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Applying the ANP Model for Selecting the Optimal Full-service Advertising Agency

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Abstract — This study develops a model for selecting full-service advertising agencies considering the interdependencies among evaluation criteria. First of all, the proposed model adopts the Nominal Group Technique (NGT) to identify suitable evaluation criteria for selecting advertising agencies. Secondly, the model uses the Analytic Network Process (ANP) to determine the relative weights of criteria, then ranks the alternatives and selects the optimum advertising agency. Finally, an example of famous Taiwanese food company is used to demonstrate the process of advertising agency selection for this model. The proposed model helps advertisers to effectively select full-service advertising agencies, making it highly applicable for academia and commerce.

Keywords — Advertising agency, nominal group technique (NGT), analytic network process (ANP)

1. INTRODUCTION

For an advertiser, searching an ideal full-service advertising (Ad) agency to find right marketing strategies and execute promotional plans efficiently will increase brand awareness and sales. If an advertiser makes a poor agency choice, not only will their marketing goal not be achieved, but the advertiser will also be led to later switch agencies. Buchanan and Michell (1991) reported that selecting a new agency consumes much time and attention, as does creating a new working relationship. The disruption to promotional strategy caused by a change in agencies can weaken the brand's image. Therefore, how to objectively and effectively select an ideal Ad agency and avoid incurring switching costs is a very important problem for most of advertisers.

Selecting the optimal full-service Ad agency is a multi-criteria decision-making (MCDM) problem. Suitable criteria and strict screening is necessary to select an ideal Ad agency. Several researchers have attempted to define the criteria of Ad agency selection (Cagley and Robert, 1984; Dowling, 1994; Luk and Yip, 1996) and to compare advertiser perceptions to agency perceptions (Cagley, 1986). Additionally, some researchers have provided the process for selecting Ad agencies (Harvey and Rupert, 1998; Dowling, 1994; Marshall and Woon, 1994). But, few studies have reported the quantitative selection model of Ad agencies. Analytic hierarchy process (AHP) (Saaty, 1980) is a widely used approach for handling such MCDM problems. However, AHP suffers a significant limitation in assuming independence among various decision-making criteria. On the other hand, analytic network process (ANP) captures interdependencies among the decision attributes and permits more systematic analysis. ANP also allows the inclusion of all the relevant criteria (tangible or intangible, objective or subjective, *etc.*) that can help in arriving at an optimal decision (Saaty, 2001). In contrast to AHP, ANP provides a more generalized model for decision-making that is free of assumptions about the independence of higher-level elements from lower-level elements, and also of the elements within a level. Coulter and Sarkis (2005) used ANP for media selection. Hsu (2009) adopted ANP to select advertising spokespersons. Additionally, Hsu (2010) also used ANP for independent media agencies selection. In the selection of Ad agencies, the criteria include both subjective and objective types. These criteria are also interdependence, and thus cannot be captured by the popular AHP method. Therefore, rather than using the common AHP approach to solve such types of problems, this study recommends using an ANP-based model to select Ad agencies.

The proposed model uses the nominal group technique (NGT) to identify suitable evaluation criteria and ANP to weight those criteria, then ranks the alternatives and selects the optimal Ad agency. In addition, a renowned Taiwanese food

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company is used as an example of how an Ad agency can be selected using the proposed model. This model provides consumer product' advertisers with a more objective and effective means of selecting the optimal Ad agency.

2. METHODOLOGY

2.1 Nominal Group Technique (NGT)

NGT was developed by Delbecq, Van de Van and Gustafson. It was derived from social psychology studies of decision conferences, management science studies of aggregating group judgments, and social work studies of problems surrounding citizen participation in program planning. Since that time, NGT has gained recognition and has been widely applied in health, social service, education, industry and government organizations (Delbecq *et al.*, 1975). This study applies the NGT to define the evaluation criteria (Van de Van and Delbecq, 1971). The process of decision marking in NGT is as follows (Delbecq *et al.*, 1975): (1) silent generation of ideas in writing, (2) round-robin feedback from group members to record each idea in a terse phrase on a flip chart, (3) discussion of each recorded idea for clarification and evaluation, and (4) individual voting on priority ideas with the group decision being mathematically derived through rank-ordering or rating.

2.2Analytic Network Process (ANP)

ANP (Saaty, 1996) is a comprehensive decision-making technique that has the capability to include all the relevant criteria, in arriving at a decision. ANP is an extension of AHP, and AHP models a decision-making framework that assumes an un-directional hierarchical relationship among decision levels. Although AHP can help resolve complex MCDM problems, it is less successful when applied to problems involving multi-criteria or hierarchy dependence relationships (Saaty, 1980). Consequently, Saaty again advances a new theory, which maintains the spirit of AHP and continues developing the ANP method, elevating the analytical ability of ANP. In many cases, interdependence exists among criteria and alternatives. ANP provides an effective tool in cases where interactions among the elements of a system form a network structure via a supermatrix approach (Saaty, 1996). Lee and Kim (2000) used ANP for information system project selection. Cheng and Li (2004) applied ANP to select contractor. Moreover, Poonikom *et al.* (2004) adopted ANP for university selection decisions. Additionally, Jharkharia and Shankar (2007) used ANP to select logistics service providers.

The process of ANP comprises four major steps (Meade and Sarkis, 1998; Saaty, 2001)

Step 1: Model construction and problem structuring

The problem should be clearly stated and decomposed into a rational system such as a network. The framework can be determined based on decision maker opinion via brainstorming or other appropriate methods.

Step 2: Pair-wise comparisons matrices and priority vectors

The ANP decision elements at each component are compared pair-wise with respect to their control criteria, and the components themselves are also compared pair-wise with respect to their contribution to the goal. Decision makers are asked to respond to a series of pair-wise comparisons in which two elements or components at a time will be compared in terms of how they contribute to their particular upper level criterion. The relative importance values are determined on a scale of 1 to 9, where "1" represents equal importance between the two elements and "9" indicates extreme importance of one element (row component in the matrix) versus the other one (column component in the matrix) (Meade and Sarkis, 1999). A reciprocal value is assigned to the inverse comparison (that is, aij =1 / aij) where aij denotes the importance of the ith element compared to the jth element. Like AHP, pair-wise comparison in ANP is made in the framework of a matrix, and a local priority vector can be obtained for estimating the relative importance associated with the elements (or components) being compared by solving the following formulae:

$$A \cdot w = \lambda_{\max} \cdot w, \tag{1}$$

where A denotes the matrix of pair-wise comparison, w represents the eigenvector, and λmax is the largest eigenvalue of A. If A denotes a consistency matrix, then eigenvector X can be determined using

$$(A - \lambda_{max} I)X = 0. \tag{2}$$

Saaty (1980) proposed adopting the consistency index (CI) and consistency ratio (CR) to verify the consistency of the comparison matrix. The CI and RI are defined as follows:

$$CI = (\lambda_{\max} - n)/(n-1) \tag{3}$$

$$CR = CI / RI \tag{4}$$

where RI denotes the average consistency index for numerous random entries of same-order reciprocal matrices. If CR $\leq$ 0.1, then the estimate is accepted; otherwise, a new comparison matrix is solicited until CR $\leq$ 0.1.

Step 3: Supermatrix formation

The supermatrix concept resembles the Markov chain process (Saaty, 1996). To obtain global priorities in a system involving interdependent influences, the local priority vectors are entered into the appropriate columns of a matrix, known as a supermatrix. Consequently, a supermatrix is actually a partitioned matrix, where each matrix segment represents a relationship between two nodes (components) in a system (Meade and Sarkis, 1999). Let the components of a decision system be Ck; k =1, ⋯, n, where each component k has mk elements, denoted by ek1, ek2, ⋯, ekmk. The local priority vectors derived in Step 2 are grouped and located in appropriate positions in a supermatrix based on the flow of influence from one component to another, or from a component to itself, as in the loop. The standard form of a supermatrix resembles that in (5) (Saaty, 2001).

$$W = \begin{array}{cc} & \begin{array}{ccccc} C_1 & \cdots & C_k & \cdots & C_n \\ e_{11}\cdots e_{1m_1} & \cdots & e_{k1}\cdots e_{km_k} & \cdots & e_{n1}\cdots e_{nm_n} \end{array} \\ \begin{array}{cc} & e_{11} \\ C_1 & \vdots \\ & e_{1m_1} \\ \vdots & \vdots \\ & e_{k1} \\ C_k & \vdots \\ & e_{km_k} \\ \vdots & \vdots \\ & e_{n1} \\ C_n & \vdots \\ & e_{nm_n} \end{array} & \begin{bmatrix} W_{11} & \cdots & W_{1k} & \cdots & W_{1n} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ W_{k1} & \cdots & W_{kk} & \cdots & W_{kn} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ W_{n1} & \cdots & W_{nk} & \cdots & W_{nn} \end{bmatrix} \end{array} \tag{5}$$

If the criteria are interrelated, the (2, 2) entry of Wn given by W22 would indicate the interdependency, and the supermatrix would be (Saaty, 1996)

$$W_n = \begin{bmatrix} 0 & 0 & 0 \\ w_{21} & w_{22} & 0 \\ 0 & w_{32} & I \end{bmatrix} \tag{6}$$

Notably, any zero in the supermatrix can be replaced by a matrix if there is an interrelationship among the elements in a component or between two components. Since interdependence generally exists among clusters in a network, the columns of a supermatrix usually total more than one. The supermatrix must be transformed first to make it stochastic; that is, each column of the matrix sums to unity. Saaty (2001) recommended determining the relative importance of the clusters in the supermatrix with the column cluster (block) as the controlling component (Meade and Sarkis, 1999). That is, the row components with nonzero entries for their blocks in that column block are compared according to their impact on the component of that column block (Saaty, 1996). Through a pair-wise comparison matrix of the row components with respect to the column component, an eigenvector can be obtained. This process obtains an eigenvector for each column block. For each column block, the first entry of the respective eigenvector is multiplied by all the elements in the first block of that column, the second entry is multiplied by all the elements in the second block of that column and so on. The block in each column of the supermatrix is thus weighted, and the result is termed the weighted supermatrix, which is stochastic.

Raising a matrix to powers gives the long-term relative influences of elements on each other. To achieve convergence of the importance weights, the weighted supermatrix is raised to the power of 2k + 1; where k is an arbitrarily large number, and this new matrix is called the limit supermatrix (Saaty, 1996). The limit supermatrix has the same form as the weighted supermatrix, but all the columns of the limit supermatrix are the same. Normalizing each block of this supermatrix can obtain the final priorities of all the elements in the matrix.

Step 4: Selection the best alternatives.

If the supermatrix formed in Step 3 covers the whole network, the priority weights of alternatives can be found in the column of alternatives in the normalized supermatrix. On the other hand, if a supermatrix is only comprised of interrelated components, additional calculations must be performed to obtain the overall priorities of the alternatives. The alternative with the largest overall priority should be the one selected. This study applies the first method, and a supermatrix that covers the whole network, as shown by the bracket in Figure 1, is then formed.

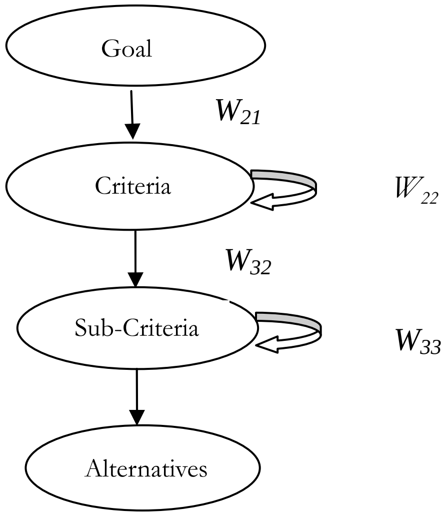

Figure 1 Network form for this study

3. MODEL APPLICATION AND RESULTS

The famous Taiwanese food company with a nominal, advertising budget of NT$ 80 million annually is taken as an example. Selecting a full-service Ad agency is a critical decision for this food company. Thus, a decision group for agency selection is organized, comprised of the following members: the CEO, Marketing director (MD), Advertising Manager (AM), Product Manager (PM), and Assistant Product Manager (APM). Data used in this study appeared in the local Brain Magazine and represent all Ad agencies in Taiwan with annual billings exceeding NT$ 100 million (Editorial Department of Brain, 2011). The research object of this study is mainly according to the Brain Magazine announces that choose front five Ad agencies in Taiwan. The five Ad agencies were labeled agency A, B, C, D and E, and the evaluation figures are ultimately obtained from these plans.

The proposed model involves five steps, during which the NGT is used to identify suitable criteria for evaluating Ad agencies, after which the ANP is applied to determine the relative weights of the criteria, then rank the alternatives and select the optimal Ad agency via Super Decision software. These steps are detailed as follows:

Step1. *Define the evaluative criteria for selecting full-service Ad agencies.*

Nine experts are selected to be responders of the NGT. All of them are professional managers with experience in Ad agency decision-making and currently working as advertising managers, product managers or marketing managers from nine well-known consumer product's manufactures in Taiwan.

Community experts determine the evaluation criteria by using the NGT to reach a consensus of opinion and achieve uniform recognition. This study obtained essential five criteria and ten sub-criteria, which are duly listed below:

1. Strategic Planning Ability: including three sub-criteria for (1) marketing research: ability in marketing survey and analysis, (2) whole planning: integrated marketing planning and strategy development and (3) business understanding: really understanding advertiser business and products.
2. Media Ability: including two sub-criteria for (1) media planning: identifying the advertising media and specific individual units that must be purchased to reach the target audience, including an advertising placement timetable, and (2) media buying: checking that agencies execute contracts for space and time, negotiating for favorable media rates.
3. Creativity: including two sub-criteria for (1) creative work that sells: monitoring whether the creative work is following the development of marketing strategies and helping products to sell and (2) advertising awards: total numbers of 4A awards, China Times awards and international advertising awards. Both creative work that sells and awards are considered, to avoid the trap of creative success and sales failure.
4. Service Level: including three sub-criteria for (1) service range: checking the range of agency services besides advertising planning, creativity and media, including marketing research, sales promotion, public relations, direct marketing, and package design, (2) personnel quality: the professional quality of people assigned to the account and (3) compatibility and timing: whether the agency people are easy to work with and provide timely feedback.
5. Cost Consciousness: to confirm whether or not the agency meets budget commitments. It is expected that agencies will not emphasize creative quality at the expense of cost.

Step 2: Establish a hierarchical structure and the ANP network.

The problem of Ad agency selection is broken into four levels: first that of achieving the ultimate goal of selecting the optimal Ad agency, followed by five criteria, 10 sub-criteria and finally the alternatives, as shown in Figure 2. According to the suggestions of nine experts, Figure 3 and 4 show the interdependence among criteria based on the hierarchical structure.

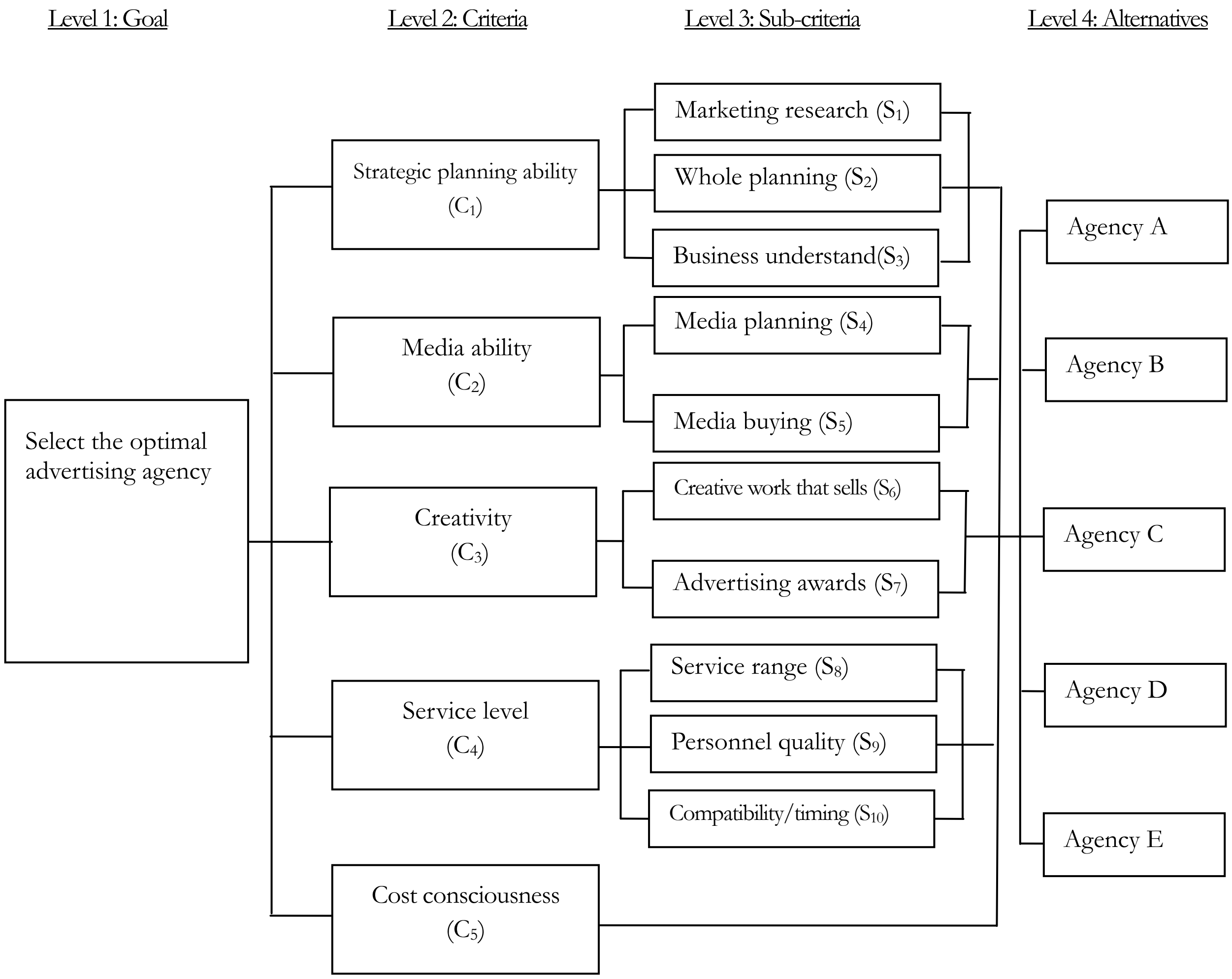

Figure 2 Hierarchical structure required to selecting the optimal Ad agency

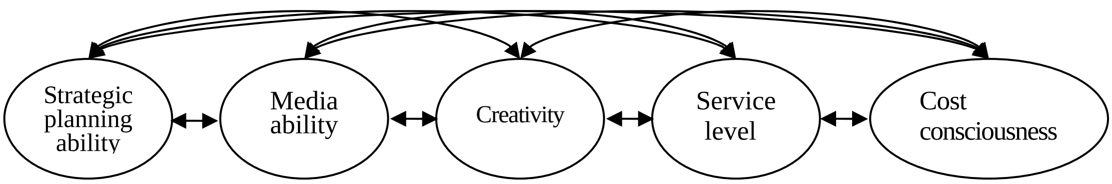

Figure 3 Interdependence criteria of ANP model

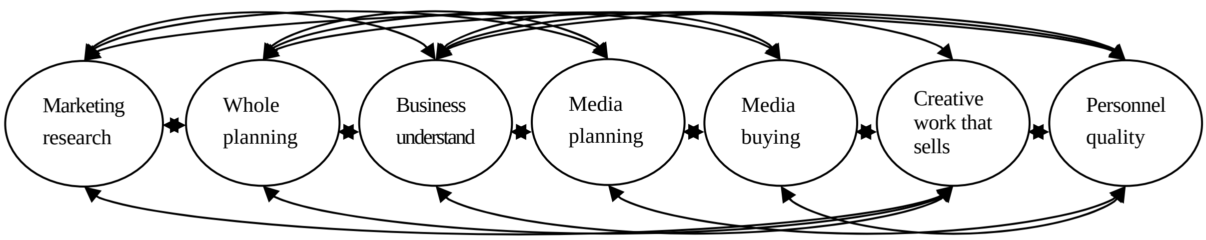

Figure 4 Interdependence Sub-criteria of ANP model

***Step 3**. Establish the pair-wise comparisons matrices and determine eigenvectors*

Nine experts make a pair-wise comparison of the decision criteria and assign relative scores, and the geometry mean value is used to calculate comprehensive decision-making community scores, and the eigenvectors are then calculated using Eg. (2). Egs. (3) and (4) are used to calculate the criteria comparison matrix of consistency for each hierarchy. The results of the consistency test, the *CR* of the comparison matrix from each of the nine experts, are all smaller than "0.1", indicating "consistency". Furthermore, the *CR* of the aggregate matrix is also below "0.1", again indicating "consistency". Table 1 lists the aggregate pair-wise comparison matrix of criteria and consistency test. Table 2 presents the aggregate pair-wise comparison matrix for sub-criteria and consistency test.

Table 1: Pair-wise comparison matrix for criteria of Level 2

Level 2 Criteria	C_1	C_2	C_3	C_4	C_5	e Vecter (W_{21})
Strategic planning (C_1)	1.000	3.837	1.653	4.314	4.716	0.422
Media ability (C_2)	0.261	1.000	0.337	1.196	1.259	0.107
Creativity (C_3)	0.605	2.963	1.000	3.393	3.411	0.293
Service level (C_4)	0.232	0.836	0.295	1.000	1.019	0.091
Cost consciousness (C_5)	0.212	0.794	0.293	0.981	1.000	0.087
λ_{max}=5.007; *CI*=0.002; *CR*=0.002 ≦0.1 consistency						

Table2: Pairwise comparison matrix for sub-criteria of Level 3

Strategic planning ability (C_1)					Service level (C_4)				
	S_1	S_2	S_3	e Vecter (W_{32})		S_8	S_9	S_{10}	e Vecter (W_{32})
S_1	1.000	1.068	0.898	0.328	S_8	1.000	0.378	0.282	0.138
S_2	0.936	1.000	0.860	0.310	S_9	2.645	1.000	0.655	0.350
S_3	1.114	1.162	1.000	0.362	S_{10}	3.543	1.526	1.000	0.512
λ_{max}=3.000; *CI*=0; *CR*=0.000≦0.1					λ_{max}=3.002; *CI*=0.001; *CR*=0.002≦0.1				

Media ability (C_2)				Creativity (C_3)			
	S_4	S_5	e Vecter (W_{32})		S_6	S_7	e Vecter (W_{32})
S_4	1.000	1.338	0.572	S_6	1.000	3.765	0.790
S_5	0.747	1.000	0.428	S_7	0.266	1.000	0.210
λ_{max}=2.000; *CI*=0; *CR*=0.000≦0.1				λ_{max}=2.000; *CI*=0; *CR*=0≦0.1			

Step 4. *Establish pair-wise comparisons matrices of interdependencies*

In order to consider interdependencies between second level criteria, and between third level sub-criteria, this study also invited the above nine experts to assign interdependent weights, and then integrate the geometric mean for these interdependent weights. Table 3 lists the aggregate pair-wise comparison matrix of interdependence between criteria and consistency test. Table 4 lists the interdependence matrix of sub-criteria.

Table 3: Pair-wise comparison matrix for interdependent weights between criteria

Strategic planning ability (C1)	C2	C3	C4	C5	e Vecter (W22)
Media ability (C2)	1.000	0.919	1.366	2.101	0.287
Creativity (C3)	1.088	1.000	3.998	2.898	0.425
Service level (C4)	0.732	0.250	1.000	1.000	0.151
Cost consciousness (C5)	0.476	0.345	1.000	1.000	0.137
CI= 0.029; CR= 0.032 ≦0.1 consistency					
Media ability (C2)	**C1**	**C3**	**C4**	**C5**	**e Vecter (W22)**
Strategic planning (C1)	1.000	1.255	2.507	5.999	0.453
Creativity (C3)	0.767	1.000	1.500	3.000	0.279
Service level (C4)	0.399	0.667	1.000	1.194	0.161
Cost consciousness (C5)	0.167	0.333	0.838	1.000	0.106
CI= 0.021; CR= 0.023 ≦0.1 consistency					
Creativity (C3)	**C1**	**C2**	**C4**	**C5**	**e Vecter (W22)**
Strategic planning (C1)	1.000	1.212	3.533	4.221	0.448
Media ability (C2)	0.825	1.000	2.000	1.741	0.291
Service level (C4)	0.283	0.500	1.000	1.194	0.135
Cost consciousness (C5)	0.237	0.574	0.838	1.000	0.127

CI= 0.016; CR= 0.017 ≦0.1 consistency

Service level (C4)	C1	C2	C3	C5	e Vecter (W22)
Strategic planning (C1)	1.000	3.000	1.519	4.035	0.440
Media ability (C2)	0.333	1.000	0.458	1.562	0.162
Creativity (C3)	0.658	2.184	1.000	1.328	0.265
Cost consciousness (C5)	0.248	0.640	0.753	1.000	0.133
CI= 0.031; CR= 0.034 ≦0.1 consistency					

Cost consciousness (C5)	C1	C2	C3	C4	e Vecter (W22)
Strategic planning (C1)	1.000	3.000	0.999	6.000	0.439
Media ability (C2)	0.333	1.000	0.667	1.000	0.146
Creativity (C3)	1.001	1.500	1.000	3.000	0.311
Service level (C4)	0.167	1.000	0.333	1.000	0.104
CI= 0.041; CR= 0.045 ≦0.1 consistency					

Table 4 Interdependent weights between third levels of sub-criteria

W33	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
S1	0	0.168	0.115	0.117	0	0.110	0	0	0.128	0
S2	0.160	0	0.168	0.117	0.167	0.190	0	0	0.148	0
S3	0.239	0.267	0	0.316	0.329	0.350	0	0	0.225	0
S4	0.104	0.141	0.083	0	0.099	0	0	0	0.079	0
S5	0.076	0.071	0.061	0	0	0	0	0	0.060	0
S6	0	0	0.287	0	0	0	0	0	0.361	0
S7	0	0	0	0	0	0	0	0	0	0
S8	0	0	0	0	0	0	0	0	0	0
S9	0.422	0.353	0.287	0.450	0.405	0.350	0	0	0	0
S10	0	0	0	0	0	0	0	0	0	0

Step 5. *Determine the weight of ANP and select the optimum Ad agency*

A supermatrix resolves the effects of interdependence between the system elements. A supermatrix denotes a partitioned matrix, in which each criterion comprises the vectors determined from the pair-wise comparison. The supermatrix in Figure 1 covers all the network elements. Table 5 presents the supermatrix, in addition to the respective vectors and matrices previously obtained. Since the supermatrix includes interactions between clusters, e.g. inner dependence exists among criteria, not all of the columns sum to one. A weighted supermatrix is transformed first into a stochastic value, as presented in Table 6. After entering the normalized values into the supermatrix and completing the column stochastic, the supermatrix is then raised to a sufficiently large power until convergence occurs (Saaty, 1996; Meade and Sarkis, 1998). The current supermatrix reached convergence and attained a unique eigenvector. Table 7 presents the final limit matrix. This limit matrix is column-stochastic, and represents the final eigenvector. The rankings of the Ad agencies from applying this approach are agency A (0.333), agency C (0.252), agency D (0.233), agency B (0.097) and agency E (0.085). Thus, the optimal selection is agency A.

4. CONCLUSION

This study presented a new model for selecting advertising agencies according to advertiser perceptions. The proposed model adopts the NGT to identify suitable evaluation criteria and ANP to weight those criteria, then ranks the alternatives and selects the optimal advertising agency. A famous Taiwanese food company is used herein as an example of how an advertising agency can be selected using the proposed model. The new model is also applied for an empirical study. The analytical results reveal that the advertising agencies are ranked in the following order of desirability: Agency A, Agency C, Agency D, Agency B, Agency E was selected herein as the optimal Ad agency. The proposed model ranks the importance to consumer product's advertisers of the various criteria used herein to compare the desirability of different Ad agencies as follows: strategic planning (0.309), creativity (0.255), media ability (0.199), service level (0.125), and finally cost consciousness (0.112). In practice, advertisers of a renowned Taiwanese food manufacturer sign a contract with Agency A. The proposed model provides an objective and effective decision model for advertisers to use in selecting an advertising agency.

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Table 5 The supermatix

	Goal	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Goal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C1	0.422	0	0.453	0.448	0.440	0.439	0	0	0	0	0	0	0	0	0	0
C2	0.107	0.287	0	0.291	0.162	0.146	0	0	0	0	0	0	0	0	0	0
C3	0.293	0.425	0.279	0	0.265	0.311	0	0	0	0	0	0	0	0	0	0
C4	0.091	0.151	0.161	0.135	0	0.104	0	0	0	0	0	0	0	0	0	0
C5	0.087	0.137	0.106	0.127	0.133	0	0	0	0	0	0	0	0	0	0	0
S1	0	0.328	0	0	0	0	0	0.168	0.115	0.117	0	0.110	0	0	0.128	0
S2	0	0.310	0	0	0	0	0.160	0	0.168	0.117	0.167	0.190	0	0	0.148	0
S3	0	0.362	0	0	0	0	0.239	0.267	0	0.316	0.329	0.350	0	0	0.225	0
S4	0	0	0.572	0	0	0	0.104	0.141	0.083	0	0.099	0	0	0	0.079	0
S5	0	0	0.428	0	0	0	0.076	0.071	0.061	0	0	0	0	0	0.060	0
S6	0	0	0	0.790	0	0	0	0	0.287	0	0	0	0	0	0.361	0
S7	0	0	0	0.210	0	0	0	0	0	0	0	0	0	0	0	0
S8	0	0	0	0	0.138	0	0	0	0	0	0	0	0	0	0	0
S9	0	0	0	0	0.350	0	0.422	0.353	0.287	0.450	0.405	0.350	0	0	0	0
S10	0	0	0	0	0.512	0	0	0	0	0	0	0	0	0	0	0
A	0	0	0	0	0	0	0.346	0.416	0.285	0.328	0.342	0.337	0.429	0.351	0.365	0.087
B	0	0	0	0	0	0	0.061	0.057	0.062	0.066	0.042	0.237	0.183	0.042	0.085	0.069
C	0	0	0	0	0	0	0.250	0.205	0.255	0.239	0.281	0.187	0.228	0.193	0.296	0.308
D	0	0	0	0	0	0	0.258	0.241	0.316	0.277	0.249	0.182	0.106	0.311	0.159	0.407
E	0	0	0	0	0	0	0.085	0.081	0.082	0.090	0.086	0.057	0.054	0.102	0.095	0.128

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Table 6 The weighted supermatrix

	Goal	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Goal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C1	0.422	0	0.227	0.224	0.220	0.220	0	0	0	0	0	0	0	0	0	0
C2	0.107	0.144	0	0.145	0.081	0.073	0	0	0	0	0	0	0	0	0	0
C3	0.293	0.213	0.140	0	0.133	0.156	0	0	0	0	0	0	0	0	0	0
C4	0.091	0.076	0.081	0.067	0	0.052	0	0	0	0	0	0	0	0	0	0
C5	0.087	0.069	0.053	0.063	0.067	0	0	0	0	0	0	0	0	0	0	0
S1	0	0.164	0	0	0	0	0	0.084	0.057	0.059	0	0.055	0	0	0.064	0
S2	0	0.155	0	0	0	0	0.080	0	0.084	0.059	0.084	0.095	0	0	0.074	0
S3	0	0.181	0	0	0	0	0.119	0.134	0	0.158	0.165	0.175	0	0	0.112	0
S4	0	0	0.286	0	0	0	0.052	0.071	0.041	0	0.050	0	0	0	0.039	0
S5	0	0	0.214	0	0	0	0.038	0.036	0.030	0	0	0	0	0	0.030	0
S6	0	0	0	0.395	0	0	0	0	0.143	0	0	0	0	0	0.180	0
S7	0	0	0	0.105	0	0	0	0	0	0	0	0	0	0	0	0
S8	0	0	0	0	0.069	0	0	0	0	0	0	0	0	0	0	0
S9	0	0	0	0	0.175	0	0.211	0.177	0.143	0.225	0.203	0.175	0	0	0	0
S10	0	0	0	0	0.256	0	0	0	0	0	0	0	0	0	0	0
A	0	0	0	0	0		0.173	0.208	0.143	0.164	0.171	0.169	0.429	0.351	0.183	0.087
B	0	0	0	0	0		0.031	0.029	0.031	0.033	0.021	0.119	0.183	0.042	0.043	0.069
C	0	0	0	0	0		0.125	0.103	0.128	0.120	0.141	0.094	0.228	0.193	0.148	0.308
D	0	0	0	0	0		0.129	0.121	0.158	0.139	0.125	0.091	0.106	0.311	0.080	0.407
E	0	0	0	0	0		0.043	0.041	0.041	0.045	0.043	0.029	0.054	0.102	0.048	0.128

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Table 7 The limit supermatrix

	Goal	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Goal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A	0.333	0.339	0.336	0.341	0.280	0.333	0.350	0.381	0.321	0.340	0.346	0.344	0.387	0.351	0.365	0.087
B	0.097	0.087	0.082	0.120	0.084	0.096	0.070	0.067	0.080	0.073	0.061	0.158	0.143	0.042	0.085	0.069
C	0.252	0.253	0.258	0.243	0.270	0.252	0.261	0.239	0.257	0.256	0.275	0.227	0.237	0.193	0.296	0.308
D	0.233	0.237	0.236	0.216	0.269	0.234	0.233	0.228	0.259	0.242	0.230	0.199	0.166	0.311	0.159	0.407
E	0.085	0.085	0.087	0.080	0.099	0.085	0.087	0.085	0.084	0.090	0.088	0.073	0.068	0.102	0.095	0.128