretical and practical background of this paper have shown the fuzzy analytical network process can capture expert's knowledge existing in the form of incomplete and vague information for the mutual influence on attribute and criteria of brand image management.

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### 1. Introduction

Brand images have been increasingly considered primary topics for many marketing businesses [3]. Utilizing the ideal brand image not only assists enterprises to establish market positions, but also protect brands from other competitors [15]. These potential factors with the brand life cycles have also strengthened the importance of brand image management.

Bennett and Rundle-Thiele [5] demonstrated the brand image before entering the market needed to plan a series of marketing strategies, including (1) the position of the target market and brand image in the brand life cycles; (2) the situation of the competitive market; (3) the expected results for diverse integrated marketing communication tools; (4) revising the brand characteristics in different stages of the brand life cycles. Thus, the key axle for developing marketing strategies should focus on how to integrate brand image dimensions, attributes and marketing communication tools in brand life cycles, especially considering the interactive effects.

The issues for managing and strengthening brand images have emerged as the most crucial topics for marketing management [1,2,25]. Most research ignores the interdependency of interactive characteristics among the dimensions and attributes of brand images, even though there is feedback between the brand images and different brand life cycles, causing a weakness of the hierarchical frameworks in brand images. Further, the decision makers

subjectively plan diverse marketing strategies based on the unique posture of brand images in their psychological position. This unique posture is the same concept as the “share of mind” cited by Temporal [33] in which there is a fuzzy and vague awareness in decision makers' minds. When decision makers decide to transmit a consistent brand image values in different brand life cycles based on consumer response to the marketing of a brand, the incomplete and uncertain information will have an imprecise effect on their assessment of the degree of importance of brand images.

Moreover, brand image selection problem usually involves more than one criterion and criteria often conflict with each other. In multi-attribute decision-making (MADM), it is widely assumed the criteria are independent. A considerable number of decision models have been developed based on the theory, such as the preference ranking organization method, the analytical hierarchy process, discrete choice analysis, and data envelopment analysis [14]. However, the available information in a multi-criteria decision process is usually uncertain, vague, or imprecise, and the criteria are not independent in the real situation [10,18]. In the real world, this usually exists when the brand image selection is full of uncertainty and the imprecision of human subjective judgment. Thus, in this paper fuzzy sets theory is used to cope with these situations.

Furthermore, the weight and the grade of importance are the general forms used to demonstrate the preference of brand images. If the importance of a criterion can be captured properly, the quality of the decision-making for brand image management will be enhanced correspondingly. Conventionally, the importance-assessing methods used to demonstrate the importance of criteria are often based on the assumptions of independence. However, in fact, people have found that using such an independence model is not always suitable because of the interactions and feedbacks

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among the criteria to somewhat different degrees. Whereas the analytical network process (ANP) [31] does not need to assume independency of one criterion from another, it can be used in non-linear situations. Even in an objective sense, any two criteria may be dependent from the subjective viewpoint of decision makers. Therefore, this paper further applies the fuzzy sets theory and uses ANP technique called FANP to evaluate the synthetic importance index of brand images to reflect in reality that the decision criteria are inevitable correlated to others with different degrees.

## 2. Analytic network process with fuzzy concepts

The ANP was proposed in [28,30] to overcome the problem of interdependence and feedback between criteria on alternatives. The ANP is the general form of the analytic hierarchy process (AHP) [29] which has been used in multi-criteria decision-making (MCDM) to release the restriction of hierarchical structure. The ANP feedback approach replaces hierarchies with networks, in which the relationships between levels are not easily represented as higher or lower, dominated or being dominated, directly or indirectly [24]. For instance, not only does the importance of the criteria determine the importance of the alternatives as in a hierarchy, but also the importance of the alternatives may have impact on the importance of the criteria [31]. Therefore, a hierarchical structure with a linear top-to-bottom form is not applicable for a complex system.

While AHP has been a popular research and application tool for multi-attribute decision-making, the ANP technique so far has had only a few applications in literature. A matrix manipulation approach, developed by Saaty and Takizawa [27], is applied to solve a network, which is very similar to a hierarchy but has dependence among criteria and dependence among alternative with respect to each criterion. Lee and Kim [19] used the above-cited ANP approach within a zero-one goal-programming model to suggest an information system project selection methodology, which can reflect interdependencies among evaluation criteria and candidate projects. Karsak et al. [17] deal with product planning in quality function deployment by also using a combined ANP and goal-programming approach. Chung et al. [11] adopt Saaty's matrix manipulation concept and suggest a simplified ANP approach to analyze multiple process inputs and outputs, and with experts' opinion on their priority of importance, to obtain optimal product mixes for semiconductor production. Recently, Lee et al. [20] apply ANP to analysis core technologies in a technology network and Lin et al. [23] adopt ANP to evaluate the sustained travel intermediary as well as elaborating the service performance and quality.

However, human judgment varies from person to person, as human perception always contains a certain degree of vagueness and ambiguity. Zhang and Lu [35] think human judgment is generally characterized by vague language, like 'equal', 'moderately', 'strongly', 'very strongly', 'extremely', and a 'significant degree' of investment. Using such language, decision makes quantity uncertain events and objects. Fuzzy theory enables decision makers to tackle the ambiguities involved in the process of the linguistic assessment of the data. Subsequently, in fuzzy ANP, the linguistic assessment is converted to triangular fuzzy numbers. These triangular fuzzy numbers are used to build a pairwise comparison matrix for the ANP and one can obtain the weights for attributes on each level. Several authors have applied the fuzzy ANP-based approach to solve complex decision-making scenarios [11–13,21,32,34]. Recently, some researchers [4,22,26] applied a fuzzy ANP approach to quality function deployment problems. Their method is an extension of FAHP approach proposed by Chang [8], which derives crisp local priorities from fuzzy comparison matrix using the extent analysis method and possibility theory.

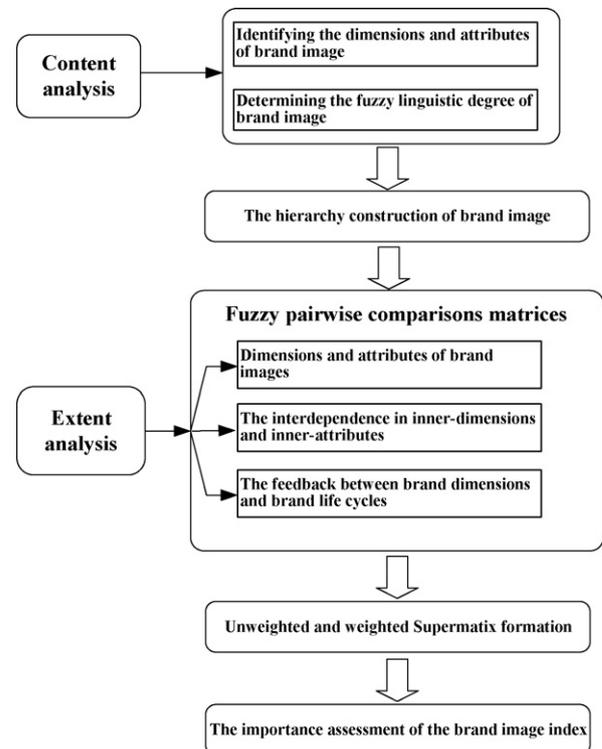


Fig. 1. The flow chart for the algorithm in this study.

## 3. Construction of FANP in brand image

Brand image evaluations generally involve the questions of three aspects: (1) the unique status of brand images emerging in the decision makers psychological position through linguistics have subjective fuzzy cognitions; (2) the multi-criteria levels in the dimensions of brand images and marketing communication tools; (3) the feedback effect between different brand life cycles and brand image dimensions. This study addresses the issue of combining both brand image dimensions and attributes using fuzzy ANP along with the interaction in the brand life cycles. The flow chart for the algorithm in this study is shown in Fig. 1.

### 3.1. The hierarchy construction of brand image

This study establishes network hierarchical process of brand images by the depth interview with experts to collect relational variables. The purpose is to understand the decision markers' cognitions, the share of mind in brand images with fuzzy sets concepts, among the interdependent characteristics of brand life cycles. Therefore, the whole goal of brand image can be decomposed by brand image dimensions and its attributes, in which the interrelationships in different brand life cycles and the feedback effects with brand image dimensions. The proposed FANP model is depicted in Fig. 2.

### 3.2. Determining the fuzzy linguistic degree of brand image

Throughout the fuzzy concept, it is assumed that decision makers use the linguistic weighting set  $N_k$ ,  $N_k = \{\text{medium, a little important, important, very important, extremely important}\}$  ( $k=1, 2, \dots, 5$ ), to evaluate the relative importance among the inner-dimensions, inner-attributes of brand images in the brand life cycles. The fuzzy linguistic scales are illustrated in Fig. 3.

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